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OR,

Universal Dictionary

OF

ARTS, SCIENCES, AND LITERATURE.

VOL. XIII.

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OF

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ARTS and SCIENCES.

ELOCUTION.

ELOCUTION is a term which, according to the ſtrictneſs of etymological definition, might be applied to ſignify every thing that is included in the faculty and utterance of thought, by the means of language, whether oral or written; and ſome writers, even in modern times, have applied it, with more attention apparently to derivation than to authorized preciſion and neceſſary contradiſtinction, to written compoſition as well as to actual ſpeech. At the ſame time, two other terms, oratory and eloquence, (which etymological refinement might undoubtedly reduce to the ſame original ſignification,) have admittance and current uſage in our language, and are occaſionally uſed as ſynonyms of elocution in our looſer converſation. But every copious ſubject, when it comes to be treated in a didactic way, requires more terms of ſettled diſtinction than the ſimplicity of rigid etymology can be expected to furniſh; and "many terms which, in the laxity of general converſation, are indifferently and indiſtinctly uſed, in the preciſion of ſcientific diſcuſſion muſt be carefully ſeparated and placed in contradiſtinction: the very admiſſion of ſynonyms being perfectly inconſiſtent with the progreſs and comprehenſion of ſcientific truth."

Theſe three terms, therefore, in the very outſet of the preſent ſubject, ſhould be clearly and diſtinctly defined, and the boundaries of ſignification aſſignable to each, as terms of contradiſtinction, be preciſely marked. This has accordingly been done by a popular lecturer of the preſent day. "Eloquence," ſays he, "may be defined, "the art of expreſſing our thoughts and feelings with preciſion, force, and elegance; and of heightening the impreſſions of reaſon by the colourings of imagination." It is applicable, therefore, to the whole faculty of verbal diſcourſe, whether oral or written. It addreſſes itſelf by the pen, to the eye, as well as by the living organs to the ear. Thus we ſpeak (with admitted accuracy) of an eloquent book, as freely as of an eloquent oration; of the eloquent Buffon (alluding to his celebrated work upon natural hiſtory); and of the eloquent writings, as well as the eloquent ſpeeches of Edmund Burke. The Apoſtrophe to the queen of France, is as genuine a piece of eloquence as if it had been ſpoken in the houſe of commons.

Oratory, on the contrary, is preciſe and limited in its application: and, in this reſpect, indeed, even popular uſage is pretty generally correct. It may be defined, "oral eloquence; or the art of communicating, by the immediate action of the vocal and expreſſive organs, to popular, or to ſelect aſſemblies, the dictates of our reaſon, or our will, and the workings of our paſſions, our feelings, and our imaginations." Oratory, therefore, includes the idea of eloquence: for no man can be an orator who hath not an affluence of thought and language. But eloquence does not neceſſarily include the idea of oratory; ſince a man may be rich in all the ſtores of language and of thought, without poſſeſſing the advantages of a graceful and impreſſive delivery. It is, therefore, the name of a more complex idea; and includes, beſides the general notion of eloquence, the practical part of elocution: which being our immediate object, muſt be ſpoken of more at large. "Elocution may be regarded either as a ſcience, or as an act. In the former caſe it may be defined, "the ſcience by which the rules for the juſt delivery of eloquence are taught;" in the latter, "the happy combination and coincidence of vocal, enunciative, and geſticulative expreſſion, by which oratorical excitement is ſuperadded to the eloquence of thought and language." In other words: "Elocution is the art, or the act of ſo delivering our own thoughts and ſentiments, or the thoughts and ſentiments of others, as not only to convey to thoſe around us (with preciſion, force, and harmony) the full

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purport and meaning of the words and ſentences in which thoſe thoughts are clothed; but, alſo, to excite and impreſs upon their minds, the feelings, the imaginations, and the paſſions, by which thoſe thoughts are dictated, or with which they ſhould naturally be accompanied."

"Elocution, therefore, in its more ample and liberal ſignification, is not confined to the mere exerciſe of the organs of ſpeech. It embraces the whole theory and practice of the exterior demonſtration of the inward workings of the mind." In ſhort, "eloquence may be conſidered as the ſoul, or animating principle of diſcourſe; and is dependent on intellectual energy and intellectual attainments. Elocution is the embodying form, or repreſentative power; dependent on exterior accompliſhment, and cultivation of the organs. Oratory is the complicated and vital exiſtence reſulting from the perfect harmony and combination of the two."

The object, then, of the ſcience of elocution is the improvement of oral language, as contradiſtinguiſhed from mere graphic compoſition; and the cultivation of every external grace and accompliſhment with which the delivery of language ſhould be accompanied, whether in reading, in recitation, or in ſpontaneous utterance: an object, to the attainment of which the ancients devoted a very conſiderable portion of attention; and for the due comprehenſion of which, it appears to be neceſſary to go ſomewhat deeper in our reſearches into the phyſical and moral powers of man, than has been ſuſpected by the generality of modern profeſſors; and inſtead of calling in queſtion, as ſome recent cavillers have done, whether elocution is even to be regarded as an art, to eſtabliſh its doctrines on the ſettled principles of ſcience, and demonſtrate the eſſential elements of that ſcience as a branch of natural philoſophy. To the want of this due conſideration of the ſubject, and to the incongruous maxims relative to it, are perhaps to be attributed not only the frequency of every ſpecies of diſguſting impediment in modern ſpeech, but the lame and impotent ſtate of public ſpeaking among us, when compared in its effects with the ſplendid and impreſſive oratory of ancient times. "In thoſe parts of oratory, indeed, which relate to the arrangements of thought, and the energies of expreſſive language, there is no deficiency of exiſting models; and, certainly, no paucity whatever of pedantic rules and treatiſes. Cicero and Demoſthenes ſtill continue to ſpeak to the eye, in all the eloquence of graphic words; and Quintilian and Blair (like two conſpicuous luminaries, in the ancient and modern hemiſpheres of oratorical criticiſm) illumine the tracks of written language, and may help to inform us how orations ſhould be compoſed. In this part of oratory, the preſent and the preceding generation have, accordingly, ſomething to boaſt. But for the theory and practice of thoſe impreſſive exterior demonſtrations with which the delivery of ſuch orations ſhould be accompanied, to what ſyſtems, or to what models can the Engliſh ſtudent appeal? In ſhort, eloquence has been cultivated among us with conſiderable diligence; but elocution has been ſo much neglected, that the very nature of the ſcience ſeems to be entirely forgotten; and the few fragments of antiquity that have deſcended to us upon the ſubject, are evidently miſunderſtood by thoſe who have pretended to comment upon them; and many of our moſt learned critics have either ingenuouſly acknowledged, or unwarily betrayed, their total inability to comprehend ſome of thoſe very diſtinctions moſt indiſpenſable to the expreſſion and harmony of oratorical delivery: ſuch, for example, as the muſical accents of ſpeech, or inflections of the voice in the harmonic ſcale; the proportions of reſpondent ſounds and cadences, and the eſſential contradiſtinctions of percuſſion, accent, and quantity."

Such is the language of the lecturer already quoted; who, to reſcue the elements of elocution from this ſtate of neglect and chaos, and to facilitate the general attainment of an accompliſhment ſo generally deſirable, proceeds, in his "Introductory Diſcourſe," thus curſorily to ſtate the extent and nature of the ſubject.

"Elocution," ſays he, "is, 1. Partly a ſcience, founded on aſcertainable principles, and ſuſceptible of palpable demonſtrations; 2. Partly an art, attainable by imitative application and obſervance; and ſubject to ſuch laws as reſult from compariſon of general principles with practical experience; and, 3. Partly an object of taſte and ſentiment, dependent on acuteneſs of perception, and delicacy and refinement of feeling.

1. "As a ſcience its foundations are to be ſought, 1ſt. In phyſiology; that is to ſay, in the anatomical ſtructure of the elocutionary organs, and the laws of phyſical neceſſity, by which their actions and reactions are directed and circumſcribed: ſome knowledge of which ſeems to be indiſpenſably requiſite to the complete developement and exertion of their reſpective powers; to the ſupply of accidental and occaſional deficiencies; and to the correction of thoſe erroneous and defective modes of utterance, which, originating in negligent or vicious imitation, have ripened into habitual impediments. 2d. In muſic, the eſſential laws and accidents of which, with only one conſpicuous exception;" the progreſs of the tune, in one inſtance, being by ſlides or accentual inflections, "lifting the voice up and down in the muſical ſcale;" and in the other, by aſcertainable intervals and perceptible gradations; "are as applicable to elocution as to ſong: all fluent and harmonious ſpeech (even that of the moſt eaſy and familiar converſation) as neceſſarily and as abſolutely falling into the rythmical diviſion of muſical bars, and into the two generic meaſures of common and of triple time, as the warblings of the moſt ſcientific ſinger on the ſtage; while ſeveral of the impediments which moſt ſeriouſly obſtruct and deform the elocution of injudicious ſpeakers, may be proved to originate in no other cauſe than the violation of theſe muſical principles, and the conſequent reſiſtance of thoſe phyſical neceſſities which limit the facilities of organic action, and with which the elementary principles of harmonic proportion ſo admirably and ſo myſteriouſly conform. 3d. In philology, alſo, elocution hath a baſis, inaſmuch as to the philoſophy of the ſtructure and compoſition of language, and to the acute reſearches of the etymologiſt, many of thoſe diſputed queſtions of pronunciation, quantity, and percuſſive accent, which have hitherto been ſurrendered to the arbitrary and fluctuating deciſions of faſhion, ought, in reality, to be referred."

To which might have been added that the time of ſpeech itſelf, is, or ought to be, a reſult of philological perception: the quantities, emphaſes, and inflections of ſyllables, in all perfect ſpeech, being dictated by the ſenſe and import of ſuch ſyllables; either inherent in their original ſtructure and individual ſignification, or derivable from ſentiment and aſſociation.

2. As an art, the laws of elocution are partly grammatical, as ariſing out of the ſtructure and arrangement of ſentences, and the conſequent degrees of connection and relationſhip between the different words and members and portions of the diſcourſe to be pronounced; partly harmonic, as connected with the practical regulation of the variations and proportions of harmonic ſound, with which ſuch diſcourſe ſhould be accompanied; and partly mechanical, or experimental,

mental, as relating to the motions and poſitions of the reſpective organs, by which the varieties of vocal and enunciative expreſſion are produced.

3. As a matter of taſte, elocution embraces the conſideration of ſuch peculiar habits of ſtudy, deportment, and aſſociation, as are favourable to acuteneſs and delicacy of ſuſceptibility, both in the intellectual and the organic ſyſtem, and give them their peculiar bias and direction. In this point of view, all the finer arts, and all the more intellectual accompliſhments conſtitute eſſential parts of the ſtudies of the finiſhed elocutioniſt. He ſhould have an *eye* for the glowing tints and flowing lines of picture, the proportions of architecture and the ſymmetries of ſtatuary; an *ear* for the raviſhing delights of muſic; a *perception* of the vital graces of look and attitude and motion, far beyond all that the dancing ſchool and the opera houſe can teach; and a *ſoul* tremblingly alive to all the enthuſiaſm of poetry, and all the poignancy of ſentiment and pathos.

In vindication of the claim of this ſcience to ſuch an ample field of illuſtration and accompliſhment, an appeal may be made from modern maxims to the example of claſſical antiquity, to the facts that ſtand upon record, and the relics of ancient criticiſm that yet remain: for although much in the outſet of the inquiry appeared to the lecturer in the light of original diſcovery, further inveſtigation, we are informed, "convinced him, that many of thoſe doctrines, which he imagined to be new, are only "reſtitutions of decayed intelligence:" and what has, in reality, been added to the treaſures that well-directed labours might have redeemed from the overwhelmed ruins of claſſical criticiſm, is probably confined to the phyſiological parts of the ſubject, and the connection attempted to be traced between the primary laws of phyſical action and re-action, and the elements of muſical proportion."

Theſe, however, conſtitute a very eſſential portion of the ſcience of elocution; and the ſtudent of that ſcience muſt begin, in the firſt inſtance, by inveſtigating the ſtructure and offices of thoſe organs upon which the functions of ſpeech depend, which will be found to conſiſt of two diſtinct claſſes, the ſeparate actions and attributes of which, it is highly important that the profeſſor at leaſt ſhould accurately comprehend, leſt by miſtaking the ſource of the defects to be removed, he ſhould neceſſarily fail in the application of the remedy. Theſe are, 1, the vocal organs, or thoſe portions of the organic ſyſtem employed by the human (or other animated) being in the production and variation of expreſſive ſounds; and, 2, the enunciative organs, which, in the complication and perfection of their ſtructure, are peculiar to man, and are employed in ſuperadding to the ſounds of voice, certain other ſpecific impulſes, conſtituting thereby the elements and ſyllables out of which are compoſed the whole mechaniſm of human language.

When, however, theſe two claſſes of organs are ſaid to be diſtinct, that word is not to be underſtood in ſo abſolute a ſenſe, as to preclude the ſuppoſition of ſome of them diſcharging the two-fold office of modifying the tune and ſuperadding the ſpecific quality of literal element. The noſtrils, for example, which conſtitute a very eſſential part of the complicated organization that gives character to individual voices, are the chief implement employed in forming the elementary ſounds of *n*, *ng*, &c. while the teeth, and ſome other parts of the mouth, principally employed in the formation of the characteriſtic elements, have, alſo, a material operation in modifying the tone of the voice. The practical diſtinction is, however, ſufficiently evinced, by the ſeparate manifeſtation of their effects: the tones and inflexions of voice being exhibited in the moſt exquiſite perfection by ſeveral ſpecies of ſinging birds, who are deſtitute of the organization requiſite for ſpeech, and ſpeech itſelf being capable of proceeding, in the human ſubject, in forcible whiſpers, that is to ſay, by the action of the enunciative organs on a mere ſtream of breath, without accompaniment of any tone, or ſound of voice. Of this, however, more hereafter. See VOICE, ENUNCIATION, ORGANS of SPEECH, &c.

From the ſtructure of the organs, the phyſiological enquirer is next conducted to a conſideration of the laws of phyſical neceſſity, under which the functions of theſe reſpective organs are performed; and the mode of operation by which volition accommodates itſelf to the reſtrictions inevitably impoſed: an inveſtigation which involves ſeveral topics of conſiderable curioſity. From the ſimple principle of pendulation (the primary and indiſpenſible law of all reiterated action) are explained many of the eſſential phenomena of enunciative and vocal expreſſion, as the trill of the R; the impracticability of *reiterating* identical elements, or pronouncing, in immediate ſucceſſion, certain elements cloſely approximating in organic formation, without intervening pauſes; the facilities of certain combinations of element, the difficulty of others, and, conſequently, the phyſical cauſes of euphony and cacophony; (ſee EUPHONY, &c.) and, above all, the nature and cauſes of thoſe radical differences in the qualities of ſucceſſive ſyllables ſo well underſtood (in practice, and eſſence at leaſt, if not in cauſe,) by the grammarians of Greece, and deſignated by them under the terms *theſis* and *arſis*, but the total inapprehenſion of which has been the cauſe of ſo much confuſion in the theories and embarraſſment in the practical inſtructions of modern profeſſors. The leading dogmas of this ſyſtem are ſo ſelf-evident, their application to organic as well as mechanic motion, and to the actions of the organs of ſpeech in particular, ſo demonſtrable, and the coincidence of theſe actions with the phenomena of a certain alternate energy and remiſſion in the proceſs of verbal utterance ſo apparent, that it is only aſtoniſhing how the principle itſelf ſhould have remained ſo long obſcured. But there is ſtill room enough in the world of ſcientific diſcovery for other Columbuſes to crack the heavy end of other eggs. But our buſineſs is an abſtract, not a declamation. Thus then, it is contended, that action is of two kinds, continuous, or proceeding for a certain ſpace of time, in a certain direction, from one original impulſe, as the flight of a dart by the impulſe of the bow, or of a ball from the exploſion of a cannon, &c.; or reiterated and capable of unlimited continuity, from ſucceſſive impulſe, as in the pendulum of a clock, the motion of the legs in walking, &c. But ſpeech is not a continuous action proceeding for a certain ſpace in a certain direction from one original impulſe, like the flight of a dart, &c. but a ſeries of reiterated actions like thoſe of the pendulum, or of walking, &c. though much more complicated and diverſified by variety of phenomena, and, for that end, by neceſſary modification of impulſe. Still, however, ſpeech is action, reiterated action, reſulting from reiterated impulſe, and conſequently ſubject to the indiſpenſible law of reiteration, namely, re-action, or alternation; for as the pendulum when it has made its full ſwing in one direction muſt re-act in the oppoſite direction, before the primary action can be repeated; and as when one of the lower extremities has been advanced at full ſtride before the body it muſt either be drawn back again towards its former poſition, or, by a more complicated pendulation, the body muſt advance upon the limb, and thus reſtore the original poiſe to give the other extremity an opportunity of ſimilar action, before the leg firſt advanced can advance again; ſo when the tongue, lip, or uvula have acted in any given direction for the formation of any given element, it muſt re-act ſilently or expreſſively either upon the primary, or in ſome new direction, before the ſame element can be repeated, or any other element, requiring a ſimilar line of action can be formed. And ſo, alſo, when the primary organ of cadential or ſyllabic impulſe (the cartilage that ſurrounds the larynx) has been once contracted for the impulſion of the more energetic note, a re-action of that organ, either ſilent or accompanied by another note of leſs energy, muſt take place before the contractile energy can be renewed. Hence are derivable all the phenomena that belong to, or are to be deſcribed under the denominations of *cadence, meaſure, rythmus, metrical feet*, and other diſtinctions ariſing out of thoſe radical and eſſential differences in the qualities of ſyllables, ſometimes deſcribed by the terms *accented* and *unaccented*, and ſometimes by the very ſame writers, in the very ſame page, denied the diſtinction of accentuation; and ſometimes, alſo, confounded with the *quantities*, and by the denominations, of *long* and *ſhort*. but with which moſt certainly, neither accent nor quantity have any thing whatever to do. (See ACCENT, MEASURE, RYTHMUS, PROSODY, METRICAL FEET, QUANTITY, &c. See, alſo, POISE, THESIS, and ARSIS, PULSATION, and REMISSION, &c.) Hence, alſo, will be found derivable (not from caprice, or taſte, or arbitrary invention, but from phyſical principles) the diſtribution of all vocal melodies (and thence by imitation of all other melodies) into the proportions and cadences of common and of triple time; (ſee TIME,) and hence ſome light perhaps may be thrown upon that curious and hitherto unfathomable queſtion, the cauſe of the excluſive ſatisfaction received by the human ear from ſounds that follow each other in thoſe definite and ſimple proportions.

Having laid theſe foundations of theory on the ſolid baſis of experiment, the elocutionary phyſiologiſt may proceed to practice, and the crown and pinnacle of his labours conſiſt in the expoſition of the nature and cauſes of the various impediments and imperfections of ſpeech; and in the application of the proper remedies applicable to thoſe defects, whether originating in organic deficiencies, or malconformations; or adopted from imitation, confirmed by the inveteracy of erroneous habit. (See IMPEDIMENT.) The practical part of elocution alſo neceſſarily includes all that relates to the education and management of the organs of ſpeech; the improvement of the expreſſive powers of voice and enunciation; the laws of inflection, proportion and harmony; and the graces and accompliſhments with which the delivery of ſpeech (whether original or imitative) ſhould naturally be accompanied; and by which its effects upon the heart, the judgment and the imagination may be heightened and confirmed. See PHYSIOGNOMICAL EXPRESSION, GESTICULATION, &c.

Such is the general outline of the ſcience of elocution, according to the only profeſſor of modern times, by whom the ſubject has ever been treated in a ſcientific point of view, and from the notes of whoſe public lectures this abſtract is principally furniſhed; a ſcience which, however neglected, deſerves (for its practical application at once to the nobleſt purpoſes of public exertion, and the moſt familiar gratifications of private life,) a conſiderable portion of the attention of thoſe who are entruſted with the education of youth. For if oratorical excellence be an object only to the few, yet that thoſe few ſhould have the means of cultivating thoſe parts of ſuch excellence which appear to be within reach of ſyſtematic tuition, is certainly highly deſirable; and (not to dwell upon the conſideration that it is not always practicable to foreſee, during the ſeaſon of early tuition, who ſhall, or who ſhall not, be among the number of that few to whom ſuch accompliſhment might be of primary importance) "ſome degree, at leaſt, of elocutionary accompliſhment is certainly deſirable by all. There are few, indeed, to whom it would not be advantageous (at leaſt in point of mental gratification) to be able to read, with emphaſis and harmony, the fine paſſages of our poets, or the inſtructive and elegant compoſitions of our hiſtorians, moraliſts, and amuſive writers:—There is, perhaps, ſcarcely any individual who has not, occaſionally, experienced the advantage of delivering what he had to ſay with correctneſs, eaſe, and impreſſiveneſs; or (lacking this accompliſhment) who has not felt the diſadvantages reſulting from ſuch defect. Even in the ſocial intercourſes of private life, how great are the benefits of this attainment! How does it multiply the ſources of innocent pleaſure! What a zeſt does it impart to the higheſt, though moſt familiar, of our intellectual gratifications!"

"Fortunately for mankind," continues Mr. Thelwall, "this accompliſhment, ſo univerſally to be deſired, needs never to be deſired in vain. With thoſe exceptions only, which reſult from deafneſs, or from mental imbecility, I ſhall, I think, demonſtrate, that (by no greater ſacrifice of time and effort than is uſually devoted to leſs important ſciences and much more frivolous accompliſhments) correct and impreſſive elocution is attainable by all." He admits, however, "that hitherto, at leaſt, the inſtances of ſuch attainment have been exceedingly rare; that few are the Engliſhmen who converſe with fluency and impreſſive grace; and fewer ſtill who can read with tolerable harmony and propriety. Even in our churches, the ſublimeſt paſſages loſe their impreſſiveneſs from the imperfect manner in which they are delivered; and thoſe very preachers who are moſt accompliſhed in every other particular, too frequently obſcure, by the wretchedneſs of their elocution, the eloquent diſcourſes they compoſe.

"But the cauſes of this it is not difficult to diſcover. We trace them, at once, in the almoſt univerſal neglect of this important branch of education. Even of the profeſſed teachers, in this department, where is the individual who has properly explored the extent, or the principles of the ſcience, or who has even ſuſpected that ſcience had any thing to do with the ſubject? It has almoſt been queſtioned whether elocution were even an art? Excellence has been regarded as the mere myſterious gift of nature or of fortune—as the original and unſolicited diſpenſation of a partial providence; which no education could ſecure, and which ſtudy and application were ſcarcely neceſſary to improve. With reſpect to the conſtituents of that excellence, mere taſte and preſentiment have been regarded as the only arbiters; the very laws of inflection and poportion have been denied all foundation and exiſtence in the utterance of modern ſpeech; and pronunciation, tone, and melody, and even the conſtituent requiſite of percuſſive accent, (upon which the individuality, the character and the force of ſpoken words eſſentially depend,) have been abandoned to the lawleſs rule of faſhion and caprice." Introductory Diſcourſe on the Nature and Objects of Elocutionary Science.

Elocution has by many been conſidered as contradiſtinguiſhable into three ſeveral kinds, reading, recitation, and ſpontaneous ſpeech; and ſome profeſſors have marked theſe diſtinctions ſo abſolutely, as to preſcribe different ſtyles of utterance, both in vocal and enunciative expreſſion, to the reader and the reciter, from thoſe which they regard as belonging to the unpremeditative ſpeaker. Mr. Cockin, in particular, in an ingenious diſſertation (publiſhed without his name, 1775) on "The Art of Delivering written Language," has maintained this hypotheſis; and has diſcuſſed the ſubject of theſe ſuppoſed differences under the reſpective heads of accent, emphaſis, modulation, expreſſion, (of voice as well as geſture,) and pauſes; for the latter four of which, ſee hereafter under their reſpective titles. This work, we are informed in the dedication, was altogether approved by Mr. Garrick, who aſſured the author "that the doctrine laid down in that eſſay agreed exactly with his own ſentiments." The popular axiom, however, "read exactly as you would ſpeak," (ſuppoſing it addreſſed to a good ſpeaker,) ſeems, in its principle, to be a rule much more rational than any thing that even the ingenuity of Mr. Cockin, though applauded by Mr. Garrick, has been able to adduce. It is objectionable, indeed, on account of its impracticability; pointing out a degree of perfection that was never yet attained, nor ever will be, till perfection in other arts and accompliſhments ſhall be attained alſo. But the principle is not, therefore, the leſs valuable; the models of perfection muſt not be diſcarded from our minds, becauſe art could never yet completely realize them: and although there are impediments, perhaps inſurmountable, in the way of giving either to reading or recitation all the eaſe, the grace, and the vitality of ſpontaneous ſpeech, yet, in principle, they ſhould aſſuredly be the ſame; for reading and recitation are only two different modes of imitating that nature, which ſpontaneous ſpeaking exhibits in her original reality; and the imitation ought to be ſo much the more perfect and exact, as, in this inſtance, the artiſt has the excluſive advantage of operating not only on the model, but with the very materials which nature herſelf employs in her creations. Mr. C., however, contends, "that reading does not receive any of its beauties from the principles of imitation, being no copy, but only another kind of ſpeech." That, generally ſpeaking, it is ſo, cannot be denied: but it is ſo far from unqueſtionable that it ought to be ſo, that this may be perhaps aſſigned as the genuine reaſon why the *reading* even of thoſe very perſons produces only ſleep, whoſe unpremeditated *ſpeaking*, is the delight of all ears; and why lectures never intereſt the auditors, like ſpontaneous harangues.

There are, however, certain particulars of eſſential diſtinction in the practical facilities, and even capabilities of excellence, in reading, recitation, and original ſpeech, which the ſtudent of elocution ought to underſtand, as thereby each may perhaps be brought ſomewhat nearer to perfection than can be expected without the due conſideration of theſe circumſtances. Thus, for example, ſpontaneous ſpeech, ſpringing immediately from the inſpiration of feeling, with all the freſhneſs and glow of original conception, is capable of a degree of warmth, eaſe, and flowing energy, which can belong only to firſt impreſſions and unpremeditated language. From this very circumſtance, however, it is incapable of all the ſmoothneſs, proportion, and harmony, which a minute attention to euphony, conſtruction, rythmus, and quantity, may enable the reader and reciter to accompliſh. The reader, on the contrary, who finds the language ready poliſhed to his hands, and ſees it ſpread out before him, has leiſure for full attention to all the minutiæ of rythmical cadence; and if his ear be good, his perceptions acute, and his notions of the principles of elocutionary harmony correct, he may certainly attain a degree of perfection of utterance, in what relates to mere proportion and melody, which none but the reader muſt expect. But then, on the other hand, the reader (eſpecially he who reads at ſight; and if he has previouſly ſtudied, he becomes, in a certain degree, a *reciter*,) pronounces what he reads, not with the feelings of an originator, or imparter, but with the feelings of a recipient; his mind is paſſive while his organs only are active: hence, inevitably, a certain degree of coldneſs and unnatural reſtraint. The reciter partakes of the advantages and diſadvantages of both; and he has both advantages and diſadvantages peculiar to himſelf. If what he ſhould repeat be completely in his memory, he makes it, to a certain degree, his own, and may *approximate* to the eaſe of the ſpontaneous ſpeaker, and the ſmooth melody of the accompliſhed reader, though he can never completely attain the unſophiſticated warmth and vitality of the former, or the complete rythmus and nicely meaſured pauſes of the latter. At the ſame time, by repeated experiment, he may have adjuſted his tones and attitudes, and the expreſſions of his countenance, more completely to the ſentiment and paſſion of the paſſages he is to deliver than the reader could poſſibly have done, and have accommodated them more completely to the rules and principles of grace, than is practicable to the ſpontaneous ſpeaker: but what he gains in force and propriety he is in danger of loſing in ſimplicity; and the mere reciter, however excellent, is more likely to extort applauſe than to awaken the genuine ſympathies of the ſoul. From this view of the ſubject, the lecturer already cited concludes, that though the principles of Engliſh elocution, fundamentally conſidered, are the ſame, to which ſoever of theſe three modes of utterance they may be applied, yet the practical excellencies and obvious difficulties of each being peculiar, the ſtudent of elocution, whatever department be his ultimate object, ſhould practiſe in all three, ſince reader, reciter, and ſpontaneous ſpeaker, have each ſomething to learn, from the other two, for the full accompliſhment of his own particular branch of the art.

Another and more rational diviſion of the art of elocution may be made from a conſideration of the ſubjects to which it is applied, or the circumſtances under which it is exerciſed. According to this principle, elocution may be conſidered as diſtinguiſhable into the following kinds, 1. The converſational; 2. The narrative; 3. The didactic; 4. The authoritative or judicial; 5. The argumentative; 6. The perſuaſive; 7. The declamatory and impaſſioned; relative to each of which ſome general rules may be laid down both with reſpect to voice and enunciation: as that in the firſt, the enunciation ſhould be eaſy and familiar, the tone ſimple, the inflection limited, and the pitch of the voice but juſt ſo far beyond a whiſper as to render it tuneable. In the ſecond, the enunciation, though exceedingly ſimple, ſhould be ſomewhat more preciſe and emphatic; the tone clear, unoſtentatious, and impreſſive; level, but not monotonous. In the third, both tone and enunciation ſhould be ſtrong, firm, and emphatic; which in the authoritative and judicial ſhould ſwell to ſomething like pomp, mingled with a degree of firmneſs that in effect ſhould border on auſterity, and with reſpect to modulation, almoſt on monotony. In the argumentative, clearneſs of voice and perſpicuity of enunciation are the principal objects. In the perſuaſive, the tones ſhould be mild, inſinuative, and pathetic, the pronunciation remote alike from the affectation of ſonorouſneſs and of preciſion. In this, indeed, as in the ſeventh and laſt deſcription of elocution, the enunciation ſhould rather be ſubſervient to the tone, (that is to ſay, to the feelings,) than the tone to the enunciation, as the object of the ſpeaker is rather to be underſtood by the heart than by the underſtanding. In ſubjects and paſſages of ſtrong paſſion and emotion, the enunciation ſhould be occaſionally accelerated and retarded; apparently wild and irregular, but obedient always to the changes of paſſion and ſentiment; the modulation extenſively varied, and the voice ranging through great varieties of ſoftneſs, force, and vehemence, of acuteneſs and gravity, and the whole compaſs of expreſſive or reflective intonation.

The four great ſchools of elocution, or rather the four great theatres for the exhibition of that talent, are, the bar, the pulpit, the ſenate, and the ſtage; and before we take leave of the ſubject, ſomething ought to be ſaid on each of theſe. We ſhall conſider them, therefore, in their alphabetic order.

Elocution of the Bar.—The ſtyle of elocution adapted to this profeſſion, will beſt be underſtood by conſidering the objects to which the eloquence of the bar is principally to be directed. Theſe are, 1. To demonſtrate, by the elucidation of evidence, diſputed facts; 2. To convince, by arguments, the doubtful judgment; 3. To influence by perſuaſion, or controul by declamation, the paſſions, the ſympathies and moral feelings of thoſe upon whom the deciſion of a cauſe may depend. For the firſt of theſe, we require an elocution diſtinguiſhed by impreſſive diſtinctneſs, an unaffected deliberation, and collected coolneſs; an enunciation preciſe without formality, at once terſe and familiar; a deportment candid, firm, and unaſſuming. For the ſecond, we demand an emphatic perſpicuity; an air of deciſive, but modeſt confidence; an ardour not impetuous, but chaſtened and reſtrained, by all the decorums of circumſtance and ſituation. For the laſt, the nobleſt, and moſt arduous of all the exertions of forenſic eloquence, are required, a range of elocutionary expreſſion, as various as the paſſions and emotions to be commanded; an inſinuating mildneſs, a melting or a kindling pathos; the tone, the look, the whole manner, geſticulation and deportment, ſhould occaſionally aſſume the entire range of expreſſive variety, from the moſt conciliating ſympathy to the deepeſt ſolemnity, and even, perhaps, on ſome occaſions to intimidating boldneſs. The occaſions, indeed, on which all that is here demanded can with propriety be exerted by the forenſic orator, may but rarely occur; but when they do occur, the opportunities are deciſive, and the reputation of the pleader, who is fully qualified to avail himſelf of them, is ſtamped for ever.

Elocution of the Pulpit.—The objects of clerical eloquence have been oratorically thus enumerated, "to inform the underſtanding even of the inapprehenſive; to arouſe the ſlumbering conſcience; to regulate the moral feelings; to reſtore the ſocial ſympathies, which the diſparities of fortune have but too much tendency to ſuſpend; to reſtrain the fury of ambition, and check the mad career of voluptuous prodigality; to unlock the iron graſp of avarice, and expand the liberal palm to deeds of charity; to humble the towering inſolence of pride, and diſarm the uplifted hand of oppreſſion and revenge; to infuſe the ſpirit of benevolence into the heart of unfeeling obduracy; to breathe the ſacred love of peace into the boſoms of the turbulent, and the mild ſpirit of forbearance and toleration into the ſoul of perſecuting bigotry and prejudice." How far all theſe objects are, practically, in the contemplation of every orator of the pulpit, this is no place to diſcuſs; but if ſuch be, in reality, among the proper objects of pulpit eloquence, it is obvious that all, and more than all, that we have demanded for the elocution of the bar, is requiſite in this ſpecies of elocution alſo. Among the indiſpenſible requiſites of ſuch elocution, are a familiar ſimplicity, inſinuative and endearing; an impreſſive energy, ſtimulative and arouſing; a pathos varied, characteriſtic, and deſcriptive; and a ſublimity awful, elevating, and commanding. A mingled ſolemnity and enthuſiaſm ſhould occaſionally give an air of inſpiration to the preacher, and his pronunciation, and all the particulars of utterance properly included in the term enunciation, ſhould be full, ſonorous, and oratorical, rather than looſe and colloquial. At the ſame time, nothing is more to be avoided than any overmarked peculiarity or affectation, or than the vulgar vehemence, the bawling and vociferation, which are ſometimes miſtaken for energy and oratorical animation.

The modes of elocution in this profeſſion, are thoſe of reading, as applied to portions of the ſcriptures, or to ſet forms of worſhip; of ſermon, which may be either read, (according to the general cuſtom of the church of England,) recited, (as is uſual among the preachers of the church of Scotland,) or delivered ſpontaneouſly, (that is to ſay, from notes or reflections previouſly digeſted, without actual compoſition,) as has been recommended by biſhop Burnet, and as is practiſed by ſome of our ſeparatiſts, and even by a very ſmall number of our regular clergy; and of prayer. Of the firſt of theſe, it is only neceſſary to ſay, that the only circumſtance in which it ſhould differ from any other ſpecies of reading, ſeems to be, that it ſhould be rather more ſolemn, and deliberate, from reſpect to the place and the occaſion to which it is accommodated. In all kinds of reading, the ſtyle of elocution ſhould accord with the ſubject, the tone and manner ſhould harmonize with the language and ſentiment; and as the ſubjects of ſcriptural and devotional reading are ſo exceedingly diverſified, it follows as a conſequence, that the ſtyle of the reader ſhould be diverſified as widely; and that nothing can be more inconſiſtent with the objects of clerical elocution than monotony. With reſpect to the three modes of delivering a ſermon, this is not the place for diſcuſſing their reſpective claims of preference; and what has been already ſaid of the application of the ſame common principles to reading, recitation, and ſpontaneous ſpeech, and the different kinds of excellence moſt attainable in each, precludes the neceſſity of particular rules for them reſpectively. In prayer, a ſolemn proſtration of manner, with a conſiderable mixture of enthuſiaſm, ſeems particularly required; and an eſpecial avoidance of all thoſe odd tricks and peculiarities, into which miniſters are ſo apt to fall. But the further conſideration of this ſubject belongs, properly, to the title GESTURE.

Elocution of the Senate.—As the eloquence of the ſenate is partly deliberative, partly controverſial, and partly declamatory, it requires an elocution uniting almoſt all the principal requiſites enumerated under the two preceding heads; and it admits, and even occaſionally demands, a more impetuous warmth, a more rapid and vehement emotion, than in either of the former inſtances could be at all decorous. The ſermons of Maſſillon might require, or, at leaſt, their effect might be heightened by a denunciative ſeverity, an awful auſterity of manner, that ſhould impreſs his audience with all the ideas and feelings of a ſupernatural agency; and under ſuch circumſtances the oratory of the pulpit might ſeem to have been carried, even above the heights, and beyond the force of ſenatorial and popular oratory; but it is in the ſenate alone, and the popular aſſemblies of the nation, that the orator is to hurry away the impetuous paſſions, and tranſport the hearer into abſolute action; and there only are, of courſe, required the full thunders of elocutionary energy. But it is not only in the fervid tones of an impetuous declamation, that the ſenatorial elocutioniſt ſhould excel; in the calm dignity of a well modulated cadence, and the poliſhed grace and propriety of enunciation, he ſhould alſo ſurpaſs; and in the eaſy urbanity of tone and euphony (when the ſtronger exertions of eloquence are not required) he ſhould manifeſt, at once, the dignity of the ſtateſman, and the elegance and refinement of the polite ſcholar. How little theſe circumſtances, (almoſt all of them within the reach of a well directed education,) are attended to, is but too generally known; and in the humble ſtate of modern oratory (as judged by its effects) the conſequences may but too well be diſcovered.

Elocution of the Stage.—The critical object of theatrical repreſentation is *imitation*. Its excellence is *veriſimilitude*. It is a moving picture, that exhibits ſounds as well as objects,

jects, and a part of whoſe pigments are the tones of the human voice. Its elocution, therefore, ſhould be that of Nature—Nature in her higheſt perfection. Ideal nature, if you pleaſe; ſuperior, in perfection, to any thing that individual nature ever exhibited, but in principle nothing deviating from unſophiſticated reality. The harmony may be more perfect, the intonation ſomething more diverſified, the inflection and range of the voice rather more extenſive, the utterance a little more emphatic, and ſome other graces and obſervances may be carried a degree further than ever was obſervable (or perhaps practicable) in ſpontaneous ſpeech and real life; but ſtill that ſpontaneity and reality muſt be the models; and the elocution, in all eſſential particulars, that would be unfit for the bar, the pulpit, or the popular aſſembly (ſo far as the difference does not ariſe out of the different ſentiments to be expreſſed and paſſions to be indulged or excited) is unfit for the ſtage alſo. It ſhould be remembered, however, that the drama deals in the *extremes* of paſſion and emotion; that its moral requires that it ſhould exhibit thoſe paſſions burſting all bonds of decorum, and triumphing over the reſtraints of reaſon. The player has frequently to exhibit the judgment under the domination of paſſions; and is even to repreſent the full malignity of the worſt, as well as the imprudent exceſſes of the beſt paſſions of our nature; while the paſſions of the orator are always, in reality, (though not always in appearance,) to be under the controul of his judgment; and all the malignant and evil paſſions are to be ſuppreſſed, or kept out of ſight, any otherwiſe than as they may be *mentioned*, or alluded to, in moral reprehenſion. Hence even the ſimplicity and truth of principle may, and muſt produce, occaſionally, much apparent difference of effect; and the ſame exerciſe of judgment (for the judgment of the player muſt, in reality, ſtill be paramount over his paſſion, though he be exhibiting the very reverſe) that leads the orator, to temper and qualify, may induce the actor, to exaggerate the paſſion. It is in theſe exaggerations, however, that the art and maſtery of the performer are moſt ſeverely tried, and taſte and judgment are alike imperiouſly requiſite. They are neceſſary undoubtedly to the perfection of his art; yet the inſtant the exaggeration is apparent, diſguſt begins;—the inſtant the vulgar feeling of wonder is excited, the tragedian ſinks to a level with the rope dancer; and many a time ought he to be overwhelmed with confuſion, by thoſe very plaudits to the attainment of which he has ſacrificed all the finer touches of nature that might have ſecured the genuine applauſe of ſympathy and emotion. But fully to attain, or even diſtinctly to comprehend, the higher excellencies of theatrical elocution, requires a very different courſe of preparation and ſtudy from what generally falls to the deſtiny, or enters into the apprehenſions of the profeſſors of this art. It is not in the ſcience of the green room, the library of the prompter, and the technical knowledge of ſtage trick, to make a finiſhed actor. To deliver language well, it is neceſſary fully to comprehend it, not looſely and colloquially merely, but grammatically, etymologically, and ſympathetically; to detect the niceſt ſhades of alluſion and diſcrimination, and enter into the ſentiment of the author; to realize the paſſion, where paſſion is, and the character, where the compoſition is characteriſtic. To excel in any ſpecies of elocution, therefore, demands ſome knowledge of general literature; to be a maſter of that elocution that ſhould illuſtrate the fine paſſages of Shakeſpeare, will require a knowledge of our language which, fully poſſeſſed, would entitle the elocutioniſt to the rare and valuable character of an *Engliſh ſcholar*. But the ſources of human paſſion muſt be ſtudied alſo; human nature muſt be known, in the general, and in the particular, in all ranks and conditions, and under all circumſtances and aſſociations. The perceptions muſt be diligently cultivated; the diſcriminative powers muſt be well exerciſed; feeling, keen, vigorous, varied feeling, muſt be cheriſhed; and the imagination muſt be perpetually at work. For the developement of the flexible powers of the voice, no pains well directed can be too elaborate, and the mind ſhould comprehend, and the ear ſhould perceive the delicacies and varieties of rythmus, with all the ſubtile nicety of a poet. The actor ſo qualified will diſcard from his elocution all the pedantries alike of the convent and of the green room; all profeſſional affections and preſcriptive peculiarities; he will copy nature in ſuch a ſtyle, that nature in her turn will copy him; and like the great actors of Greece and Rome, he will be worthy to give, while he receives, inſtructions to another Cicero or Demoſthenes.

ELODES, in *Botany*, Adanſon 444. (Elodea; Juſſ. 255.) A genus formed by Adanſon of the *Hypericum Ægyptiacum* of Linnæus, on account of an oblong ſcale or appendage to the claw of each petal, conſidered by Linnæus as a ſort of nectary, to which opinion he was probably led by the analogy of the nectariferous glands in his own *Hypericum Elodes*. We ſee no reaſon to ſeparate the above plant from *Hypericum*, nor does Juſſieu more than hint at the meaſure. See Hypericum.

Elodes is alſo uſed among the ancient writers in *Medicine*, for a ſpecies of fever, attended with profuſe ſweats.

ELOGIUM, Eloge, a praiſe, or panegyric, beſtowed on any perſon or thing, in conſideration of its merit.

The word is Latin, but formed of the Greek ευλογια, *commendation*; which is compounded of ευ, *well*, and λεγω, *to ſay*, or *ſpeak*.

The ſecretary of the Royal Academy of Sciences at Paris formerly compoſed the eloges of ſuch members as died; and delivered them at the next public meeting of the company. Funeral orations are eloges of eminent perſons deceaſed.

Extravagant and improbable eloges are of the greateſt diſ-ſervice to their own deſign; and do, in effect, diminiſh the perſon whom they pretend to magnify, and degrade him whom they profeſs to exalt. Any worthy man may paſs through the world, unqueſtioned and ſafe, with a moderate recommendation: but when he is ſet off and bedaubed with rhetoric, and embroidered ſo thick, that you cannot diſcern the ground, it awakens naturally (and not altogether unjuſtly) intereſt, curioſity, and envy; for all men pretend a ſhare in reputation, and love not to ſee it engroſſed, or monopolized; and are therefore apt to enquire (as of great eſtates ſuddenly got) whether the perſon ſo commended, came honeſtly by it, and of what credit the perſon is that tells the ſtory.

ELOHA, in *Scripture*, the ſingular of Elohi, one of the names of God. See Elohi.

ELOHI, Eloi, or Elohim, one of the names of God. But it is to be obſerved, that angels, princes, great men, judges, and even falſe gods, are ſometimes called by this name. The connection of the diſcourſe aſſiſts us in judging rightly concerning the true meaning of this word. It is the ſame as Eloha; one is the ſingular, the other the plural. Nevertheleſs, Elohim is often conſtrued in the ſingular number, particularly when the true God is ſpoken of; but when falſe gods are ſpoken of, it is conſtrued rather in the plural. Calmet, Diction. Bibl. See Jehovah.

ELOI. See Elohi.

ELOIGNED, in *Law*. See Eloncata and Elongatus.

ELOINE, ſignifies to remove, or ſend a great way off. Thus it is ſaid, if ſuch as be within age be eloined, ſo that they cannot come to ſue perſonally, their next friends ſhall be admitted to ſue for them. Stat. 13 Ed. I. cap. 15.

ELOME, a name given by ſome authors to orpiment.

ELON, in *Ancient Geography*, a town of Paleſtine, in the tribe of Dan. Joſh. xix. 43.

ELONGATA, in *Law*, is a return of the ſheriff, that cattle are not to be found, or removed, ſo that he cannot make deliverance in replevin. 2 Lil. Abr. 454. 458.

ELONGATION, in *Aſtronomy*. The angle under which we ſee the diſtance of a planet from the ſun, reduced to the ecliptic.

Let S T (*Plate* XII. *Aſtronomy*, *fig.* 104.) be the diſtance of the ſun from the earth, S L the curtate diſtance of the planet from the ſun, the angle T S L equal to the difference of longitude of the planet P and earth T ſeen from the ſun, called the commutation; the reſolution of the triangle T S L, in which the two ſides and contained angle are given, will give the angle at the earth S T L, called the elongation, and this being taken from the longitude of the ſun, if the planet is to the eaſt, or right of the ſun, will give the geocentric longitude of the planet.

The triangle S L T may be reſolved by the following rule: the leaſt ſide is to the greateſt as radius is to the tangent of an angle, from which 45° muſt be taken. The tangent of the remainder, multiplied by the tangent of half the ſum of the unknown angles, gives the tangent of half their difference, which muſt be added to or ſubtracted from the half ſum to trace the angle of elongation. This angle is the leaſt of the unknown angles in the caſe of an inferior planet when the half difference muſt be ſubtracted; it is the greateſt for a ſuperior planet when it muſt be added.

It is ſometimes uſeful to recollect the following proportions.

The ſine of the commutation is to the ſine of the elongation as the tangent of the heliocentric latitude is to the tangent of the geocentric latitude.

The ſine of the elongation is to the ſine of the commutation as the curtate diſtance of the planet from the ſun is to the curtate diſtance of the planet from the earth.

It is at the time of the greateſt elongations of the inferior planets Mercury and Venus, that they are uſually ſeen to the greateſt advantage. The greateſt elongation of Venus was, according to Ptolemy, from 45° 25″ to 47° 35′, and that of Mercury between 16° 8′ and 28° 37′. According to our modern tables theſe numbers are, for Venus 44° 57′ to 47° 48′, and for Mercury 17° 36′ to 28° 20′.

ELONGATION is alſo uſed, by ſome authors, for the difference in motion, between the ſwifteſt and the ſloweſt of two planets; or the quantity of ſpace, whereby the one has overgone the other; called alſo *ſuperation.*

The ſwifteſt motion of the moon, with regard to the ſun, is called the elongation of the moon from the ſun. We alſo ſay diurnal elongation, horary elongation, &c.

ELONGATION, as it relates to *Fortification*, is a term uſed to expreſs that deviation from the immediately regular conſtruction, which is derived from a polygon formed upon a circle, to one formed upon an ellipſis, or oval: when this happens, only two of the faces retain that conſtruction and proportion which would appertain to the reſpective circles of which they would each form a part. In this we conſider the ellipſis in queſtion to be drawn upon two circles, and having a line paſſing through both their centres, as well as through the centres of the two retained faces; which neceſſarily are parallel. The two ſides, or *elongated* arcs of the ellipſis, may be divided into any number of faces, according to the extent of the area incloſed; they are uſually on the ſcale of the *greater* ſyſtem, while the ends are on the ſcale of the mean ſyſtem. Sometimes the elongation muſt be made ſo as to occupy a great extent of front; in which caſe it may become expedient to throw forth a crown-work from the centre of the *elongated* arc, or line, in order to prevent the enemy from occupying any part of the eſplanade ſufficiently near to batter thoſe works which may be rather weak for want of a flanking fire ſufficiently powerful to impede the beſiegers. Theſe crown-works anſwer much the ſame purpoſe as advanced redoubts in front of a line of entrenchments, and ſcour the whole advance ſo completely, enfilading the aſſailants, as to render it peremptorily neceſſary to become maſters of them before the lines can be carried. This will ſhew not only their ability, but the abſolute neceſſity for conſtructing all ſuch advanced defences, in that ſcientific manner which may render them untenable by the enemy, after being poſſeſſed by them, as well as perfectly incompetent to make any impreſſion on the intrenchments, which would command them *in reverſe*, that is, in their rear, and compel the enemy to quit. Crown-works being on a more important ſcale, require that every attention ſhould be paid that their batteries ſhould not bear upon any of the main defences.

The foregoing relates to regular works: for the irregular we have ſcarcely any thing like a defined rule; but it muſt always be held in mind, that the more the defences are elongated, the more they will require additional ſupport, either from various lines of fortification one within the other, or from detached works, ſo ſituated as to defend the weaker parts. This neceſſity ariſes chiefly from the ſaliant angles being rarely allowed to fall within 90°, leſt they ſhould plunge upon ſome other parts of the defences; whereas in all works formed upon a pentagon, hexagon, heptagon, or even an octagon, the angles of the baſtions may be conſiderably reduced, and the ravelines equally ſo; it is owing to this that fortreſſes, on a large ſcale, not only admit, but require, numerous additional defences to fill up the ſeveral intervals between the exterior ſaliant angles, or extremes of the defences, but to prevent the enemy from occupying poſitions favourable to their views.

We do not term works conſtructed in an irregular manner along the ſhores of a bay, or around a peninſula, *elongated;* they may be carried for miles without coming under that deſignation; it is only when a line of defence, and particularly fortifications, forming a figure either perfectly regular, or nearly ſo, are in every particular part extended, for the purpoſe of embracing more ſpace, or conforming to any particular local circumſtance, that we conſider the term *elongation* to be applicable.

In *Tactics*, the term implies ſuch an extenſion of the front as is produced artificially, without the aid of reinforcements. Thus, we draw up troops only two, inſtead of three, deep, for the purpoſe of elongating our front; which conſequently thus becomes extended to half as much more as it formerly occupied in length. This is often neceſſary, but it certainly weakens the fire and the reſiſtance throughout; beſides, it prevents the caſualties in the front from being ſo readily filled up, and is apt to leave gaps, or openings, through which the enemy's cavalry may make a charge.

Where it is abſolutely neceſſary to retain a very firm front, yet to extend it ſo far as local means may allow, eſpecially where it is principally intended to repel the enemy's horſe, thoſe parts of the line which may be moſt expoſed by the evenneſs of the ground, &c. ought to be blocked by *abbatis*, that is, timber felled and laid in ſuch a manner as ſhould obſtruct the paſſage of cavalry; behind theſe a few men ſhould be diſperſed to prick off any of the aſſailants who ſhould attempt to cut an opening, or to drag away the trees, ſo as to obtain admiſſion. Frequently trees can be cut down, but cannot be drawn away to any choſen ſpot: in ſuch caſe, their trunks and principal branches may be left, while their leſſer boughs may be cut into ſtakes and paliſades for the defence of other parts. The line will of courſe be elongated by ſuch devices, while the more expoſed parts may retain their effective ſtrength. Where a convoy is in queſtion, and that the attack upon it can be made only upon one long front, which cannot be entirely covered by the waggons, &c. then, placing the artillery in the moſt commanding ſituations, the infantry muſt be ranged in ſuch manner as may *elongate* the defences, and keep the enemy in check. This will be peculiarly neceſſary where a neighbouring height muſt be cut off from the enemy's poſſeſſion, though it could not be occupied by the defenders of the convoy without weakening and dividing them.

The elongation of an attack, is where only a ſmall front is ſhewn at firſt, but is gradually extended ſo as to embrace a greater portion of the defences: thus, when after opening a battery upon a baſtion only, other batteries are made to bear upon the curtain almoſt parallel thereto; in ſuch caſe, we ſuppoſe only a bridge-head, or a *fleche* to exiſt, but no raveline. Likewiſe, when a column of infantry bearing down upon, and menacing only one particular point, ſuddenly deploys, and acts upon a greater extent of line, the attack is ſaid to be *elongated*. But, in either caſe, the term does not apply to any additional force brought to act on the ſame point; it relates to extenſion merely.

ELONGATION, in *Surgery*, is an imperfect luxation; when the ligament of any joint is ſo extended, or relaxed, as to lengthen the limb, but yet not to let the bone go quite out of its place. See LUXATION.

ELONGATUS, ELOIGNED, a return of the ſheriff that a perſon is conveyed out of his juriſdiction. See writ *de* HOMINE REPLEGIANDO.

ELOPEMENT, in *Law*, is when a married woman, of her own accord, departs from her huſband, and dwells with an adulterer; for which, without voluntary reconcilement to the huſband, ſhe ſhall loſe her dowry; nor ſhall the huſband, in ſuch caſe, be compelled to allow her any alimony. Stat. Weſtm. 2. 13 Edw. I. c. 34. See DIVORCE and DOWER.

"Sponte virum mulier fugiens, & adultera facta,
Dote ſua careat, niſi ſponſo ſponte retracta."

The word is formed from the Belgic, *Ee*, matrimony, and *loopen*, to run away.

However, mere advertiſing a wife in the Gazette, or other public papers, is not a legal notice to perſons in general not to truſt her; though a perſonal notice given by the huſband to particular perſons is ſaid to be good. An action lies, and large damages are uſually given, againſt a perſon for carrying away, and detaining another man's wife. See FORCIBLE *Abduction* and RAVISHMENT.

ELOPS, in *Ichthyology*, a genus of abdominal fiſhes, the character of which, according to the Linnæan ſyſtem, conſiſts in having the head ſmooth; edges of the jaws and palate rough with teeth; gill-membrane with thirty rays, and armed on the outſide in the middle with five teeth.

The genus elops is defined by Bloch as having the gill-membrane furniſhed with more than thirty rays, (ſpecimens he examined exhibiting thirty-four,) and Boſc admits there ſhould not be leſs than thirty to conſtitute the genus. Bloch conſiders the bony ſhield or plate beneath the chin, and the dorſal fin being placed oppoſite the ventral, as eſſential characters of the genus.

The only ſpecies of this genus at preſent known is the Linnæan elops ſaurus; le lézard of the French writers. Perhaps the earlieſt deſcriber of this fiſh is ſir Hans Sloane, who, in the ſecond volume of his hiſtory of Jamaica, gives a figure and detailed deſcription. He ſpeaks of it under the name of ſaurus maximus, and acquaints us that it is called in Jamaica the ſein-fiſh, or ſea gally-waſp. "This fiſh (he obſerves) was about fourteen inches long, in the middle five inches round, and tapering to both ends; the mouth in both jaws had one row of ſmall ſharp teeth, and on the upper two more within, parallel to them, and a row of the ſame on the upper part of the cartilaginous tongue; three quarters of an inch from the end of the ſnout were the eyes, round, and grey; there were two *pinnæ poſt branchias*, two under the belly, one on the middle of the back, *poſt anum* another, and a forked tail; it was all over ſcaly, the back of a dark brown, and the belly of a white colour." The ſpecies is found in various parts of the American ſeas; it was met with by Dr. Garden about Carolina, and communicated by him to Linnæus. The ſtrong ſpine at each ſide of the tail is conſidered as a ſpecifical diſtinction of elops ſaurus by Linnæus, Gmelin, and others, but this muſt obviouſly remain a very doubtful character till another ſpecies at leaſt of the ſame genus be diſcovered in order to aſcertain whether ſuch ſpines be not characteriſtic of the genus inſtead of the ſpecies.

It has been obſerved by writers that elops ſaurus bears ſome reſemblance to a pike, or rather to a ſalmon; with the former it has no kind of affinity whatever, but on the contrary it is ſo cloſely allied to the ſalmo tribe that were it not from being deſtitute of the fleſhy rayleſs fin, ſo uniformly obſervable on the lower part of the back in the ſalmon kind, we ſhould be almoſt induced to refer it to that genus.

The head of elops ſaurus is without ſcales. The lower jaw rather longer than the upper. Both jaws, together with the tongue and palate, are armed with a vaſt number of ſmall teeth. The eyes nearly vertical; the irides double, the inner one yellow, exterior red, and the pupil black; and the eyes partly covered with the ſkin of the head. The body of this fiſh is ſlender, and the ſcales large; the head yellowiſh, back blueiſh, ſides ſilvery. The lateral line is ſtraight. All the fins browniſh; the exterior half of the pectoral fin, anterior part of the dorſal fin, and extremity of the tail blueiſh. The tail is much furcated, and divided in the middle by a diſtinct longitudinal ſtripe of black.

ELOPS, Ελωψ, in *Zoology*, the name of a ſerpent, otherwiſe called elaps.

ELOQUENCE, the art of ſpeaking or writing well, ſo as to move and perſuade. The term, however, in its greateſt latitude, denotes that art or talent, by which the diſcourſe is adapted to its end; "Dicere ſecundum virtutem orationis. Scientia bene dicendi." Quintilian. In common converſation, however, the word eloquence is ſeldom uſed in ſuch a comprehenſive ſenſe. But this definition exactly correſponds to Tully's idea of a perfect orator; "Optimus eſt orator qui dicendo animos audientium et docet, et delectat, et permovet." Accordingly all the ends of ſpeaking are reducible to four; every diſcourſe or ſpeech being intended to enlighten the underſtanding, to pleaſe the imagination, to move the paſſions, or to influence the will. When a ſpeaker addreſſes himſelf to the underſtanding his aim is to inform, and to convince, for the former of which purpoſes the predominant quality is perſpicuity, and for the attainment of the latter, argument. By the firſt we are made to know, and by the ſecond to believe. The imagination is addreſſed, by exhibiting to it a lively and beautiful repreſentation of a ſuitable object. As in this exhibition, the taſk of the orator may be ſaid to reſemble that of the painter, which conſiſts in imitation, the merit of the performance reſults entirely from the two following ſources, *viz.* dignity, as well in the ſubject, or thing imitated, as in the manner of imitation, and reſemblance, in the portrait or performance. This addreſs attains the ſummit of perfection in the *ſublime*, (which ſee,) or thoſe great and noble images, which, preſented to the mind in ſuitable colouring, expand, as it were, the imagination with ſome vaſt conception, and quite raviſh the ſoul. The characteriſtic of the third ſpecies of diſcourſe, or that which is addreſſed to the paſſions, is the *pathetic*. (See PASSIONS and PATHOS.) But the moſt complex and moſt important of all the kinds of eloquence is that which is calculated to influence the will and to perſuade to a certain courſe of conduct. This is an artful mixture, of that which propoſes to convince the judgment, and of that which intereſts the paſſions; and its diſtinguiſhing excellence reſults from theſe two, the argumentative and the pathetic duly blended. Theſe, combining their force and acting in concert, conſtitute that *vehemence* of addreſs, which is admirably fitted for perſuaſion, and has always been regarded as the ſupreme qualification in an orator. This animated reaſoning was by the Greek rhetoricians termed δεινότης, and from ſignifying the principal excellency in an orator was uſed at length to denote oratory itſelf. Hence, as vehemence and eloquence became ſynonymous, the latter, in conformity to this mode of thinking, was ſometimes defined "the art of perſuaſion." In order to perſuade, which, though not the only object of eloquence, is the moſt important and for many reaſons the moſt difficult, the moſt eſſential requiſites are ſolid argument, clear method, a character of probity appearing in the ſpeaker, joined with ſuch graces of ſtyle and utterance as ſhall command attention to what he ſays. Hearers who exerciſe their underſtanding cannot be perſuaded, without being convinced; but conviction and perſuaſion, though they are ſometimes confounded, ought to be diſtinguiſhed from each other. Conviction affects the underſtanding only; perſuaſion, the will and the practice. It is the buſineſs of the philoſopher to convince a perſon of the truth; but it is the buſineſs of the orator to perſuade him to act agreeably to it, by engaging the affections of the hearer. Conviction and perſuaſion ought always to accompany each other, but this is not univerſally the caſe; becauſe the inclinations do not regularly follow the dictates of the underſtanding. The inclination may revolt, though the underſtanding be ſatisfied; the paſſions may prevail againſt the judgment. Conviction, however, is one avenue to the inclination, or heart; and it is that which an orator ſhould firſt endeavour by his utmoſt efforts to gain; for no perſuaſion is likely to be ſtable, which is not founded on conviction. But in order to perſuade, the orator muſt do more than produce mere conviction; he muſt duly conſider the nature of man, and endeavour to act upon the different ſprings by which he is moved. He muſt addreſs himſelf to the paſſions; he muſt paint to the fancy, and touch the heart; and hence, beſides ſolid argument and clear method, all the conciliating and intereſting arts, both of compoſition and pronunciation, enter into the idea of eloquence.

"We may diſtinguiſh," ſays Dr. Blair, (Lectures, vol. ii.) "three kinds, or degrees, of eloquence. The firſt, and loweſt, is that which aims only at pleaſing the hearer. Such, generally, is the eloquence of panegyrics, inaugural orations, addreſſes to great men, and other harangues of this ſort. This ornamental ſort of compoſition is not altogether to be rejected. It may innocently amuſe and entertain the mind; and it may be mixed, at the ſame time, with very uſeful ſentiments. But it muſt be confeſſed, that where the ſpeaker has no farther aim than merely to ſhine and to pleaſe, there is great danger of art being ſtrained into oſtentation, and of the compoſition becoming tireſome and languid.

"A ſecond and a higher degree of eloquence is when the ſpeaker aims not merely to pleaſe, but alſo to inform, to inſtruct, to convince; when his art is exerted in removing prejudices againſt himſelf and his cauſe, in chuſing the moſt proper arguments, ſtating them with the greateſt force, arranging them in the beſt order, expreſſing and delivering them with propriety and beauty, and thereby diſpoſing us to paſs that judgment, or embrace that ſide of the cauſe, to which he ſeeks to bring us. Within this compaſs, chiefly, is employed the eloquence of the bar.

"But there is a third and ſtill higher degree of eloquence, wherein a greater power is exerted over the human mind; by which we are not only convinced, but are intereſted, agitated, and carried along with the ſpeaker; our paſſions are made to riſe together with his; we enter into all his emotions, we love, we deteſt, we reſent, according as he inſpires us; and are prompted to reſolve or to act, with vigour and warmth. Debate, in popular aſſemblies, opens the moſt illuſtrious field to this ſpecies of eloquence; and the pulpit alſo admits it." See farther on the different ſpecies of eloquence under the article ELOCUTION. For the hiſtory of eloquence, and an account of the moſt diſtinguiſhed orators; ſee ORATORY and ORATOR. Thoſe who diſtinguiſh between eloquence and rhetoric repreſent the latter as propoſing and explaining the theory, and the former as the practice of the art; but they are generally uſed indiſcriminately for each other. See ELOCUTION and RHETORIC. On the ſubject of this article, ſee Campbell's Philoſophy of Rhetoric, Blair's Lectures, vol.ii. and Cambray's Dialogues on Eloquence.

ELORA, or **ELLORA**, in *Geography*, a town of Hindooſtan, in the vicinity of Dowlatabad, famous for its numerous pagodas, moſt of which are cut out of the natural rock. M. Thevenot, who has particularly deſcribed them, ſays, that for two leagues together nothing is to be ſeen but pagodas, in which are ſome thouſands of figures. The ſculpture of them he does not much commend; and we may apprehend, ſays major Rennell, that they are of early Hindoo origin. It ſhould be recollected, that Deoghire, which ſtood in this neighbourhood, was the greateſt and richeſt principality in the Deccan; and that the fame of its riches incited Alla to attack it in 1293; and theſe elaborate monuments of ſuperſtition were probably, as Rennell ſuggeſts, the offspring of that abundant wealth, under a government purely Hindoo. Sir C. W. Malet has given a particular account of theſe wonderful excavations, illuſtrated with drawings, in the ſixth volume of the "Aſiatic Reſearches." As to their origin or date no inquiry which he had been able to make afforded him ſatisfaction. He has no doubt, however, that they are the works of people, whoſe religion and mythology were purely Hindoo; and he adds, that moſt of the excavations carry ſtrong marks of dedication to "Mahdew," as the preſiding deity. Nevertheleſs he ſuggeſts, that the moſt northerly caves of Ellora, occupied by naked ſitting and ſtanding figures, are the works of the "Sewras" or "Juttees," who by the Brahmens are eſteemed ſchiſmatics, and whoſe ſect, called "Srawuk," is very numerous in Guzerat. The tenets, obſervances, and habits of the "Sewras" are peculiar, and in many points very different from other Hindus. Their adoration of the deity is conveyed through the mediation of "Adnaut" and "Pariſnaut," the viſible objects of their worſhip, perſonified as a naked man ſitting or ſtanding. This ſect is ſuppoſed to be of a comparatively modern origin; and if this be the caſe, and the hypotheſis of the dedication of the temples to their idol be admitted, the limit of their poſſible antiquity will be aſſigned; but without aſcertaining, or affecting, that of the others. As to the antiquity of theſe aſtoniſhing works, this writer has detailed two different accounts; one given by an intelligent Mahometan and another by a Hindu. The account of the firſt is ſaid to have been derived from a perſon of acknowledged erudition. The ſecond was deduced from a book, entitled "Sewa Lye Mahat," or the grandeur of the manſion of Sewa, *i. e.* Mahdew. The Mahometan reported, that "the town of Ellora was built by rajah Eel, who alſo excavated the temples, and being pleaſed with them, formed the fortreſs of Deoghire (Dowlatabad,) which is a curious compound of excavation, ſcarping, and building, by which the mountains were converted into a fort, reſembling, as ſome ſay, the inſulated temple in the area of the "Indur Subba" (one of the pagodas.) Eel rajah was contemporary with Shah Momin Araf, who lived 900 years ago." The Brahmen, on the other hand, ſaid, "that the excavations of Ellora are 7894 years old, formed by Eeloo rajah, the ſon of Peſhpout of Elichpore, when 3000 years of the Dwarpa Youg were unaccompliſhed, which, added to 4894 of the preſent Kal Youg, makes 7894." Our author inclines to the former opinion. He farther informs us, that the "Koond," or ciſtern, mentioned by the Brahmens, is ſtill in excellent preſervation, juſt without the town of Ellora; and the holineſs of its water is even now in ſuch high eſtimation as to render it a "Teerut" (pilgrimage) of great reputation and reſort, under the appellation of "Sewalla Teeruit," or "Kond." There are many other excavations in a ſemicircular mountain, that commands a view of the fine valley of Ellora. In order to account for theſe extraordinary works, and the ſituation in which they were conſtructed, it ſhould be conſidered, that the ancient Brahmens avoided the contamination of cities, and affected the purity and ſimplicity of rural retirement. In ſituations remote from obſervation, the imagination of their diſciples probably enhanced the merits of their ſanctity. Accordingly, to alleviate auſterities, and to gratify the devout propenſities of theſe holy men, became objects of pious emulation. Under the influence of this principle, the munificence of princes may have engaged to provide them retreats, which, ſanctified by the ſymbols of their adoration, were at once ſuited, in ſimplicity and ſecluſion, to thoſe for whom they were intended, and in grandeur to the magnificence of their founders. Thus power and wealth may have been combined, under the guidance of enthuſiaſm, to produce monuments, ſcarcely leſs extraordinary or leſs permanent, though leſs conſpicuous and leſs known, than the pyramids of Egypt. Although ſome of theſe excavations are of very ancient origin, there are others, and particularly two, in a hill near a garden in the neighbourhood of Aurungabad, formed, as it is confidently aſſerted, by rajah Paur Sing, one of the Rajpoot Ameers of Aurungzebe's court, as a place of retirement, during his attendance on that monarch in his excurſions to the neighbouring garden.

ELOTZ, a town of Ruſſia, in the diſtrict of Orlof; 112 miles E.N.E. of Orel. N. lat. 53° 20'. E. long. 39° 14'.

ELOVKA, a town of Ruſſia, in the government of Tobolſk; 16 miles W. N. W. of Tomſk.

ELOY, Nicholas Francis Joseph, in *Biography*, was born at Mons, in the province of Hainault, on the 20th of September 1714, and died on the 10th of March 1788, having exerciſed his profeſſion as a phyſician with great ability and diſintereſted humanity. He was a man of extenſive learning, and great modeſty, and much addicted to ſtudy; whence, notwithſtanding his profeſſional avocations, he was enabled to write upon a variety of topics, and his publications are numerous. His firſt work, which was publiſhed in 1750, was a ſmall treatiſe, entitled "Reflexions ſur l'Uſage du Thé." His next publication was an attempt at a hiſtory of medicine, arranged in the form of a dictionary, and entitled "Eſſai du Dictionnaire Hiſtorique de la Medicine Ancienne et Moderne," in two volumes octavo, which appeared in the year 1755; this work was afterwards greatly enlarged, by extending the different articles which it contained, and was publiſhed in 1778, in four volumes quarto, with the title of "Dictionnaire Hiſtorique de la Medicine Ancienne et Moderne;" to which, as our readers will have obſerved, we have been much indebted for information relative to the different medical characters, of whom we have already given a biographical account. Eloy likewiſe publiſhed, in 1755, a ſmall volume, entitled "Cours Elementaire des Accouchemens;" and, a few years previous to his death, *viz.* in the years 1780 and 1781, he committed to the preſs two other eſſays, the firſt of which was entitled "Memoire ſur la Marche, la Nature, les Cauſes, et le Traitement de la Dyſenterie;" and the other, "Queſtion Medico-politique; ſi l'Uſage du café eſt avantageux à la ſanté, et s'il peut ſe concilier avec le bien de l'état dans les Provinces Belgiques?" As a ſlight reward for the patriotic zeal manifeſted in this tract, the eſtates of Hainault preſented him with a ſuperb ſnuff-box, with this inſcription, "Ex Dono Patriæ;" *the Gift of his Country*. He held the honourable office of phyſician to prince Charles of Lorraine. Nouveau Dict. Hiſtor. &c. Lyon, 1804.

ELPHIN, in *Geography*, a poſt town of the county of Roſcommon, province of Munſter, Ireland, 75 Iriſh miles W. by N. from Dublin, and 7 miles S. from Carrick, on Shannon.

Elphin, a biſhopric in Ireland, in the archi-epiſcopal province of Tuam. It dates its origin from St. Patrick, in the middle of the 5th century. It comprizes the greater part of the county of Roſcommon, a large ſcope in Sligo and Galway, and a very little in Mayo; and is reckoned one of the moſt valuable of the Iriſh biſhoprics. There are 75 pariſhes, which are formed into 29 benefices, and of theſe 26 have churches, which are the only ones in a tract of 420,150 Iriſh acres! The cathedral is a poor pariſh church, but the biſhop's palace is a very good modern houſe, in the midſt of an excellent demeſne, and adjoining the ſmall town of Elphin. Beaufort.

ELPHINSTON, William, in *Biography*, a Scotch prelate and ſtateſman, was born at Glaſgow about the year 1431. He was educated at the Univerſity of his native place, and became diſtinguiſhed for his proficiency in the learning of the times. He afterwards went to Paris, where he ſtudied the civil and canon law, and likewiſe delivered lectures with great reputation for ſeveral years. Upon his return to Scotland he was promoted to church livings, and admitted a member of the king's council. He was, ſoon after this, appointed a joint commiſſioner with the biſhop of Dunkeld and the earl of Buchan, in ſettling ſome diſputes between the courts of Scotland and France. As a reward for the prudence and eloquence which Mr. Elphinſton diſplayed on this occaſion, he was, on his return, nominated to the biſhopric of Roſs; whence, about the year 1484, he was tranſlated to the ſee of Aberdeen, and appointed, at the ſame time, to the chancellorſhip of the kingdom, an office which he held ſome time with the higheſt reputation; but when the troubles which took place between the king, James III., and his diſcontented nobility, had involved the kingdom in a civil war, he abandoned public ſtate affairs, and confined himſelf wholly to the duties of his biſhopric. But, on the acceſſion of James IV. his talents as a ſtateſman were again called into exerciſe, and from this time his ſovereign undertook no affairs of moment without his advice and concurrence. He died in 1514, at the advanced age of eighty-three, leaving behind him an excellent character; he was the patron of learning and learned men, and it is ſuppoſed, that by his influence the bull was obtained from the pope, for eſtabliſhing a univerſity at Aberdeen, with as ample privileges as were enjoyed by the moſt favoured ſeats of learning; and to his perſonal exertions and ſuperintendence, it was chiefly owing that the building of King's college was undertaken and completed. To that foundation he proved himſelf a munificent benefactor during the remainder of his life; and, at his death, when he bequeathed large ſums of money for its ſupport. Gen. Biog.

ELPISTICI, Ελπιςικοι, among the Greeks, a ſect of philoſophers, who made hope the ruling paſſion of mankind.

ELRICH, in *Geography*, a town of Germany, in the circle of Upper Saxony, and county of Klettenburg; formerly the capital of the county; in which are ſome conſiderable manufactures; 6 miles N. W. of Nordhauſen.

ELRICK, or EGELRIC ROAD, in *Antiquity*, was an ancient artificial road, made with great labour and expence through the fens, ten miles from Spalding to Deeping, by Egelric, abbot of Crowland, in the county of Lincoln, and afterwards biſhop of Durham; who, as Ingulphus relates in his hiſtory of that monaſtery, raiſed, by means of wood and gravel, a cauſeway, or cauſey, for travellers, through the centre of a wild foreſt and deep marſhes, called, after him, Egelric; or, by abbreviation, Elric-road. A part of it is ſtill viſible, lined with willows, between the river Welland, and the marſhes north of Crowland. Gough's Tranſlation of Ingulphus's Hiſtory of Crowland.

ELS, in *Geography*, a town of Moravia, in the circle of Brunn, 32 miles W. of Olmutz, and 24 N. N. W. of Brunn.

ELSA, a river of Tuſcany, which runs into the Arno, about a mile W. from Empoli.

ELSE, a river of Sileſia, which runs into the Oder, near Oderburg.

ELSEN, a ſmall town of France, in the department of the Roer, chief place of a canton in the diſtrict of Cologne, with a population of 304 individuals. But the canton contains 36 communes, and 12,239 inhabitants.

ELSEN, a town of Germany, in the kingdom of Weſtphalia, and biſhopric of Paderborn; 2 miles W. N. W. of Paderborn.

ELSFLETH, a ſmall town of Germany, in the duchy of Oldenburg, ſituated on the river Weſer, where the duke of Oldenburg exacts a conſiderable toll from all veſſels ſailing up the river towards Bremen. At the peace of Luneville, the duke was offered an indemnity for this toll, with the view to favour the commerce of Bremen; but its produce is ſo important, that the duke would not conſent to its abolition.

ELSGAU, a bailliage of Switzerland, being part of the biſhopric of Baſle, lying between the mountains and the Larg, and comprehending the town and bailiwick of Porentru, and 20 pariſhes.

ELSHEIMER, ADAM, in *Biography*, a painter of very extraordinary talents, ſtanding quite alone in the peculiar province of the liſt he adopted, *viz.* ſmall pictures of landſcapes with figures, and of ſmall figures with landſcape back-grounds. The figures being in ſome the principal object, and occupying the largeſt portion of the ſpace of the picture; and, in others, the landſcapes being the moſt important. He was born at Franckfort; at what period, thoſe who have written his life, differ much in ſtating; but the beſt authorities determine it to have been in 1574, and his death to have happened in 1620, ſo that he lived only 46 years.

He was at firſt a diſciple of Philip Uffenbach, whom he ſoon excelled, and then determined to go to Rome, where alone he could acquire that high taſte to which he aſpired.

After ſome time ſpent in ſtudy of the fine works there expoſed to his view, and an intimacy with many eminent painters, he fixed upon that ſtyle of art which has been mentioned as decidedly his own; in which no one had ever before exerted himſelf; and in which no one has ever ſince ſo highly excelled as Elſheimer.

That which renders his pictures ſo intereſting is, the grandeur of ſtyle in which they are executed. Many of his figures partake ſo much of Raphael's beſt manner of character, of action, and diſpoſition of the draperies, that if they were magnified, they would appear to be of that great maſter's own hand; and they have ſuperadded a colour which is of a ſuperior claſs; in the production of which, indeed, the ſmallneſs of their ſize was of conſiderable aſſiſtance to him; for it is by no means ſo eaſy to extend a full body of colour over a large ſurface, with equally pleaſing variety of tone, and freedom of execution; and in it to ſeparate and form the diſtinct parts as in a ſmaller one; and though it requires more neatneſs in the execution of the latter, it does not demand ſo free and ſo ready a hand to unite, to blend, and ſoften the various parts, and to give expreſſion its full force, as in the former.

His pictures exhibit great attention to nature; particularly his perſpective is very perfect, in lines, at leaſt; and he not unfrequently choſe very difficult things to manage: ſuch as working with a ſhort perſpective diſtance, and ſometimes placing his figures on the top of a hill, and ſuddenly loſing the ground, till it is recovered again in a deep valley. His landſcapes have, in general, the air of real views, and are finiſhed with wonderful attention to general form, and beautiful ſcenery. Their colour is not always exactly that of nature, but as ſeen under a peculiar illumination, like the tone which Titian has adopted in his St. Peter Martyr; giving it an air of grandeur not to be obtained, perhaps, by the brighter hues of nature.

From the extreme care and excellence with which his works are finiſhed, they were not, of courſe, in his ſhort life, very numerous; and are rarely to be met with. The richeſt collection of them in this country is at the earl of Egremont's, at Petworth, in Suſſex. There are ten pictures by him, eight of which are of one ſize, *viz.* about four inches high, by two and a half wide, or perhaps a little more. The ſubjects are, a St. Peter, St. Paul, St. John Baptiſt, Tobit and the Angel with a Fiſh, an old Woman and a Girl, an old Man with a Boy, and a Capuchin Friar, with a model of a convent in his hand. The figures in all theſe are about three inches high, yet their characters and expreſſions are juſt and excellent; and the drawing of their figures, and the draperies, in the beſt ſtyle of art. Another picture repreſents the interior of a brothel by fire and candle light, in which there are ten or more figures gaming, and indulging in the licentiouſneſs of ſuch a place, all exquiſitely wrought; with ſome expreſſions that have never been ſurpaſſed, although the figures are not more than two inches and a half high. The laſt is Nicodemus's viſit to Chriſt; but it is not of ſo good a quality as the others.

The ſubjects he choſe were generally moon light or candle light pieces, which he painted with great lightneſs, ſpirit, and delicacy of touch, and with great knowledge of the chiaro-ſcuro, and excellent colour; and with ſuch finiſh, that every part will bear the minuteſt inſpection.

While he lived his pictures bore high prices, and they of courſe were greatly enhanced on his death; one of them is mentioned by Houbraken, repreſenting Pomona, as having ſold for 800 German florins. There are engravings from many of Elſheimer's pictures by his friend and benefactor, count Gaud; but they are in general too heavy and black, and have a flatneſs of effect, particularly in the trees, very unlike the originals; among them is one from his moſt famed picture, the Flight into Egypt, a moonlight. It is now, with two others of different ſubjects, in the National Muſeum at Paris.

Elſheimer, though thus endowed with taſte and ſkill, was not the favourite of fortune. Notwithſtanding he obtained great prices for what he did, yet his care in the execution of them, and the time they coſt him to finiſh, were not ſo recompenſed as to enable him to live and maintain a large family with comfort. As what he earned by his paintings would not find ſuſtenance for himſelf and them, he fell into debt, and was caſt into priſon; the diſgrace of which, though he was not ſuffered to remain long confined, is ſaid to have preyed on his ſpirits, and haſtened his diſſolution. He was greatly regretted, and his works eagerly bought up, even by the Italians. The grand duke of Tuſcany had ſeveral of them, and the world juſtly lamented the ſevere fortune of ſo extraordinary a genius, who deſerved far more felicity than he was permitted to enjoy.

Elſheimer is highly celebrated, ſays another writer, for his careful pencil and extraordinary effects of light. Moſt of his landſcapes are illumined by fire, or by moon, or torch light; and in them he has introduced ſmall hiſtorical figures, which are highly appropriate to the ſcenes, and moſt exquiſitely painted: yet his Aurora, of which there is an excellent print by count Gaudt, ſhews that bright and ſudden light was not abſolutely neceſſary to the diſplay of his powers, and that he dipped his pencil in early dawn, with equal felicity.

The accuracy of his obſervation, and the retention of his memory were great, and the ſkill was ſcarcely leſs with which he introduced into his compoſitions, ſuch pictureſque incidents as he had once ſeen. Pilkington ſays that "it is impoſſible to conceive any thing more exquiſite in painting than the productions of the pencil of Elſheimer; for whether we conſider the fine taſte of his deſign; the neatneſs and correctneſs of the drawing of his figures; the admirable management and diſtribution of his lights and ſhades; the lightneſs, the ſpirit, and the delicacy of his touch; or the excellence of colouring; we are aſtoniſhed to obſerve ſuch combined perfections in one artiſt; in whoſe works even the minuteſt parts will bear the moſt critical inſpection, and the whole together is inexpreſſibly beautiful. He underſtood the principles of chiaro-ſcuro to the utmoſt perfection; and ſhewed the ſolidity of his judgment in the management of his ſubjects, which for the moſt part were night-pieces, by candle, or torch light," &c.

With theſe high claims to contemporary patronage, it was the fate of Elſheimer to fall a martyr to his own merits. Not affluence, nor even comfort, attended him in his profeſſional purſuits. His family was numerous, and the great care with which his ſenſibility to the minuter beauties of nature prompted him to finiſh his pictures, occupied ſo much time, that he was gradually overwhelmed with debts, and caſt into priſon. Being much reſpected, he was ſoon releaſed; probably by his friend Gaudt, the engraver: but returned, ſpirit-broken, to his art, and ſurvived not long. Poſterity will reverence his profeſſional merits, and regret his misfortunes.

Of artiſts of tranſcendant talent, it has been the frequent lot to receive from their contemporaries but a trifling earneſt, either of the value of their works, or the extent of their fame: ſo blind is taſte, with all its lofty pretenſions, or ſo reluctant is human nature to recogniſe the claims of living excellence.

Among the moſt celebrated of his works, which are known through Europe, by the diffuſion of count Gaudt's excellent engravings after them, may be mentioned his "Flight into Egypt," wherein he has contraſted the effects of fire and moonlight; two landſcapes, in each of which he has introduced "Tobit and the Angel;" a "Cottage Door by Candle-light, with Ceres drinking from a Pitcher;" the ſtory of "Baucis and Philemon;" the "Decollation of John the Baptiſt;" "Latona and her Sons, with the Lycian Peaſants metamorphoſed into Frogs;" and the "Death of Procris:" the two latter ſubjects were engraven in England by Magdalen Paſs. Some of his moſt valued performances were late in the gallery of the grand duke of Tuſcany. L.

ELSHOLTZIA, in *Botany*, ſo named by profeſſor Willdenow in memory of a Pruſſian botaniſt, John Sigiſmund Elſholtz, who lived in the middle of the 17th century, and publiſhed a *Flora Marchica*, or catalogue of plants cultivated in the principal gardens of Brandenburg, printed at Berlin in 1663, in ſmall 8vo. Willdenow mentions alſo a manuſcript work on Horticulture by the ſame writer in his native tongue, preſerved in the royal library of Berlin.—Willden. in Römer Uſteris Magazine, faſc. 11. 1. t. 1. Sp. Pl. v. 3. 59. Claſs and order, *Didynamia Gymnoſpermia*. Nat. Ord. *Labiatæ*, *ſect.* 3. Juſſ.

Gen. Ch. *Cal.* Perianth of one leaf, bell-ſhaped, with ten furrows, and five oblong acute teeth; the orifice cloſed with hairs. *Cor.* of one petal, ringent: tube cylindrical, ſhort, the length of the calyx: upper lip ſhorteſt, obtuſe, concave, four-toothed, clothed externally with long white hairs; lower obtuſe, ſtraight, ſharply crenate, externally clothed with hairs. *Stam.* Filaments four; the two uppermoſt ſhorteſt, lodged in the upper lip; the two lowermoſt in the under one: anthers roundiſh. *Piſt.* Germens four, roundiſh, ſuperior: ſtyle thread-ſhaped: ſtigma cloven. *Peric.* none. *Seeds* four, naked, browniſh, in the bottom of the calyx. Willdenow.

Eſſ. Ch. Calyx tubular, five-cleft. Corolla ringent: upper lip four-toothed; lower longeſt, undivided, finely crenate. Stamens diſtant.

1. E. *criſtata*. Willd. as above. (Hyſſopus ocymifolius; Lamarck Encycl. v. 3. 187.) "Spikes ſolitary, erect." Native of Siberia, about the lake Baikal. *Root* annual, fibrous. *Herb* with the habit of an *ocymum*, and a very fragrant ſcent, eſpecially when rubbed after drying, compared by ſome to roſes, but in our opinion more reſembling the muſcat grape. *Stem* a foot or more in height, ſquare, leafy, with oppoſite branches. *Leaves* ſtalked, oppoſite, ovate, acute, ſerrated, light green, ſmooth. *Spikes* terminal, ſolitary, ſtalked, unilateral, conſiſting on one ſide of a double row of obovate, pointed, imbricated bracteas, and on the other of three or four denſe rows of pale lilac-coloured flowers. This plant is propagated by ſeed, with little trouble, in our gardens, but has more ſingularity than beauty in its aſpect. The ſcent indeed renders it deſirable.

2. E. *paniculata.* Willd. Sp. Pl. v. 3. 59. (Hyſſopus criſtatus; Lamarck Encycl. v. 3. 187. Manám-podam; Rheede Hort. Mal. v. 10. 129. t. 65.) "Spikes panicled, reflexed." Native of moiſt places on the coaſt of Malabar. Lamarck, who had in his poſſeſſion fine ſpecimens of this plant from Sonnerat, aſſures us that the leaves are not alternate, as drawn in the *Hortus Malabaricus*, but oppoſite as in the preceding ſpecies, with which he rightly perceived its generic affinity. The chief ſpecific difference ſeems to be in the infloreſcence, which in the plant we are deſcribing is panicled, each branch of the panicle conſiſting of a numerous ſeries of reflexed ſpikes, ſhorter than in the former, with more oblique, unequally cordate, bracteas. Every part of this herb is ſaid to exhale an agreeable aromatic odour. The root ſeems to be annual.

ELSIMBURG, in *Geography*. See Helsinburg.

ELSINEUR, in Daniſh *Helſingoer*, a handſome town of Denmark, in the iſland of Zealand, at the entrance of the Baltic, oppoſite the Swediſh coaſt, 20 miles N. of Copenhagen. E. long. 12° 34′. N. lat. 55° 58′. The population amounts to between 6 and 7000 individuals. It derives its name from the Helſingers, an ancient Gothic colony, and is ſituated on the declivity of a hill, almoſt directly over-againſt Helſinburg, in the Swediſh province of Scania. The paſſage is not above 4 Engliſh miles. The narrow arm of the ſea, which joins the North ſea and the Baltic, is called the Oereſund, or *Sound*, and is protected by the caſtle of *Cronenburg*, which ſee.

Till the year 1425, when king Erick of Pomerania beſtowed on it the privileges of a city, Elſineur was but a ſmall inſignificant place. It has two churches, a grammar-ſchool, ſeveral handſome private buildings, and a ſugar-houſe. In 1753, a harbour was attempted, but the execution of the project was found impracticable. The road-ſtead, however, is excellent.

The principal trade of Elſineur is in wine and ſpirituous liquors; but it derives all its importance from the Sound dues, which, in times of peace, are paid at Elſineur by all veſſels paſſing through the Sound from either the Baltic or the North ſea. The cuſtom-houſe, where theſe duties are paid, is a very fine building, and it is on account of this toll, that all nations trading in the Baltic keep a conſul at Elſineur. The Sound dues are in proportion to the ſize of the ſhip and to the value of the cargo. They were originally a mere contribution to the expence of keeping light-houſes on the coaſt.

The number of veſſels of different nations that ſailed through the Sound and paid the dues at Elſineur, was in

1768 - - - -	6,30 veſſels.
1778 - - - -	8476
1788 - - - -	9224
1792 - - - -	12,114
1798 - - - -	9508
1802 - - - -	12,130
1803 - - - -	11,631
1804 - - - -	10,579
1805 - - - -	11,587
1806 - - - -	7 40
And in the firſt three months of	
1807 - - - -	342

From which ſtatement it appears, that the Baltic trade has been moſt conſiderable in the years 1792 and 1802, which both preceded the two late ruptures between England and France. See Sound.

ELSNABBAN, a ſea-port town of Sweden, in the province of Sudermania, on the coaſt of the Baltic; 32 miles E.N.E. of Nikioping.

ELSNER, James, in *Biography*, a doctor of theology, was born, in 1692, at Saalfield, in Pruſſia, and was deſtined by his father for trade, to which, however, he felt ſo ſtrong a diſinclination, that nothing could overcome it. He was accordingly ſent to the univerſity of Konigſberg, where he became private tutor to ſome young noblemen, and was afterwards appointed chaplain in the garriſon to field-marſhal count Alexander Von Dohm. He next went to Utrecht and Leyden, where he formed an intimacy with the moſt eminent literary characters of thoſe cities. In the year 1719, he publiſhed a work on the delivery of the law on Mount Sinai, and ſhortly after the firſt volume of his "Sacred Obſervations on the New Teſtament." In the following year he left Holland, at the invitation of his Pruſſian majeſty, by whom he was appointed profeſſor of theology and the oriental languages at Lingen, having firſt taken his degree of doctor at Utrecht. From this place he was called to Berlin to reſtore the reputation of Joachim's ſchool, which had fallen into much diſrepute for want of proper diſcipline. Elſner performed all that was required of him, and attained a high degree of reſpect, by the dignity and firmneſs of his manners. In the autumn of 1722, he pronounced an inaugural diſcourſe on the obligation of uniting piety to learning; and immediately after this, he was choſen a member of the Royal Academy of Sciences. Other preferments were conferred upon him, and he was always very fully employed either as a preacher or an author; and, in 1742, he was appointed director of the claſs of the belles-lettres in the Royal Academy; and when the ſociety was renewed in 1744, he retained the ſame office, and maintained the character which he had heretofore ſupported, as well by his attention to his academical duties, as by the learned diſſertations with which he enriched the memoirs of the inſtitution. He died of a fever on the eighth of October, 1750. His works are very numerous, and on various topics, but chiefly in theology. He publiſhed alſo, "A new deſcription of the ſtate of the Greek Chriſtians in Turkey," in which he received very important aſſiſtance from Athanaſius Doroſtamos, who came to Berlin to collect money for the Chriſtian ſlaves in England.

ELSTER, originally *Halſtrow*, in *Geography*, a ſmall town of the kingdom of Saxony, in Upper Luſatia, on a river called the *Black Elſter*, remarkable for its manufacture of knitted ſtockings.

ELSTERBERG, a ſmall town of the kingdom of Saxony, in the circle of Voigtland, between ſome high hills on the river Elſter, with an old ruined caſtle. It has a grammar-ſchool, about 2000 inhabitants, and a flouriſhing manufacture of ſtuffs and woollen cloth.

ELSTERWERDA, a ſmall town of the kingdom of Saxony, in the circle of Meiſſen, on the river Elſter, with a fine hunting caſtle and a beautiful park. It has only 700 inhabitants; but is remarkable for a canal which was dug here in 1740, and by means of which it has a conſiderable timber trade to Meiſſen and Dreſden.

ELSTOB, William, in *Biography*, was born at Newcaſtle-upon-Tyne, in the year 1673. He was educated at Eton and Cambridge, but the latter place not being congenial to his health, he removed to Queen's college Oxford, where he was choſen fellow and tutor. In the year 1697, he took his degree of M. A., and in 1702 was appointed rector of the united pariſhes of St. Swithin and St. Mary Bothaw in London. He died in 1714, when he was only forty-one years of age. He publiſhed ſeveral works, and had collected materials for a hiſtory of Newcaſtle. He had likewiſe projected many literary deſigns, of which the moſt important, was an edition of the Saxon laws, with great additions, together with notes of various learned men, and a prefatory hiſtory of the origin and progreſs of the Engliſh laws, down to the Conqueror and to Magna Charta. This great work was completed in 1721 by Dr. Wilkins, who deplores the loſs which the literary world had ſuſtained in the early death of Mr. Elſtob. He intended alſo a tranſlation, with notes, of Alfred's Paraphraſtic Verſion of Oroſius, of which his collections came into the poſſeſſion of the late Dr. Tegge. This work was afterwards publiſhed by the Hon. Daines Barrington, with an Engliſh tranſlation, who made uſe of Mr. Elſtob's tranſcript. Biog. Brit.

Elstob, Elizabeth, ſiſter of the preceding, was attached to the ſame kind of purſuits, and was born at Newcaſtle in 1683. From a very early period ſhe ſhewed a ſtrong predilection for literary purſuits. She reſided at Oxford during her brother's continuance at that univerſity, and is deſcribed as having been the *indefeſſa comes* of his ſtudies. She probably accompanied him to London, and aſſiſted him in his antiquarian purſuits. To one of his publications, *viz.* the Homily on St. Gregory's day, ſhe gave an Engliſh tranſlation, and a preface in vindication of female learning. By the encouragement of Dr. Hickes, ſhe undertook a Saxon Homiliarium with an Engliſh tranſlation, notes, and various readings, but only a few of the homilies were printed at Oxford in folio. In the year 1715, ſhe publiſhed a "Saxon Grammar," the types for which had been cut at the expence of lord chief juſtice Parker, afterwards earl of Maccleſfield. After the death of her brother, her circumſtances were ſo very low, that ſhe was reduced to the neceſſity of keeping a ſchool at Eveſham, in Worceſterſhire. By the interceſſion of ſome friends, queen Caroline allowed her a penſion of twenty guineas, which was paid very regularly till the death of that princeſs, when ſhe was again reduced to great difficulties, and had recourſe to education as a refuge from poverty. In 1739, ſhe was received into the family of the ducheſs of Portland, where ſhe continued till her death in the year 1756. Biog. Brit.

ELSYNGE, Henry, was born at Batterſea in 1598, and received his education at Weſtminſter-ſchool, and Chriſt-church college, Oxford. From the univerſity he went to the continent, and ſpent ſeven years in foreign travel. Upon his return he was, through the intereſt of archbiſhop Laud, elected clerk of the houſe of commons, the duties of which office he performed with ſingular ability, and much credit. He acquired the eſteem of all parties in the midſt of much diſcord and faction, and kept his poſt under the long parliament till December 1648, when he choſe to retire rather than take a part in the trial of the king. After this, he declined public buſineſs till his death in 1654. As an author his chief publication was entitled "The ancient Method and Manner of holding Parliaments in England." This was firſt printed in 1663. Anthony Wood ſuppoſed that it was chiefly tranſcribed from a MS. of the author's father, who was clerk of the houſe of lords, but there is no doubt it received many valuable additions from our author's own parliamentary experience. Mr. Elſynge left a tract concerning proceedings in parliament, never publiſhed; and alſo other tracts and memorials. Biog. Brit.

ELTEN, in *Geography*, a ſmall town of Germany, in the new kingdom of Weſtphalia, formerly a free imperial abbey, which was ſecularized at the peace of Luneville, and given as an indemnity to the king of Pruſſia, who loſt it again at the peace of Tilſit in July, 1807.

ELTERLEIN, a ſmall town of the kingdom of Saxony, in the circle of the Ertzgebirge, ſituated between Annaberg and Grunhayn, with about 1000 inhabitants. It is chiefly remarkable for the adjacent mines, which yield excellent magneſia and a very fine potters' clay for china. There is likewiſe a good manufacture of thread lace at Elterlein.

ELTHAM, a large village in the hundred of Blackheath and lathe of Sutton, in the county of Kent, England, conſiſts of 256 houſes, which are occupied by 1627 inhabitants. Its ancient name was Eald-ham, the old manſion or dwelling. John de Veſei, lord of Eltham, procured a grant of a market for this manor; and two other grants relating to it are extant among the records in the Tower. The market appears to have been diſcontinued in the time of James I., when the royal palace, the remains of which ſtand about two furlongs ſouthward from the village, ceaſed to be viſited by our kings.

Eltham palace was for ſeveral centuries a favourite retreat of the Engliſh ſovereigns, to which, probably, its vicinity to the metropolis contributed, as well as the pleaſantneſs of its ſituation. When it was originally built is unknown, yet it muſt have been prior to the year 1270, when Henry III. kept a grand public chriſtmas here, accompanied by his queen and all the great men of the realm. In the next reign, Anthony Bec, the warlike biſhop of Durham, obtained poſſeſſion of it, and conſiderably improved it: he died here in 1311. Edward II. frequently reſided here; and in the year 1315, his queen was delivered of a ſon in the palace, who was called John of Eltham, from the place of his birth. Edward III. held a parliament here in 1329, and another in 1375, when the Commons petitioned him to make his grandſon, Richard de Bourdeaux, prince of Wales. Edward IV. was at a great expence in repairing the palace, where, in 1482, he kept his chriſtmas in a very magnificent and coſtly manner, two thouſand perſons being daily fed at his charge. Moſt of the ſucceeding monarchs, to the time of Henry VIII., reſided much in this palace; but on the riſe of Greenwich it was gradually deſerted. The change which it has undergone is exceedingly ſtriking: formerly the abode of ſovereigns, and the birth-place of princes, it is now a farm; and the beautiful great hall, where parliaments were held, and entertainments given in all the pomp of feudal grandeur, is now uſed as a barn for the houſing and threſhing of corn. The area, in which the buildings ſtand, is ſurrounded by a high ſtone wall, that has been partially repaired and ſtrengthened by arches, &c. of brick, and a broad and deep moat, over which are two bridges, nearly oppoſite to each other, on the north and ſouth ſides. The hall is a moſt noble remain, meaſuring 100 feet in length, by 56 broad, and about 60 high. The windows have been extremely elegant, but are now bricked up. The roof is of timber, curiouſly wrought in the manner of that of Weſtminſter-hall, and richly ornamented with finely carved pendants. Three parks, well provided with deer, were formerly connected with this palace: in the largeſt, which includes an area of two miles in circumference, ſtands a reſpectable manſion, called Eltham lodge. Haſted's Hiſtory of Kent.

ELTMAN, a town of Germany, in the circle of Franconia, and biſhopric of Wurzburg; 8 miles W.N.W. of Bamberg, and 40 E.N.E. of Wurzburg.

ELVAS, formerly *Jelves*, a town and biſhop's ſee of Portugal, in the province of Alentejo, containing three pariſh churches, ſeven convents, two hoſpitals, and 12,500 inhabitants, including the diſtrict, in an open and fruitful territory, 18 leagues N.E. of Evora, and ſix W. of Badajoz, in Spain. It has a caſtle on an eminence, and is commanded by Fort la Lippe, a new and ſtrong fortification on the top of a hill. Here is a remarkable aqueduct, ſupported in ſome places by three arches one over the other; the ſtreets are narrow, irregular, and dirty; and the houſes are indifferently built. At ſome diſtance from the town the country is bleak and barren. N. lat. 38° 44'. W. long. 7°.

ELVÆ. See Elfs.

ELUDING, the act of evading, or rendering a thing vain, and of no effect: a dextrous getting clear, or eſcaping out of an affair, difficulty, embarraſſment, or the like.

We ſay, to elude a propoſition, &c. The deſign of chicanery is, to elude the force of the laws; this doctor has not reſolved the difficulty, but eluded it. Alexander, ſays the hiſtorian, in cutting the Gordian knot, either eluded the oracle, or fulfilled it: "Ille nequicquam luctatus cum latentibus nodis, Nihil, inquit, intereſt, quomodo ſolvatur; gladioque ruptis omnibus loris, oraculi ſortem, vel eludit vel implevit." Q. Curt. 13.

ELVEN, in *Geography*, a ſmall town of France, in the department of Morbihan, chief place of a canton in the diſtrict of Vannes, with a population of 3829 individuals. The canton contains five communes and 9136 inhabitants, upon a territorial extent of 220 kiliometres.

ELVERDINGHE, a ſmall town of France, in the department of the Lys, chief place of a canton in the diſtrict of Ypres, with 2729 inhabitants. Its canton has a population of 9057 individuals diſperſed in 9 communes, on a territorial extent of 112½ kiliometres.

ELVERS, in *Ichthyology*, an Engliſh name for a ſmall ſort of eels, caught in ſome parts of the kingdom, particularly about Glouceſter and Tewkſbury. Theſe are, in reality, young congers, or ſea-eels. They get up into rivers while very ſmall, and as they precede the ſhads, it is conjectured that they ſupply them with food. They are taken in prodigious numbers in the rivers, in dark nights, by a kind of ſieve made of hair-cloth, fixed to a long pole, and are eſteemed a very delicate food. Willughby.

EL-VISO, in *Geography*, a well built town of Spain, in the province of New-Caſtile, and diſtrict of La Manche, containing a pariſh church, a convent, a palace of the marquis D'El-Viſo, and 3500 inhabitants, about 20 leagues S.W. of Alcaraz; and 13 S.S.E. of Ciudad Real, ſituated in a fertile plain, producing corn, wine, and fruits.

ELVIUS, Peter, in *Biography*, was born at Upſal in 1710, and applied himſelf in early life to the ſtudy of mechanics, under able maſters. In the year 1738, the royal college of Mines entruſted him with the care of its collection of machines. His own knowledge enabled him to conſtruct a fulling mill on new principles. In 1743 he undertook, with M. O. Hamren, a tour through the kingdom of Sweden, to examine where the beſt ſituations could be obtained for works to be driven by water; and on this occaſion he drew plans of thoſe places which ſeemed moſt convenient for the purpoſe. For this ſervice he obtained a place in the academy of Upſal, and applied himſelf to the calculation of chances and probabilities, which led him to conſider the exiſting bills of mortality, and the means for rendering them more accurate and uſeful. He was a diligent obſerver of the heavens, and on the iſland of Huen ſearched out the ruins of the reſidence of Tycho Brahe, and made ſome celeſtial obſervations amidſt the remains of Uranienburg. He died at the early age of 38, on the 27th of Sept. 1749, and the Academy of Sciences, to which he had been the ſecretary, cauſed a medal to be ſtruck in honour of his memory. Gen. Biog.

ELUL, in *Chronology*, one of the Hebrew months, anſwering partly to our Auguſt and September. There are but nine and twenty days in it. It is the twelfth month of the civil year, and the ſixth of the eccleſiaſtical. Upon the ſeventh or ninth day of this month the Jews faſt, in memory of what happened after the return of thoſe who went to view the promiſed land. Numbers, xiii. xiv.

Upon the twenty-ſecond of this month, the feſtival of the xylophori was obſerved, when wood was carried to the temple. Selden ſays, that it was celebrated on the eighteenth day of the month Ab. On the twenty-ſixth of the ſame month, the dedication of the walls of Jeruſalem by Nehemiah was commemorated. Joſeph. lib. ii. cap. 17. p. 811. Nehem. xii. 27, &c. Calmet, Diction. Bibl.

ELVO, in *Geography*, a river of Italy, which runs into the Seſia, 2 miles N. of Vercelle.

ELUSA, in *Ancient Geography*, a town of Paleſtine, in Idumæa, W. of Jordan, according to Ptolemy. This town was once an epiſcopal city, and it is placed by P. Hardouin in the third Paleſtine.

Elusa, called alſo *Eluſæ*, and *Civitas Eluſatium*, a town of Gaul, was formerly the metropolis of Novempopulania, and maintained that rank till the eighth century. But upon its deſtruction by the Normans, the ſee of Auch was advanced to the rank of Metropolitan. Some remains of this place retain the name of Ciutat near Euſe.

ELUSATES, the inhabitants of Eluſa, who occupied the N.W. diſtrict of Armagnac. Cæſar mentions them, and places them between the Taruſates and the Garites.

ELUTRIATION, or *waſhing over*, is a method of ſeparating ſubſtances of different ſpecific gravities from each other by means of water. For this purpoſe the mixture is ſtirred about briſkly in a veſſel full of water, and when the heavier particles have again fallen to the bottom, the water, ſtill turbid with the lighter ones that are as yet ſuſpended, is poured off into another veſſel, to the bottom of which they, in a ſhort time, ſubſide. By this ſimple method a ſkilful perſon will ſeparate from each other three or four ſubſtances with great exactneſs.

ELUVIES, in *Geology*, is a term uſed by Mr. Parkinſon, (Organic Remains, i. 275.) and ſome other writers, to expreſs the ſuppoſed ruins of the antediluvian earth, effected by the Noachic deluge, but which it is preſumed by others, from the Moſaic account of that miracle, did not deſtroy the exiſting vegetable productions or the fiſh, and much leſs therefore could it have effected the univerſal diſintegration of mineral ſubſtances, on which Dr. Woodward's and ſome other theories are built. Beſides, the animal and vegetable ſubſtances, which are found imbedded in the ſuppoſed poſt-diluvian ſtrata, are none of them of the ſpecies, which, by the eſtabliſhed modes of generation, have been handed down to us, immediately from thoſe individuals of each ſpecies which Noah preſerved in the ark, when the reſt were drowned by the flood.

ELUXATIO, (from *eluxo*, to put out of joint,) a diſlocation.

ELWAD-AD, in *Geography*, a town of Arabia, in the country of Yemen; about 40 miles nearly W. of Chamir. N. lat. 16° 16'. E. long. 42° 30'.

ELWALL, Edward, in *Biography*, was born at Sedgley, near Wolverhampton, in Staffordſhire. At Wolverhampton he ſettled in buſineſs, and acquired the reputation of honeſty and great integrity in his dealings. As a politician, he was diſtinguiſhed as the zealous aſſertor of the civil and religious rights of the people, and as a vigorous ſupporter of the Hanoverian ſucceſſion. He was of a ſerious and inquiſitive turn of mind, and never heſitated to proclaim his ſentiments on any ſubject that he deemed important. He conſidered the fourth commandment as binding on all generations, and not only wrote in defence of the opinion, but while in buſineſs, conſtantly ſhut up his ſhop on the ſeventh day, and opened it on the firſt day of the week; hence he was ſtigmatized as a Jew. About the year 1714 he became diſtinguiſhed as an Unitarian, and publiſhed "A true Teſtimony for God and his ſacred Law, being a Defence of the firſt Commandment of God, againſt all Trinitarians under Heaven." This drew on him the reſentment of the neighbouring clergy, who ceaſed not to purſue him with their enmity, till they procured an indictment againſt him for hereſy and blaſphemy; on which he was tried, without having had a copy of his indictment, before judge Denton about the year 1726, at Stafford aſſizes. He pleaded his own cauſe, and vindicated the principles which he had embraced with a firmneſs and preſence of mind, ſaid to have been rarely equalled in modern times, and with complete ſucceſs, for a reſpectable and honeſt jury, under the direction of an upright judge, acquitted him. Mr. Elwall was not daunted by the obloquy and proſecution which his firſt piece had drawn on him from defending with freedom the ſentiments for which he had ſuffered, but publiſhed ſeveral other tracts, having the ſame tendency. After his trial he removed to London, and became a member of the ſeventh-day Baptiſt church at Mill-yard, Goodman's fields. In the latter part of his life he frequently attended the religious aſſemblies of the quakers, and was ſometimes admitted to ſpeak among them. He died in London at an advanced age, with an unſullied reputation, about the year 1745. He had not enjoyed the advantages of a learned education; but his natural abilities, and good judgment, were ſuch as rendered his converſation agreeable to perſons in the higher ranks of ſociety, by whom he was known, and reſpected, on account of his ardent attachment to the houſe of Hanover. Speaking of himſelf, his principles, and conduct, he ſays, "I have been a ſturdy and ſtrenuous friend to my royal friend George theſe forty years and upwards, ever ſince the nation happily ſettled the crown in his illuſtrious family; and many a ſtately Jacobite and Tory have I ſilenced by dint of argument, and brought to the ground by dint of fiſt, yet generally in ſelf-defence, and not to convince his judgment." He was a man of inflexible integrity and of extenſive charity, as well as of fervent piety.

ELWANGEN, in *Geography*, a ſmall town of the kingdom of Wurtemberg, 18 miles S.E. of Halle, in Suabia, and 30 S.W. of Anſpach. It was formerly a rich abbey of the German empire, whoſe prelate ranked as a prince, and voted in the college of princes. At the peace of Luneville it was given to Wurtemberg as an indemnity for the territory which its ſovereign was forced to cede to France on the weſtern ſhore of the Rhine.

ELWY, Britain, the name of two rivers in Wales, one riſing near Gwythrin, in the weſt part of Denbighſhire, in North Wales, runs eaſtward for ſome miles, then ſuddenly turning northward above St. Aſaph, paſſes by that city, and falls into the Clwyd, about three miles below it. Another river of the ſame name riſes in the mountains to the northward of Capelton Ybedyddier, in Glamorganſhire, South Wales; and running in a ſouth-eaſterly direction paſſes Henſall park, St. Fagan's, &c. and meeting the Taf, at the Embochure, near Penarth-point, forms Penarth harbour.

ELXAI, in *Biography*. See ELCESAITES.

ELY, ISLE *of*, in *Geography*, a tract of land ſo called, is ſituated in the northern part of Cambridgeſhire, England, and was formerly ſurrounded by waters; but, in conſequence of the vaſt improvements made by draining the fens, &c. it is now merely known by the name of an iſland. The whole diſtrict, called the iſle of Ely, extends from the bridge at Tyd on the north, to Upwere on the ſouth, 28 miles in length; and from Abbot's or Biſhop's Delf on the eaſt, to the river Nene, near Peterborough, on the weſt, 25 miles in breadth: and includes ſeveral conſiderable towns and villages, of theſe the principal place is

ELY, which, though far from populous, claims, as being the ſee of a biſhop, the appellation of a city. It is ſituated on a ſmall eminence near the river Ouſe, and owes its origin to the eſtabliſhment of a monaſtery here, A.D. 673, by Etheldreda, daughter of Anna, king of Eaſt-Anglia. After her death, in 679, the government of the abbey ſucceſſively devolved on her ſiſter Sexburga, queen of Kent; Ermenilda, queen of Mercia, daughter of Sexburga, and the princeſs Werburga, her grand-daughter, all of whom were, with the foundreſs, for many centuries conſidered as ſaints. A town gradually aroſe about the monaſtery; and both remained in peace and ſecurity till the year 870, when this place of monaſtic retirement was diſcovered by the Danes, who invaded the iſle, and, though at firſt repulſed by the bravery of the inhabitants, returned in greater numbers, and overcame every defenſive effort. They put the religious to the ſword, ſet fire to the church and other buildings, and departed, loaded with the ſpoil, not only of the town and monaſtery, but alſo of all the neighbouring places, whoſe inhabitants had depoſited their valuables here for better ſecurity. Some of the inmates of the monaſtery, who had eſcaped the maſſacre by flight, returned a few years afterwards, and commenced a college for ſecular clergy, which continued till 970, when the monaſtery was reſtored to its former eſtabliſhment by Ethelwold, biſhop of Wincheſter, under the patronage of king Edgar, who, in conſideration of a large ſum paid by the biſhop, gave up to the convent the juriſdiction of the iſle, which after the Daniſh maſſacre had been annexed to the crown. Biſhop Ethelwold beſtowed large benefactions on the abbey, which now conſiſted of regular monks of the order of St. Auguſtine. Brithnoth, the firſt abbot, exerted himſelf to complete the repairs of the church. The abbey continued to proſper till the conqueſt: its privileges being previouſly augmented and confirmed by Canute, and again by Edward the Confeſſor, the latter of whom had received his education within its walls. During the confuſion which enſued on the Norman invaſion, the abbey was deprived of many eſtates; and Thurſtan the abbot, fearing that its whole poſſeſſions would be ſeized by the Conqueror, reſolved to ſupport the intereſt of Edgar Atheling, in which he was joined by ſeveral Engliſh nobles, who were determined to defend their country from the dominion of William, whom they regarded as an uſurper. A vigorous, and, for ſome time, effectual reſiſtance was made; but at length, the abbot having ſeceded from the confederacy, the ſuperior proweſs of the Norman ſoldiers prevailed. Great numbers of the Engliſh were ſlain in battle; and many of thoſe, who were made priſoners, were cruelly mutilated; ſome having their eyes put out, and others their hands and feet cut off, that they might remain living monuments of the Conqueror's vengeance, and become a terror to ſuch as diſputed his authority.

A biſhop's ſee was eſtabliſhed here in 1107, and Henry, biſhop of Bangor, was appointed the firſt dioceſan. This prelate procured many gifts and privileges for his biſhopric, and a grant of a fair for the city, to continue for ſeven days. The king granted a mandate to make an equal diviſion of the abbey eſtates, between the prelate and the abbot, but the former contrived to retain a full third of the poſſeſſions more than he was entitled to. On the ſurrender of the monaſtery to Henry VIII. that monarch granted his letter-patent, dated September 10, 1541, to convert the conventual church into a cathedral, by the title of the Cathedral Church of the Undivided Trinity; the eſtabliſhment for the performance of divine ſervice to conſiſt of a dean, a prieſt, and eight prebendaries, with other miniſters: the dean and prebendaries to form a body corporate. The biſhop of Ely poſſeſſes the rights of a lord of a county palatine, and is ſovereign within the iſle, where all cauſes are heard and determined by a judge of his appointing, who holds aſſizes, gaol delivery, and quarter ſeſſions.

The cathedral is the workmanſhip of very different periods, and diſplays a ſingular admixture of the Saxon, Norman, and Engliſh ſtyles of architecture; yet, notwithſtanding the diſſimilarity of its parts, it muſt, when conſidered as a whole, be regarded as a very magnificent ſtructure. The north and ſouth tranſepts, which are the oldeſt parts, were erected in the reigns of William Rufus and Henry I. Here the arches are ſemi-circular, as well as in the nave, which was begun in the reign of the latter monarch, and completed before 1174. Between this period and the year 1189, biſhop Rydel erected the great tower at the weſt end, which was anciently flanked on the north ſide by a building of the ſame kind as that on the ſouth: but this either fell or was taken down, and another building begun in its place. This was never carried higher than 12 or 14 feet. The interior view of this tower is particularly beautiful, it being decorated with ſmall columns and arches running round in ſeveral ſtories, and lighted by 27 windows. The lower part was repaired, and new caſed with ſtone, in the middle of the 15th century. The handſome veſtibule at the entrance, formerly called the Galilee, was built about the year 1200, by biſhop Euſtachius. The foundation of the elegant ſtructure which was originally the preſbytery, but now forms the choir, was laid by Hugh Northwold, the eighth biſhop, in the year 1234, and finiſhed in 1250. The three moſt weſtern arches were deſtroyed by the fall of the lofty central tower, in the night of the 12th of February, 1322. To prevent the recurrence of a like accident, Alan de Walſingham, ſub-prior of the convent, and ſacriſt of the church, a perſon eminently ſkilled in architecture, deſigned and erected the preſent magnificent octagon, which is ſupported on eight pillars, and terminated by a lantern. The capitals of the pillars are ornamented with hiſtorical carvings, repreſenting the principal events in the life of Etheldreda. This octagon is probably unequalled by any of the kind: the ſtone work was completed in ſix years, and the wood work raiſed thereon, and covered with lead, in about 15 years. The whole was perfected in the year 1342, at the expence of 2406*l.* 4*s.* 11*d.* The three arches eaſtward of the octagon were rebuilt about the ſame period, by biſhop Hotham, and are very much embelliſhed. At the eaſt end of the north aiſle is a ſumptuous chapel, erected by biſhop Alcock, who died at his caſtle at Wiſbech, in 1500. His tomb, with his effigy lying thereon, but much defaced, is placed under an arch of ſtone on the north ſide. In the ſouth aiſle, and in ſome reſpects correſponding with the former, but much ſuperior in its embelliſhments, is another chapel, which was erected by biſhop Weſt, about the year 1530, and is highly enriched with ornaments and elegant tracery, &c. Both theſe chapels were greatly dilapidated by the enthuſiaſtic reformers who ſprung up during the civil wars, and ſeem to have had an invincible antipathy to every religious edifice that diſplayed taſte and elegance.

The extreme extent of the cathedral, from eaſt to weſt, is 535 feet; but the interior length is only 517. The length of the tranſept is 190 feet, the height of the lantern over, 170. The extreme height of the weſtern tower 270, and the tower on the ſouth wing of the latter 120. The length of the nave is 203 feet, and the height of the roof over it 104. The height of the eaſtern front to the top of the croſs is 112 feet. Near the eaſt end of the cathedral, on the north ſide, is St. Mary's chapel, now Trinity church; it having been aſſigned to the uſe of the inhabitants of that pariſh ſoon after the Reſtoration, by the dean and chapter. This elegant ſtructure was commenced in the reign of Edward II. and is one of the moſt perfect buildings of that age. The ſhape is an oblong ſquare; the interior length being 200 feet, the breadth 46, and the height of the vaulted roof 60. This building has neither pillars nor ſide aiſles, but is ſupported by ſtrong buttreſſes, ſurmounted with pinnacles. The ſpaces over the eaſt and weſt windows were formerly decorated with ſtatues, and a variety of well-executed ſculpture: and the interior was embelliſhed with niches highly carved, and enriched with ſtatues, ornamental foliage, and flower-work. This edifice was built at the charge of the convent by John de Wiſbech, one of the monks, and Alan de Walſingham, who erected the octagon. The firſt ſtone was laid by the latter on Lady-day, 1321. The cloiſters, and other buildings belonging to the monaſtery, have been long ſince demoliſhed, with the exception of the refectory, which has been converted into the deanery; and an elegant little chapel built by prior Crauden, now uſed as a granary, adjoining to it.

The principal charitable benefaction for the uſe of the poor of Ely is veſted in the churchwardens, and ariſes from eſtates in the neighbourhood, bequeathed by —— Parſon, about the year 1425. Here is alſo a free-ſchool, ſupported by the dean and chapter; and a charity-ſchool for twenty-four boys, who are educated and cloathed by the income of an eſtate bequeathed by Mrs. Needham about 1740. The police of Ely is regulated by the magiſtrates, who are appointed by the biſhop, and are juſtices of the peace within the iſle. Theſe meet for the diſpatch of buſineſs every market-day, which was altered in 1802 from Saturday to Thurſday. This city is the only one in England not repreſented in parliament. Many of the houſes are of ſtone, and ſome of them have an ancient appearance. The ſtreets are irregular, and, with the exception of the principal one, neither lighted nor paved. The population, as aſcertained under the late act, was 3713; the number of houſes about 700. The chief employment of the inhabitants is gardening, which is carried on in this neighbourhood to a great extent. Cambridge, St. Ives, and even London, receive conſiderable ſupplies of vegetables from this place. Great quantities of ſtrawberries are alſo reared here, and ſome other fruits; but theſe are chiefly conveyed in barges to Lynn, and carried thence by the veſſels employed in the coal trade to Newcaſtle-upon-Tyne, and other places in the north of England.

The Rev. James Bentham, author of "The Hiſtory and Antiquities of the conventual and cathedral church of Ely," was a native of this city. Some account of this gentleman has already appeared in this work. (See BENTHAM.) An intereſting and well written account of Ely cathedral has recently been publiſhed by the Rev. Mr. Miller, of this place. See alſo Lyſons's Magna Britannia, vol. ii.

About one mile from Ely is Tatterſall-hall, which derived its name from the late Mr. Tatterſall, of ſporting memory, and is now poſſeſſed by his ſon.

ELY, *Elie*, or *Ellie*, a pariſh of Fifeſhire, in Scotland, within which is an ancient royal borough of the ſame name. This is ſituated cloſe to the ſea, on the ſouthern ſhore of the Frith of Forth, where there is an excellent harbour, much reſorted to by "wind-bound veſſels." Seven ſquare-rigged veſſels, carrying 1000 or 1100 tons, belong to it, and are employed in foreign trade. Veſſels of large ſize are built here; and in the town are ſome manufactories for checks, bed-ticks, and ropes. Near the ſhore rubies have been diſcovered. Contiguous to the town, in the face of Kincraig rocks, is the cave of Mac-Duff, in which it is related that Mac-Duff retreated from Macbeth and his followers. Malcolm granted many privileges to this town. Sinclair's ſtatiſtical Account of Scotland.

ELYMAIS, in *Ancient Geography*, or, as it is called by Strabo, *Elymatis*, a province of Perſia, lying between the rivers Eulæus and Oroates, and extending from the confines of Media to the Erythræan ſea, or Perſian gulf. It was formerly divided into three great diſtricts, *viz.* Meſabatene, Gabene or Gabiene, and Carbiana, and containing the following cities, *viz.* Seleucia or Soluce, on the banks of the Hedypos or Hedypnus, which Strabo calls a great city, Saſirate, at a ſmall diſtance from mount Caſyrus, Badaca, on the Eulæus, and Elymais, the metropolis of the province, famous for a rich temple conſecrated to Diana, which Antiochus Epiphanes attempted to plunder, but he was obliged by the inhabitants to retire in diſgrace to Media. This temple was afterwards plundered by one of the Parthian kings, who found in it, as we are informed by Strabo, 10,000 talents. In this country there was alſo a very rich temple conſecrated to Jupiter Belus, which Antiochus the Great attempted to plunder, but loſt his life in the attempt. The country of Elymais was inhabited, according to Pliny, by the following nations, *viz.* the Oxii, or Uxii, Mizæi, Parthuſi, Mardi, Saitæ, Hyi, Coſſæi, Parætaceni, and Meſſabatæ. The Elymæans were a powerful people, inured to the toils of war, ſkilful bowmen, and never ſubdued either by the Syro-Macedonian, or Parthian kings, but governed by their own princes. If we may depend upon the authority of Strabo, the riſe of this kingdom may be dated from the downfall of the Perſian monarchy, for the ancients are agreed that the Elymæans were ſubject to the kings of Perſia; and if they never ſubmitted to the Syrian yoke, they muſt have been firſt governed by their own princes, either in Alexander's life-time, or ſoon after his death. Nothing is known of their kings, but that they aſſiſted Antiochus the Great in his wars with Rome, but afterwards cut him off in defence of their temple. They afterwards engaged, under the conduct of their king, in a war againſt the Babylonians and Suſians, in which they were aſſiſted by the Coſſæans with 13,000 archers.

ELYMAIS is alſo a name given by ſome writers to the city of Perſepolis.

ELYMI, or HELYMI, a people who inhabited the N.W. part of Sicily, about the river Crimiſa, where were ſituated the towns of Ægeſta or Aceſta, Erice and Entella.

ELYMIA, a town of Greece, in the Peloponneſus, placed by Xenophon towards the towns of Mantinæa and Orchémene.

ELYMIOTÆ, a people of Macedonia, who occupied a plain almoſt ſurrounded by mountains, towards the ſource of the river Aliacmen, according to Ptolemy. They had to the N. W. the country of the Lynceſtes, to the N. E. Emathia, to the S. E. the Pelaſgiotide, and to the S. W. Pelagonia.

ELYMNIUM, one of the names of the iſland of Eubœa.—Alſo, a town of Macedonia, on mount Athos.

ELYMUS, in *Agriculture*, a term ſignifying lime-graſs, a genus of graſſes which are of but little uſe to the farmer, except in protecting the looſe ſandy banks on the ſea-ſhores, in different parts of the iſland; and for which purpoſe the following ſort is the moſt uſeful.

ELYMUS *Arenarius*, ſea lime-graſs, which is a kind of graſs that, with the ſea reed, helps very much, according to the opinion of Mr. Sole, to ſuſtain and keep up the looſe ſand-banks on the borders of the ſea, from the deſtructive effects of the tides.

ELYMUS, in *Botany*, ελυμος; of Dioſcorides, from ελυω, *to fold up*, alluding to the ſheath which incloſes the ſpike or ear of ſome ſpecies. This etymology applies at leaſt to the Millet or Panick, ſuppoſed to be the ancient ελυμος, but Linnæus has adopted the name for a new genus of his own, akin to *Hordeum* and *Triticum*, to which it is leſs ſuitable. Linn. Gen. 39. Schreb. 54. Willd. Sp. Pl. v. 1. 467. Juſſ. 31. Sm. Fl. Brit. 152. Mart. Mill. Dict. v. 2. Claſs and order, *Triandria Digynia.* Nat. Ord. *Gramina.*

Gen. Ch. *Cal.* Common receptacle elongated into a ſpike. Perianth lateral, aggregate, conſiſting of two lanceolate glumes to each ſpikelet. *Cor.* of two valves; the outer one largeſt, pointed, awned; the inner concave, emarginate, finely fringed. Nectary a pair of oblong, acute, fringed ſcales. *Stam.* Filaments three, capillary, very ſhort; anthers oblong, cloven at the baſe. *Piſt.* Germen turbinate; ſtyles two, divaricated, ſhort; ſtigmas feathery. *Peric.* none, except the permanent corolla. *Seed* ſolitary, linear, convex at the back, concealed by the glumes.

Eſſ. Ch. Calyx lateral, aggregate, of two valves, containining many florets.

A genus of large coarſe rigid graſſes, for the moſt part perennial, with long creeping roots. This laſt quality renders the *E. arenarius*, Linn. Sp. Pl. 122. Sm. Engl. Bot. t. 1672. Knapp. t. 108, particularly valuable, as forming a natural barrier, in the looſe blowing ſand of many ſea ſhores, to the encroachments of the ocean, being indeed one of the principal means by which the induſtrious Hollanders have gained a part of their territories from the ſea. It is in England comprehended with *Arundo arenaria* and *Carex arenaria*, (ſee thoſe articles,) under the name of Marram, and acts of parliament have been made for their preſervation. The roots and leaves of ſuch graſſes being very durable, retain the blowing ſand, of which they accumulate more and more as they extend in growth upward, and thus gradually form a natural and very firm bank. In a clay ſoil they are of no avail. Of the economy of the American or Siberian ſpecies of *Elymus*, we have no information. Two annual European ſpecies, *E. Caput-Meduſæ* and *E. Hyſtrix*, are furniſhed with very long rough capillary awns, by which their ſeeds are not only wafted to a diſtance, but detained by the accumulation of blowing ſand, when they have once alighted, till they can fix themſelves by roots.

ELYOT, *Sir* THOMAS, in *Biography*, a gentleman eminent in various branches of learning, and a patron and friend of moſt of the learned men in the reign of Henry VIII., was deſcended of a good family in the county of Suffolk, and ſon of ſir Richard Elyot. He was educated at St. Mary's Hall, in Oxford, where he made a great progreſs in logic and philoſophy; but the year in which he entered (like the year of his birth) is not certainly known; it is, however, ſuppoſed to have been about the year 1514. After he had ſpent ſome years at the univerſity, he travelled into foreign countries, and, on his return, was introduced at court. His uncommon genius and extenſive learning recommending him to the favour of Henry VIII. who was a great patron of men of letters, his majeſty conferred upon him the honour of knighthood, and employed him in ſeveral embaſſies. He ſent him, particularly, to Rome in the year 1532, on the ſubject of the divorce of queen Catharine, and afterwards to the emperor Charles V. in the year 1536. Elyot was, as Wood obſerves (ſee his Athen. Oxon.) an excellent grammarian, poet, rhetorician, philoſopher, phyſician, coſmographer, and hiſtorian; and was diſtinguiſhed as much for his candour, and for the innocence and integrity of his life, as for his accompliſhments. He was admired and beloved by all the men of learning who were his contemporaries, and his memory is celebrated by them in their reſpective works, particularly by Leland, in his "Encomia Eruditorum Virorum." He was buried on the 25th of March 1546, in the church of Carleton, in Cambridgeſhire, of which county he had been ſheriff; and a monument was ſoon after erected over his grave. He poſſeſſed ſeveral manors in Cambridgeſhire, and one or more in Hampſhire.

He wrote and tranſlated ſeveral works. 1. "The Caſtell of Health," which is ſaid to have been firſt publiſhed in 1541; but Dr. Aikin obſerves, that his edition of that year is aſſerted to be "corrected, and in ſome places augmented, by the firſt author thereof." It was reprinted in 1572, 1580, and 1595. The reading of the author, as it appears from his *proheme*, or preface, was unuſually great, conſidering that he did not follow the profeſſion of phyſic, having extended to the works of all the Greek, Arabian, and Roman writers of credit. This book was greatly eſteemed, not only by the public in general, but by ſome of the faculty in his time, and is, indeed, fully as worthy of notice as moſt of the medical pieces of that age. His rules for diet and regimen, when not drawn from Galenical theory, are on the whole founded upon plain good ſenſe; and he uniformly inculcates temperance of every kind. This he carries to a degree, with regard to certain enjoyments, that would no doubt be generally thought ſomewhat too rigorous, except by ſuch a bridegroom as the old gentleman in La Fontaine, who would be pleaſed with our knight's authority to add all the months, from April to October, to the red letter days of his calendar.

We learn from the work in queſtion, that the diſeaſe now called *a cold*, began to be common in England in the time of Elyot. "At this preſent time," he ſays, "in this realme of England, there is not any one more annoyance to the health of man's body, than diſtillations from the head, called rheums." The cauſe of their being ſo much more frequent than they uſed to be forty years before, he ſuppoſes to be "banquettings after ſupper, and drinking much, eſpecially wine, a little after ſleep;" and alſo covering up the head too hot, a practice which prevailed to ſuch a degree, that he tells us, "now a days, if a boy of ſeven years of age, or a young man of twenty years, have not two caps on his head, he and his friends will think that he may not continue in health; and yet if the inner cap be not of velvet or ſatin, a ſerving man feareth to loſe his credence."

The other works publiſhed by ſir Thomas Elyot, were, 2. "The Governor," in three books, 1544, 8vo.; 3. "Of the Education of Children;" 4. "Banquet of Sapience;" 5. "Preſervative againſt the Fear of Death;" 6. "De rebus memorabilibus Angliæ;" 7. "An Apology for Good Women;" 8. "Bibliotheca Eliotæ, or Elyot's Library or Dictionary," 1541, folio; which work was afterwards augmented and improved by Cooper. He tranſlated alſo from the Greek into Engliſh, "The Image of Governance, compiled of the Arts and Sciences, by the Emperor Alexander Severus," 1556, 8vo.; and from the Latin into Engliſh, "St. Cyprian's Sermons of the Mortality of Man," 1534, 8vo.; and, "The Rule of a Chriſtian Life," written by Picus, earl of Mirandula, printed in the ſame year. (Gen. Biog. Dict. Aikin's Biog. Memoirs of Med. in Great Britain.)

ELYRUS, in *Ancient Geography*, a town of the iſland of Crete, which, according to Pauſanias, was ſituated in the mountains.

ELYS BAY, in *Geography*, a bay of the iſland of Antigua, on the N. coaſt, a little to the ſouth of Beggar's Point.

ELYSII, in *Ancient Geography*, a people who inhabited the eaſtern part of Germany.

ELYSIUM, Ελυσιος, in the *Ancient Theology*, or rather *Mythology*, a place in the inferi, *i. e.* in the lower world, or, as we ſometimes render it, in hell; furniſhed with fields, meads, agreeable woods, groves, ſhades, rivers, &c. whither the ſouls of good people were ſuppoſed to go after this life.

Orpheus, Hercules, and Æneas, are ſuppoſed to have deſcended into elyſium, in their life-time, and to have returned again. Virgil. lib. vi. ver. 638, &c. Tibullus, lib. i. eleg. 3. gives us fine deſcriptions of the elyſian fields.

Virgil oppoſes elyſium to tartara; which was the place where the wicked underwent their puniſhment.

"Heic locus eſt, partes ubi ſe via findit in ambas:
Dextera, quæ Ditis magni ſub mœnia tendit:
Hac iter elyſium nobis: at læva malorum
Exercet pœnas, et ad impia tartara mittit."

He aſſigns elyſium to thoſe who died for their country, to thoſe of pure lives, to truly inſpired poets, to the inventors of arts, and to all who have done good to mankind.

Some authors take the fable of elyſium to have been borrowed from the Phœnicians; as imagining the name elyſium formed from the Phœnician עלז, *alaz*, or עלץ, *alats*, or עלס, *alas*, *to rejoice*, or *to be in joy*; the letter *a* being only changed into *e*, as we find done in many other names; as in *Enakim*, for *Anakim*, &c. On which footing, elyſian fields ſhould ſignify the ſame thing as a place of pleaſure; or,

"—— Locos lætos, & amœna vireta
Fortunatorum nemorum, ſedeſque beatas." Virg.

Others derive the word from the Greek λυω, *ſolvo*, *I deliver*, *I let looſe*, or *diſengage*, becauſe here men's ſouls are freed, or diſencumbered from the fetters of the body. Beroaldus and Hornius, Hiſt. Philoſoph. lib. iii. cap. 2. take the place to have derived its name from Eliza, one of the firſt perſons who came into Greece after the deluge, and the author and father of the Ætolians. According to Diodorus Siculus (l. 1. c. 36.) the whole fable of the infernal regions was borrowed from the funeral rites of the Egyptians, and introduced into Greece by Orpheus. Hence Homer is ſaid to have borrowed his ideas and deſcriptions, which occur in various parts of the Odyſſey. Accordingly in the fourth book he gives the following account of elyſium in the addreſs of Proteus to Menelaus:

"Elyſium ſhall be thine; the bliſsful plains
Of utmoſt earth, where Rhadamanthus reigns.
Joys ever young, unmix'd with pain or fear,
Fill the whole circle of th' eternal year:
Stern winter ſmiles on that auſpicious clime:
The fields are florid with unfading prime:
From the bleak pole no winds inclement blow,
Mold the round hail, or flake the fleecy ſnow.
But from the breezy deep, the bleſt inhale,
The fragrant murmurs of the weſtern gale."
Pope's Od. b. iv. v. 765, &c.

The other poets as well as the philoſophers ſeem to have copied their notions of hell and of the elyſian fields from Homer. Plato, in his account of the ſtate of departed ſpirits, repreſents the ſoul of the deceaſed as paſſing into a place, which he calls divine, and as being there judged. If his life was conformable to the right of reaſon, he is advanced to a higher apartment, where he enjoys pleaſure and proſperity in the ſociety of the gods; whilſt the ſouls of bad men ſink into a noiſome abyſs, there to dwell in thick darkneſs, and to endure every kind of miſery. Socrates alſo adopted ſimilar ideas. This philoſopher diſtinguiſhed a threefold ſtate of ſouls departed. Thoſe who had neither ſingular merit nor enormous vices, inhabited the confines of Acheruſia, where, being purified by the waters of the lake, they received the rewards of the few virtues they had practiſed. The ſouls of the wicked wandered about their tombs, where they were tormented in different ways. After which, having drank the water of Lethe, they entered into new bodies, more or leſs honourable, according to their merit. The ſouls of the good went immediately into the elyſian fields. Pythagoras maintained, that the ſoul, upon its immediate ſeparation from the body, was conducted by Mercury into a place of the pureſt air, in which were the elyſian fields, called by Virgil the "aerial regions," *aerios campos*. The ſouls of the philoſophers, which were the beſt of all, became like to the gods, while thoſe of the wicked were tormented by the furies without intermiſſion. Both the one and the other, after a certain period of purification, returned to the earth to animate new bodies. Thus did this philoſopher inculcate, firſt in Europe, the doctrine of the metempſychoſis, or tranſmigration of ſouls, which he is ſaid to have borrowed from the Egyptians, and which had been taught before by Orpheus and Homer, who had borrowed it from the ſame people. Accordingly we learn from Herodotus, that the Egyptian prieſts maintained, that the ſoul does not die with the body, but is received into Amenthes, which was a place under ground, reſembling the hell of the Greek poets. Plutarch ſays, that this word denotes "that which gives, and that which receives," and adds, that it was a place in the centre of the earth, the common receptacle of departed ſouls. Hence, after a certain period, they were releaſed, and united to new bodies. The poets have delivered ſentiments ſimilar to thoſe of the philoſophers concerning the ſtate of ſouls after death, and whilſt each had his peculiar notions, all agreed, that the ſoul goes either to Elyſium or Tartarus; though they are far from being unanimous as to the ſituation of theſe two manſions. Some place the elyſian fields in the middle region of the air; ſome in the moon; others in the ſun; and others again in the centre of the earth adjoining to Tartarus. The moſt common opinion is, that they lay in one of the iſles of the ocean, called the "Fortunate iſlands," which are reckoned to be the Canaries. According to Ol. Rudbecks the elyſian fields were ſituated in Sweden. In the opinion of many of the ancients, the manſion of the bleſſed was in the charming country of Betica (the preſent Andaluſia in the extremity of Spain towards Cadiz,) whither the Phœnicians had travelled from the earlieſt times, and which was repreſented as a delicious country, poſſeſſing a fertile ſoil, abounding with enchanted groves, enriched by mines of gold and ſilver, and watered with rivers, ſtreams, and fountains. According to Homer, the infernal regions were in the country of the Cimmerians, who are ſaid to have inhabited the weſtern coaſts of Italy, near Baiæ and Puteoli, where Ulyſſes arrives on the ſame day that he takes his leave of Circe. Virgil has adopted Homer's notion, and places the mouth of hell upon the ſame coaſt, near the lake Avernus. Others, however, of the poets, place the entrance of hell at the promontory of Tenarus, where was the cave from which Hercules dragged Cerberus when he went down to hell. Others ſeek for it in Theſprotia, and Lucan refers it to the banks of the Euphrates. The ancients differ in opinion with reſpect to the time, during which departed ſouls continued in the infernal regions. Some ſuppoſe that ſouls doomed to Tartarus continued there a thouſand years, before the period of their tranſmigration commenced. Pindar fixed the reſidence of the bleſſed in the elyſian fields for ever; whence, according to Virgil and the other poets, they were to depart after a certain period of time, having drank the water of oblivion; and this period was uſually limited to a thouſand years. (See Tartarus.) The poets, Homer, Virgil, Pindar, Claudian, Catullus, &c. deſcribe the regions of bliſs under a variety of pleaſing images, ſuch as green bowers, gliding ſtreams, murmuring ſprings, charming meadows, ſerene air, perpetual ſprings, warbling birds, &c. Tibullus, whoſe imagination was voluptuous, repreſents it as abounding with mirth and all ſenſual pleaſures. Virgil admits merely chaſte and innocent enjoyments, and in this reſpect he has copied Homer.

ELYTROCELE, (from ελυΊρον, the *vagina*, and κηλη, a *tumour*,) in *Surgery*, a hernia in the vagina.

ELYTROID, in *Anatomy*, from ελυτρον, a *ſheath*, and ειδος, *form*, is a name applied to one of the coverings of the teſticle. See Generation, *Organs of*.

ELYTRON, properly a covering of any ſort, and for any ſubſtance. Hippocrates has appropriated the word to ſignify the membranes which involve the ſpinal marrow.

ELZEVIRS, in *Biography*, celebrated printers at Amſterdam and Leyden, lay claim to a ſhort notice in this work, on account of the many valuable books which were printed at their preſſes, and of the perfection to which they carried their art at a comparatively early period. The firſt of the family was Lewis, who was diſtinguiſhed for his editions from the year 1595. He was ſucceeded by Bonaventure, Abraham, and Daniel, of whom the laſt died about the year 1680. The ſmall types of theſe famous printers have a clearneſs and elegance which have rarely been equalled. Virgil, Terence, and the Greek Teſtament, printed in 1633, diſtinguiſhed by characters in red ink, are reckoned maſter-pieces; and the beſt of their claſſics ſtill maintain a high value. Moreri.

ELZT, or Eltz, in *Geography*, a town of Germany, in the country of Lower Saxony, and biſhopric of Hildeſheim on the Saale; 9 miles S.W. of Hildeſheim.

EM, or Embak, a river of Ruſſia, in the government of Riga or Livonia, which iſſues from the lake Wyrtz, and falls into the Peipus.

EMANATION, formed of the Latin *e*, out of, and *manare*, to flow or ſtream, the act of flowing, or proceeding, from ſome ſource or origin. Such is the emanation of light from the ſun; or that of effluvia from odorous, &c. bodies; of wiſdom from God, &c.

The principle of emanation was adopted from the moſt remote times by the oriental philoſophers, and by means of emanation from an eternal fountain of being, they endeavoured to explain the nature and origin of things. Zoroaſter, at an early period, maintained this ſyſtem, alleging, that various orders of ſpiritual beings, gods or dæmons, have proceeded from the deity, which are more or leſs perfect, as they are at a greater or leſs diſtance, in the courſe of emanation, from the eternal fountain of intelligence; among which, the human ſoul is a particle of divine light which will return to its ſource, and partake of its immortality; and matter is the laſt or moſt diſtant emanation from the firſt ſource of being, which, on account of its diſtance from the fountain of light, becomes opake and inert, and whilſt it remains in this ſtate is the cauſe of evil: but, being gradually refined, it will at length return to the fountain whence it flowed. This doctrine of emanation afterwards produced many fanciful opinions in theology. It was adopted by the ancient Indians, and taught under various modifications by the Brachmans. The ſame ſyſtem was likewiſe received among the Egyptians, taught by Orpheus and Pythagoras, and communicated to the Greeks either from Egypt or from the Eaſt. Wherever it originated, it was taught for many ſucceſſive ages in the more civilized regions of Aſia and Africa, and both before and after the commencement of the Chriſtian era, it gradually ſpread through the Alexandrian, Jewiſh, and Chriſtian ſchools. It was a diſtinguiſhing tenet of the Jewiſh Cabbala, of Simon Magus, and of the Gnoſtics and modern Platoniſts. This ſyſtem, as it was taught by the oriental, Alexandrian, and Cabbaliſtic philoſophers, comprehended the following tenets. All things are derived, by emanation, from one principle; which principle is God. From him a ſubſtantial power immediately proceeds, which is the image of God, and the ſource of all ſubſequent emanations. This ſecond principle ſends forth, by the energy of emanation, other natures, which are more or leſs perfect, according to their different degrees of diſtance, in the ſcale of emanation, from the firſt ſource of exiſtence, and which conſtitute different worlds, or orders of being, all united to the eternal power from which they proceed. Matter is nothing more than the moſt remote effect of the emanative energy of the Deity. The material world receives its form from the immediate agency of powers far beneath the firſt ſource of being, and is the neceſſary effect of the imperfections of matter. Human ſouls are diſtant emanations from Deity; and, after they are liberated from their material vehicles, will return, through various ſtages of purification, to the fountain whence they firſt proceeded. Nothing can be more fanciful than the numerous fictions which are blended in this ſyſtem, and which have been grafted upon it by enthuſiaſts of different deſcriptions, both philoſophical and theological; inſomuch that it has been the ſoul of enthuſiaſm and fanaticiſm. (See THEOSOPHISTS.) Some of the modern Eclectic philoſophers attempted to unite the atomic and emanative ſyſtems; and Jordano Bruno, in particular, founded his doctrine on the ancient ſyſtem of emanation. See BRUNO.

EMANATION is alſo uſed for the thing that proceeds, as well as the act of proceeding. The power given a judge is an emanation from the regal power; the reaſonable ſoul is an emanation from the divinity.

EMANATION is alſo uſed among the ſchoolmen, for the production of a leſſer thing, in order to the production of a greater, by virtue of ſome natural connection, or dependence between them.

Hence that is called an emanative cauſe (in contradiſtinction to an efficient cauſe) which produces an effect by its mere preſence, without the intervention of any action; as a roſe doth a ſmell, &c. Others, and with good reaſon, deny that there is any ſuch thing as an emanative cauſe, to produce an effect without any action. See CAUSE.

EMANCIPATION, formed from the Latin *ex*, of, and *mancipium*, a ſlave, in the *Roman Law*, was the act of ſetting a ſon free from the power and ſubjection of his father.

Emancipation differs from manumiſſion, as the latter was the act of a maſter in favour of a ſlave, the former that of a father in favour of his ſon.

The effect of emancipation was, that the goods, and moveable effects, which the ſon ſhould thenceforth acquire, ſhould be his ſole property, and not the property of his father, as they were before emancipation. Beſides, emancipation put the ſon in a capacity of managing his own affairs, and of marrying without his father's conſent, though a minor, or pupil, and under twenty-five years of age.

There were two kinds of emancipation; the one *tacit*, which was by the ſon's being promoted to ſome dignity, or by his coming of age, or by marriage; in all which caſes, the ſon became his own maſter of courſe.

The other *expreſs*, where the father declared before the judge, that he emancipated his ſon. This was not performed without ſome formality: the father was firſt to ſell his ſon imaginarily to another man, whom the lawyers call *pater fiduciarius*, *father in truſt*; of whom being bought back again by the natural father, he manumitted, or ſet him free, by a declaration before the judge. This imaginary ſale was called mancipatio; and the manumiſſion conſequent thereon, emancipatio.

Emancipation obtained in France, chiefly with regard to minors, or pupils, who were hereby ſet at liberty to manage their effects, without the advice, or direction, of their fathers or tutors. It muſt be obſerved, however, that emancipation only extended to the ſelling of moveables, and letting of leaſes, &c. of immoveables; not to the ſelling or mortgaging of immoveables; which were only done with the conſent of a curator, ordinarily a perſon appointed, when emancipated.

Formerly emancipation was performed in the ordinary courts of juſtice, when deſired by the child; but if he were a minor, the king's letter was alſo required. Though there were other ways of emancipation, as by marriage; arriving at the age of twenty years; and in ſome provinces by the death of the mother, becauſe the children were there under the power of the father and mother conjointly; ſo that the death of either of them emancipated the child.

Emancipation by marriage, in France, gave a power of marrying again, without the father's conſent though under age; but among the Romans, Cujas tells us, a widow, under twenty-five years of age, though emancipated by her former marriage, returned into the power of the father, and might not marry a ſecond time, without his conſent.

Du-Cange obſerves, that the word emancipation was alſo uſed in the monaſteries, in ſpeaking of monks promoted to any dignity, or removed from under the power of their ſuperiors; as alſo in ſpeaking of monaſteries, chapels, &c. themſelves, when exempted by the pope, from the juriſdiction of the ordinary.

EMANUEL, in *Biography*, king of Portugal, ſon of the infant Don Ferdinand, duke of Viſco, ſucceeded his couſin John II. in 1495. He was then in his twenty-ſixth year, and highly eſteemed for the excellent qualities of his mind. He began his reign by reſtoring the nobility to that conſequence in the ſtate of which it had been the policy of his predeceſſor to deprive them. He ſhewed an inclination to favour the Jews, who had been enſlaved in the former reign; but by the violence of his adviſers, he did not dare to follow the bent of his own mind, and demanded of theſe unhappy people, as the terms of their liberty, that they ſhould inſtantly profeſs themſelves Chriſtians, in name, though a period of twenty years ſhould be allowed them for their converſion. Moſt of them complied with the required condition; but others, and thoſe not a few, voluntarily put an end to their lives, rather than ſubmit to a dereliction of principle. Some of them were ſo indignant at the requiſition that they firſt murdered their own children, and then committed the raſh deed upon themſelves; thinking death in any form better than an abandonment of the religion of their fathers. In 1496 he married Donna Iſabella, daughter of Ferdinand and Iſabella of Spain, who died the next year, having firſt given him a ſon and heir. This was the period in which the new paſſage to the Indies was diſcovered by Vaſco de Gama, a circumſtance which proved the ſource of great riches to Portugal., and contributed to fix the epithet of *fortunate* upon this prince. In 1499 he married the younger ſiſter of his late wife; and in 1501, under his auſpices, the Brazils were diſcovered, which have proved a more laſting benefit to Portugal than her Indian poſſeſſions, and which has at length become an aſylum to the exiſting monarch, driven by Bonaparte from his European poſſeſſions. Emanuel, in gratitude for the important diſcoveries made in his reign, founded the famous monaſtery of Bethlehem, near Liſbon. He now adopted the plan of making conqueſts in Africa, in which he was not very ſucceſsful, but by the talents of Albuquerque he formed a very uſeful alliance with the king of Congo. Although proſperous in a high degree, he met with mortifications ſufficient to lead him to declare his purpoſe of reſigning his crown into the hands of his ſon. The eagerneſs which the young man ſhewed for power, and the marked attention which the courtiers paid him, cauſed the monarch to change his purpoſe. He died in 1521, in the 53d year of his age, at a time when he was regarded as one of the moſt powerful and ſplendid princes in Europe. Emanuel, when religion was out of the queſtion, was capable of liberal and generous conduct. He treated with great favour Don George, natural ſon of the late king, for whom his father had endeavoured to procure the ſucceſſion to the crown; and he reſtored to their titles and eſtates the Braganza family, who had ſuffered attainder and confiſcation in the late reign. In the hiſtory of his country, Emanuel ſtands very high for piety, humanity, munificence, and thoſe other good qualities that do honour to an enlightened ſovereign. Univer. Hiſt.

EMANUEL-PHILIBERT, duke of Savoy, ſon of duke Charles III., was born in 1528, and though deſtined for the church, yet by the early death of two elder brothers, he was brought up as heir to the ſovereignty. He viſited the court of the emperor Charles V., by whom he was created knight of the Golden Fleece. He accompanied Philip II. into England, and was afterwards entruſted by him with the command of his armies. He was general at the ſiege of Metz, and at the battle of St. Quintin, in 1557, in which the French ſuſtained a ſignal defeat. He married Margaret, daughter of Francis I. of France, and by that alliance regained all the dominions which his father had loſt. At the perſuaſion of ſome bigots he attempted the extirpation of the Vaudois, proteſtants of Savoy, but was defeated in his projects, and by the influence of the ducheſs, who was well diſpoſed towards the reformation, he willingly allowed them the exerciſe of their religion. He died reſpected and beloved in 1580, after a reign of 27 years. Univer. Hiſt. Moreri.

EMARGINATUM FOLIUM, in *Botany*. (See LEAF.) The term applies only to the extremity or apex of a leaf, and expreſſes a notch in that part, apparently cauſed by a greater tightneſs or contraction in the nerve, than in the ſofter more dilatable parts adjacent, which are therefore extended beyond it. The petals of flowers, however, are very often emarginate in their original conformation, as in many ſpecies of Chickweed or Sandwort.

EMASCULATION, the act of taking from a male thoſe parts which are characteriſtic of his ſex. See CASTRATION.

EMAUX *de l'Eſcu*, in *Heraldry*, the metals and colours of a ſhield, or ſcutcheon.

EMBA, or YEMBA, in *Geography*, a river of Ruſſia, which takes its riſe in the ſouthernmoſt part of the Ural mountains, and conſtitutes the border between the Uſimſkoi government and the country of the Kirchiſtzi, though the forts are much more to the weſt, namely, on the river Ural. The Emba takes up only one river of note, the Sagiſs, has a ſtrong current, but is at the ſame time very ſhallow. It is the moſt eaſterly of all the rivers that fall into the Caſpian.

EMBABE', a village of Egypt, oppoſite to Boulac, near Cairo, upon the weſt bank of the Nile, famous for the excellent quality of its butter, and for a variety of lupins, which grow in its vicinity, and called embaben. Theſe are ſold ready dreſſed in the ſtreets and markets, and they ſupply Lower Egypt. Their general appellation in the country is "termeſs." The Chriſtians of the Eaſt eat lupins as a ſtimulus for drinking brandy. Flour is made of them, which is uſed for cleaning the hands and ſoftening the ſkin. The ſtalk, reduced to aſhes, is preferred to other charcoal in the compoſition of gun-powder.

EMBALMING, the opening of a dead body, taking out the inteſtines, and filling their place with odoriferous and deſiccative drugs and ſpices, to prevent its putrefying.

The word is formed from *balm*, which was a principal ingredient in the embalmings of the ancient Egyptians.

Dr. Grew, in his Muſeum Regalis Societatis, is of opinion, that the Egyptians boiled their bodies in a large cauldron, with a certain kind of liquid balſam. His reaſon is, that in the mummies preſerved in the collection of the Royal Society, the balm has penetrated not only the fleſhy and ſoft parts, but even the very bones; ſo that they are all as black as if they had been burnt.

The Peruvians had an effectual method of preſerving the bodies of their incas, or kings, embalmed.

The mode of embalming dead bodies among the Egyptians was as follows: when a man died, his body was carried to the artificers, whoſe trade it was to make coffins; they took the meaſure of the body, and made a coffin for it, proportioned to its ſtature, the dead perſon's quality, and the price that people were willing to give. The upper part of the coffin repreſented the perſon who was to be ſhut up in it, whether man or woman. If it was a man of condition, this was diſtinguiſhed by the figure which was repreſented on the cover of the coffin; there were generally added paintings and embelliſhments, ſuitable to the quality of the perſon. Vide Caſſian Collat. 15. cap. 3. & Cicero, Tuſc. Quæſt. lib. i. Herodot. lib. ii. cap. 86. Diodor. lib. ii. cap. 5.

When the body was brought home again, they agreed with the embalmers at what rate particularly they would have it embalmed, for the prices were different; the higheſt was a talent of ſilver, eſtimated at about 258*l.* 6*s.* 8*d.* or, as others ſay, about 300*l.*: twenty minæ was a moderate one, and the loweſt price was a very ſmall ſum. They immediately ſent for a deſigner, who marked the body, as it lay extended, at the place where it ſhould be opened, on the left ſide, and the length of the inciſion. A diſſector, with a very ſharp Ethiopian ſtone, made the inciſion, and hurried away as faſt as he could, becauſe the relations of the perſon deceaſed, who were preſent, took up ſtones, and purſued him as a wicked wretch, with an intention to ſtone him.

This operation being finiſhed, the embalmers, who were looked upon as ſacred perſons, entered to perform their office. They drew all the brains of the dead perſon through his noſtrils, with a hooked piece of iron, provided particularly for this purpoſe, and filled the ſkull with aſtringent drugs; they likewiſe drew all the bowels, except the heart and kidneys, through the aperture which they had made in the ſide. The inteſtines were waſhed in wine from the palm-tree, and in other ſtrong and binding drugs. The whole body was anointed with oil of cedar, after having been filled with myrrh, cinnamon, and other ſpices, for about thirty days, ſo that it was preſerved entire, not only without putrefaction, but had a good ſcent with it. Αιγυπτιοι δε τα εντερα εξελοντες ταριχευουσιν αυτους. And the Perſians, as the ſame author, Sextus Empiricus, obſerves, were uſed νιτρῳ ταριχευειν. Sext. Empir. Pyrrhon. Hypoth. lib. ii. cap. 24.

Bodies thus preſerved are called *mummies*, from the Arabic word *mam*, which ſignifies wax, this being an ingredient in the preparation.

After this the body was put into ſalt for about forty days; wherefore when Moſes ſays, that forty days were employed in embalming Jacob, we are to underſtand him as meaning the forty days of his continuing in the ſalt of nitre, without including the thirty days paſt in performing the other ceremonies above-mentioned, ſo that, in the whole, they mourned ſeventy days in Egypt, as Moſes likewiſe obſerves.

Afterwards the body was taken out of the ſalt, waſhed, wrapt up in linen ſwaddling-bands, dipped in myrrh, and rubbed with a certain gum, which the Egyptians uſed inſtead of glue. Then the body was reſtored to the relations, who put it in a coffin, and kept it in their houſes, or in tombs made particularly for this purpoſe. There are ſome found, at this day, in Egypt, in chambers, or ſubterraneous vaults, which fully juſtify the truth of what is here ſaid.

They who were not rich enough to bear this expence, contented themſelves with infuſing, by a ſyringe, through the fundament, a certain liquor extracted from the cedar, and leaving it there, wrapt up the body in ſalt of nitre. This oil preyed upon the inteſtines, ſo that when they took it out, the inteſtines came along with it dried, and not in the leaſt putrefied. The body being incloſed in nitre, grew dry, and nothing remained beſides the ſkin glued upon the bones. They who were too poor to be at any conſiderable expence, did no more than cleanſe the inſide, by ſyringing a liquor into it; this done, they put the body, without farther ceremony, into nitre for ſeventy days, in order to dry it. Calmet, Diction. Bibl. Pococke's Deſcription of the Eaſt, vol. i. p. 230, &c.

The preſent method of embalming in Egypt differs very much from the ancient. Mallet informs us, that it is now the cuſtom to waſh the body ſeveral times in roſe-water; then to perfume it with incenſe, aloes, and other odours, in great abundance; the body is afterwards wrapped up in a winding-ſheet, made partly of ſilk, and partly of cotton, moiſtened probably with ſome liquid perfume; this is again covered with another cloth of unmixed cotton, to which is added one of the richeſt ſuits of clothes of the deceaſed. Letter X. p. 88.

The art of embalming, ſays Sonnini, is now unknown to the Egyptians. As ſoon as a perſon is dead, they preſs the different parts of the body, in order to make it diſcharge all its impurities; they repeatedly waſh it, ſhave it, pluck out all the hair, and ſtop all the apertures cloſely with cotton; they then pour upon them odoriferous waters, and the perfumes of Arabia penetrate into all their pores. The inanimate remains are then committed to the earth; and upon the ſpot where the head of the deceaſed lies, they erect a ſmall ſtone pillar, crowned with a turban. Every Friday they reſort to the foot of this ſepulchral monument, and renew their mournful adieus.

Dr. Ward, in his Diſſertations on this ſubject, ſuppoſes that the Jewiſh method of embalming was very different from the Egyptian, and that this appears from ſeveral paſſages in the New Teſtament. Both, as he conceives, ſwathed up their dead; but inſtead of the Egyptian *embowelling*, he ſuppoſes the Jews contented themſelves with an *external unction;* and that inſtead of myrrh and caſſia, they uſed myrrh and aloes. To this account he alſo adds the ſuppoſition, that St. John might mention the circumſtance of our Lord's embalming, in order the better to obviate the falſe report which then prevailed among the Jews, that the body of our Lord had been ſtolen away in the night by his diſciples; for the linen, he ſuppoſes, could not have been taken from the body and head, in the manner in which it was found in the ſepulchre, on account of its clinging ſo faſt from the viſcous nature of theſe drugs, if they had been ſo fooliſh as to attempt it. It is certain that the modern Egyptian mode of embalming, if it may be ſo called, differs very much from the ancient; but it is not eaſy to determine how far the Jewiſh method, in the time of our Lord, differed from that of the Egyptians. It does not appear indeed to be certain, that the Jews were not accuſtomed to embowel their dead in embalming. As all other nations ſeem to have embalmed exactly according to the Egyptian manner, the ſame cauſes that induced them to do ſo, probably occaſioned the Jews not to vary from them in this reſpect. It does not, however, follow from hence, that our Lord was embowelled, though St. John ſays (ch. xix. 40.), that he was buried with ſpices, "as the manner of the Jews was to bury;" for theſe words do not neceſſarily ſignify, that all was done that was wont to be done in thoſe caſes among the Jews. Indeed, the contrary appears to have been the fact, from the farther preparations made by the women, who probably were not acquainted with what had been done, though Dr. Ward ſuppoſes the contrary; ſince St. Luke expreſsly tells us (ch. xxiii. 55.), that "the women, which came with him from Galilee, followed after, and beheld the ſepulchre, and how his body was laid." Admitting this ſtatement, Ward's thought concerning the difficulty of taking off the bandages, beſmeared with very glutinous drugs, muſt appear to be unfounded; for in that caſe, the women could have done nothing more as to the embalming of him. Beſides, aloes and myrrh do not appear to poſſeſs that very glutinous quality which Dr. Ward aſcribes to them; and it is more reaſonable to ſuppoſe that St. John mentions this circumſtance, concerning which the other evangeliſts are ſilent, becauſe he publiſhed his hiſtory for the uſe of perſons leſs acquainted with the cuſtoms of the Eaſt, than thoſe for whoſe information the others wrote. This reaſon induced him to ſay to thoſe who were wont to *burn* their dead, that our Lord was *buried with ſpices*, which was *in general* the Jewiſh method of diſpoſing of their dead; and this he might very well do, though the ſhortneſs of the time occaſioned ſome deviation from what they commonly practiſed. This ſhortneſs of time prevented them alſo from ſwathing him with that accuracy and length of bandage, which they would otherwiſe have uſed; in conformity to the cuſtom obſerved among the Egyptians, and probably alſo among the Jews: for we are informed, that the Egyptians have uſed above a thouſand ells of filletting about a body, beſides what was wrapped about the head. Such, indeed, was the hurry of the diſciples, that our Lord's head was ſimply bound about with a napkin; a practice uſed by the Mahometans at this time. What was done by Joſeph and Nicodemus with the mixture of myrrh and aloes, which they provided, doth not appear. Dr. Lardner ſuppoſes, they might have formed a bed of ſpices. A modern Jew, cited by biſhop Kidder, objects to the hiſtory of the New Teſtament; alleging that the quantity was ſufficient for 200 dead bodies, that is, allowing half-a-pound for each body. But this quantity falls far ſhort of that which modern ſurgeons uſe in embalming. It appears from what Joſephus (Antiq. lib. 15.) ſays of the funeral of Ariſtobulus, the laſt of the high prieſts of the family of the Maccabees, that the larger the quantity of ſpices uſed in their interments, the greater honour was thought to be done to the dead; and therefore we may eaſily account for the quantity brought by Nicodemus, though we may not be able to tell preciſely how he diſpoſed of it. Might not large quantities of precious perfumes be ſtrewed, or deſigned to be ſtrewed, about the body of our Lord? Harmer's Obſ. vol. ii.

It is no wonder that we find human bodies preſerved without corrupting for many ages, by means of ſpices, and other ingredients, proper to reſiſt putrefaction, applied with the niceſt care; but it is ſtrange that there ſhould be a ſort of embalming performed by nature, in ſome places, where bodies are preſerved merely by the virtues of the ſoil in which they lie; yet this is evidently the caſe in ſome inſtances. We have, in the Philoſophical Tranſactions, an account of a man and a woman who were loſt in the great ſnows on the moors of Hope, near the woodlands in Derbyſhire, on the 14th of January, 1674. Theſe perſons were not found till the 3d of the May following, at which time they ſmelt ſo ſtrong, that the coroner prudently ordered them to be buried on the ſpot. Theſe bodies lay buried in the peat-moſs 28 years before they were looked at again; when ſome people of the country, who had heard of the ſtrange virtues of the ſoil thereabouts in preſerving dead bodies, opened the ground, and found them no way altered, the colour of the ſkin being fair and natural, and the fleſh as ſoft as that of perſons newly dead. Phil. Tranſ. N° 434, p. 415.

After this the place was remarked where they lay, and they were ſhewn for a ſight for 20 years, though they were much changed by having been ſo often uncovered in that time.

EMBANKMENT, in *Rural Economy*, a large body, mound, or bank of earth, conſtructed and thrown up in different ways, according to circumſtances, with the view of guarding, protecting, and defending lands on the borders of the ſea, rivers, and lakes, from being inundated and injured by them.

They are of different kinds and forms, according to the nature of the ſituations and the materials of which they are conſtituted. In embanking againſt the ſea and large rivers, where the ſlopes next them are naturally gentle and eaſy, they are moſtly of the earthy deſcription, being well put together, and covered on the ſurface with turf cut from the tough ſward of the land in the neighbourhood; but, in caſes where the banks, borders, and ſhores, are more ſteep and bold, they are uſually of a more hard and ſolid nature: being often made with ſtone, brick, gravel, ſand, ſhells, and other ſimilar ſubſtances, laid cloſely in ſome ſort of tenacious material, ſuch as clay, mortar, and other matters of the ſame quality. Wood is likewiſe, in ſome inſtances, employed in their conſtruction.

In works of this ſort, very much depends upon the form in which they are conſtructed, and the nature and management of the materials which are made uſe of in the buſineſs. In reſpect to the firſt, it may be remarked, that banks of theſe kinds are commonly conſtructed with too narrow baſes for the heights which are given them; from which circumſtance, the ſides which are oppoſed to the effects of the water become too ſteep and upright; conſequently, in caſes of high tides or floods, they are utterly incapable of reſiſting their weight, which has equally a lateral and downright preſſure. Beſides this, there is another diſadvantage attending this method of forming them, which is, that the floods, as well as the tides, in ebbing and flowing, have a more continued action on one part than would be the caſe, if the ſlopes were more gentle and gradual; conſequently, they have a much greater tendency to break down and deſtroy the ſuperficial parts of the banks. With ſome variations in the forms, moſt of the embankments in this country are, however, made in this way. They may ſucceed in ſome particular inſtances; but in general it is found, that breaches are frequently taking place in them, from the effects of the ſea or floods, which are not capable of being filled up or repaired, without conſiderable difficulty and trouble; and which, if ſuffered to continue even for a ſhort ſpace of time, endanger the whole embankment.

The common form of embankment is ſhewn at *fig.* 1, *Plate* X. *Agriculture*, and the improved form pointed out at *fig.* 2, in the ſame plate.

The angles or ſlopes of theſe ſorts of works are made very different in different caſes; but that ſhewn in the above figure ſeems in general well calculated for the purpoſe of reſiſting the impreſſion of heavy tides, or the waters of floods. The greater breadth they have in proportion to their height, the more effectual they muſt be in reſiſting the power of the waters which come upon them.

In regulating the heights of embankments, it is neceſſary to aſcertain the greateſt depth of water at the higheſt tides or floods; making the ſummits of them about two feet higher than the points to which they riſe at ſuch times. By ſome, a leſs height than this above the higheſt mark of the tides or floods has, however, been conſidered ſufficient; but it is always proper to be on the ſafe ſide, as the conſequences of an overflow are very ſerious.

In forming embankments with ſtones, or other ſimilar materials, which, as has been ſeen, is eſſential in bold ſteep banks or ſhores, it is neceſſary that they be laid in proper materials, and be cloſely jointed next the ſea, or the rivers, ſo as to be fully capable of reſiſting the entrance of water; as, unleſs this be the caſe, they will by no means be complete: for the water, inſinuating itſelf between the openings, ſinks down among the ſtones, ſoftens and looſens the clayey or earthy matters underneath, by which portions of them are continually forced out and waſhed away; hollows being formed in that way below, and the ſtones naturally ſinking down; in conſequence of which, the waters ruſh into the cavities with conſiderable impetuoſity, and quickly diſplace others, and the whole embankment is ſoon deſtroyed. This very frequently takes place with the heads thrown acroſs rivers, and ſuch paved or cauſewayed banks as are formed with the view of protecting and preſerving thoſe bold and open ſhores, which are liable to be undermined and carried away by the waſhing operation of the waters which come againſt them. In order to render the embankments perfectly ſecure in ſuch caſes, they ſhould be laid with good mortar, and be pointed with a ſtrong cement. A good coat of gravel, in ſome caſes of this kind, is even found far ſuperior to paving with ſtones.

In conſtructing embankments of the quay, or other ſimilar kinds, a mortar formed from powdered unburnt lime-ſtone and coarſe ſharp ſand is employed; the whole being pointed with puzzolana earth, by which they become as ſolid as rock, and fully reſiſt the effects of water. The lime of particular ſorts of lime-ſtone is found more proper for forming this ſort of mortar cements than that of others: thus, that found at Dorking in Surrey is ſuppoſed to conſtitute the moſt durable ſubſtance of this kind of any in the kingdom; and has been employed in forming the new docks in the river, near London. And an excellent ſort of lime-ſtone for the ſame purpoſe has likewiſe been diſcovered near Worſley, in Lancaſhire, which is there termed Sutton lime.

It has been ſuggeſted by a late writer, that an excellent mortar cement for this uſe, which hardens under water, may be compoſed by having four parts of blue clay, ſix of the black oxyd of manganeſe, and nine of carbonate of lime, ſubmitted to a white heat, and then well incorporated with ſixty parts of ſand, and as much water as may be neceſſary to form it into a mortar.

It is invariably found, in examining the ſhores of the ſea, and the banks of rivers, that ſuch as have eaſy and gently declining ſlopes from their beds to their borders or banks; and thoſe which are formed in a ſteep upright manner, of rocky materials, ſuch as are ſhewn at *figs.* 3, and 4, are the leaſt expoſed to injury from the effects of their waters: the two former being the moſt ſecure, when ſpread over or coated with good coverings of ſand or gravel, or uniformly turfed over quite down to the water-ſide with the ſward of a tough old paſture. The ſtrength and firmneſs of their banks are in proportion to the extent of the ſlope; and their durability depends on that of their being made uniform on their ſurfaces, both in reſpect to hardneſs and ſmoothneſs: as, in the former caſe, from the great length of ſlope, the flows and decreaſes of the waters act more momentarily on their different parts, and their greater weight renders their banks more firm; while, in the latter caſe, by the equality of their ſurfaces, the power of the waters is rendered the ſame on one part as another, and no obſtacles are left for the producing of eddies, or other means of forming holes or breaks in them.

In the latter, or thoſe of the bold, upright, rocky kind of banks, their ſtrength chiefly depends on the reſiſtance of the large quantity of materials by which they are backed, and not on the manner in which they are diſpoſed, as in the former caſe; and their durability, on that of the uniform compactneſs of texture in the parts oppoſed to the effects of the waters: as, where theſe have fiſſures in them, or are ſofter in ſome parts than others, the waters are liable to enter and break down the banks in time, according to the particular nature of the caſes. A ſtriking example of this kind lately occurred in the Iſle of Wight.

It is, therefore, of importance that the modes and forms of embankment, which are thus naturally preſented, ſhould be improved upon by art. It is evident, that if a cut was formed behind the embankment, as in *fig.* 5, at the letter *x*, the ſhores or banks, though, in this caſe, as it were, detached from the land, would be found equally ſtrong and capable of reſiſting the preſſure of the waters, as in their original ſtate. Hence, if a mound or bank was formed, and placed out at the diſtance of one, two, or three miles from the ſhore or other embankment, within the bed of the ſea or other waters, as at *y* in the ſame figure, it would be equally capable of reſiſting them as in the former inſtance, and not more liable to be broken down by their preſſure than in its former ſtation; and would alſo defend them as completely from the intermediate ſpace of land, as it did before from the narrow trench. Conſequently, on this principle, vaſt tracts of land may, in different parts of the kingdom, be obtained by judicious embankments.

Though the ſhores of bold ſteep coaſts may not afford examples equally capable of being followed with advantage as the above, they nevertheleſs ſuggeſt uſeful hints for the purpoſe of defence, in caſes of bold, abrupt, broken ſhores, conſtituted of earth, or of that material and rocky ſubſtances intermixed. It readily preſents itſelf to the mind, that the raiſing a good perpendicular ſtone-wall againſt ſuch banks, renders them nearly as ſtrong and laſting as thoſe formed by nature of ſteep, ſolid, rocky bodies. This ſort of walled bank is exhibited at *fig.* 6. But though this method may be practiſed, in caſes of the above kind, with great advantage, it is not by any means applicable in general to rivers; as, with them, the water, during the periods of floods, ſtands in need of room to ſpread, which is the great uſe of giving their banks a ſloping form; while, in this way, by being confined, it would have the effect of doing more injury than was the caſe before. Inſtances may, however, happen in which it may be had recourſe to with propriety, in defending a part of the bank of a river, without giving it a ſloping direction, or for protecting one part of a bank at the riſk of that which is oppoſite to it; but well-conſtructed piers, in ſuch caſes, are frequently more perfect, and conſtantly attended with leſs expence. But inſtead of theſe, art may ſuggeſt one that may anſwer in ſome reſpects more perfectly; as in place of bringing together ſuch a maſs of earthy or other ſubſtances, as may be proper for conſtructing ſuch banks as are ſhewn at *figs.* 1, and 7, it may be more advantageous to have one formed, ſuch as is ſhewn at *fig.* 8, the ſide of which next the water forms with the baſe an angle of about 45 degrees. This will be capable of bearing all the weight or preſſure of water that can poſſibly be brought upon it, equally well with that of *fig.* 1, except that the operation of the tides would break the ſuperficial part of the ſide next the ſea, unleſs prevented by coating it with ſome durable ſubſtance, ſuch as paving ſtones, bricks, or other ſimilar materials.

But various different ones may be invented between this and the firſt natural kind, which differ only in the degree of inclination which they have towards the ſea; that which ſlopes in the higheſt degree, as *fig.* 1, having the ſurface covered over with ſand or gravel; and that which has the leaſt ſlope, as *fig.* 8, may be covered with pavement; the different intermediate ſlopes being protected by materials which have a quality between the two, ſuch as coarſe gravel, chalk-ſtones, brick, and ſand, as ſhewn in *fig.* 9. This embankment is wholly conſtructed of a ſandy loam, being depoſited upon a ſoil of the ſame quality; but as it would not, for ſome time after being formed, be ſufficiently impervious to water, a column of clay is carried upright in the middle, from the clayey ſubſtratum of the ſoil underneath, as ſhewn at *x x* in the ſection.

In caſes where the ſhores are of a very ſandy nature, it is frequently neceſſary to form the embankments wholly of a ſort of wicker-work. In ſuch circumſtances, three or four rows of pailing may be put down, of different heights; and the vacant ſpaces between them be well filled, by forcing in furze, bruſh-wood, or even ſtraw, as repreſented at *fig.* 10. Theſe ſubſtances, by detaining the mud and ſand, as the tide paſſes through them, or during high floods, ſoon form a ſort of embankment, ſuch as that ſhewn in the above repreſentation. It ſhould afterwards be covered with ſome plant, which is capable of binding and giving it ſolidity, ſuch as the *elymus arenarius*. This embankment would continue, during extraordinary tides, to retain ſtill larger quantities of the ſandy materials, until ultimately raiſed higher than they could reach, by which a ſafe bank would be formed. It is ſuggeſted by Mr. Loudon, in his uſeful "Treatiſe on forming Country Reſidences," from which many of the above hints have been drawn, that from twenty to thirty thouſand acres of land might be gained in this way, in a very few years, in different parts of the rivers Severn, Humber, Frith, &c.

In all caſes of embankment, however they may be formed, tunnels and ſluices of a proper kind, with valves towards the ſea or rivers, muſt be occaſionally placed, according to circumſtances, ſo as to permit the water that may be collected within to paſs away, and that of the ſea or rivers to flow up, with different intentions in the view of improving the land.

The utility of projecting points is very conſiderable, in different caſes, on the ſea-coaſts and rivers, in defending the bays and inlets of the former, as well as guarding the banks of the latter, by diverting their ſtreams or currents to the oppoſite ſides. Hence ariſes the formation of piers, which become highly beneficial in defending embankments, as well as the borders of rivers and brooks. In the firſt of theſe caſes, they may generally be conſtituted and coated over with the ſame ſort of material as that of which the embankment is formed; while, in the latter, they ſhould be formed of ſome ſort of ſtony matter, being conſtructed in ſuch a way as to decreaſe in every direction as they advance outwards, as repreſented in *fig.* 11. In each of theſe caſes, they are, however, capable of being conſtituted of bruſh-wood, ſecured by means of ſtakes, often with more perfect ſucceſs. And it frequently happens that a ſimple rude wicker-work fence, of not more than three or four yards in length, may be fully ſufficient for the purpoſe. Embankments formed of ſtone, unleſs conſtructed in the manner repreſented at the above figure, are apt to cauſe eddies below them; while thoſe formed of bruſh-wood cannot have this effect.

It is obvious that conſiderable attention muſt be required in deciding the moſt proper ſituations for conſtructing theſe ſorts of projections in, and the diſtances to which they ſhould extend into the rivers: as a too extended projection may be highly dangerous to the oppoſite bank, and of courſe do harm inſtead of being beneficial; while not carrying them out ſufficiently may prevent the effect which is wanted. In caſes where piers are to be formed of ſtone, as in rivers where the bottoms are of a rocky nature, the plan repreſented at *fig.* 11. is probably the moſt proper, as it will ſcarcely cauſe any eddy, and be nearly equally mild with that of wicker-work in the effect which it produces. Different works of theſe ſeveral kinds have been conſtructed in the northern parts of the iſland with much ſucceſs.

Proper Materials for Embankments.—There cannot be any doubt, but that different ſorts of materials may be made uſe of in different ſituations and kinds of works of this nature, with more advantage than others, both in ſo far as duration and expence are concerned.

Thoſe ſteep upright embankments which are conſtructed with the view of protecting bold ſhores, or coaſts, and the banks of particular rivers, may probably be beſt formed of good brick, rubble, or aſhler work in the manner of a wall, as ſeen at *fig.* 6. in the plate, the materials being laid in the ſtrongeſt ſort of mortar that can be made. But where this is not the caſe, they may be built in the common way, and pointed with puzzolana earth, or what is termed the Roman cement, prepared by Meſſrs. Parker and Co. London.

The different kinds of ſloped embankments may be formed either with common earthy materials, clay, mud, or a mixture of theſe ſeveral different ſubſtances: and any other matters which are capable of uniting into a ſolid, firm, compact maſs, may be had recourſe to for the ſame purpoſe. Where the ſides next the ſea or other waters form angles of from twenty to thirty or even thirty-five degrees, with their baſes, they may be coated with ſand, the ſhells from the ſea, or coarſe gravel from the borders of the ſhores. And ſtones, broken down to uniform ſizes of a few pounds in weight, may be employed in a ſimilar manner. But where none of theſe ſubſtances are capable of being procured in ſufficient abundance, a method practiſed in Holland, of covering them with ſuch periſhable materials as mats, reeds, ſtraw, bark, and others of the ſame nature, may be had recourſe to; but theſe are obviouſly diſadvantageous, as requiring very frequent renewal. They might likewiſe be protected by a low fence of bruſh-wood, fixed in an erect manner all along at the bottom of the bank, of an equal height, as tending to break off the violence of the waves. Another method might alſo be employed, which is, that of covering the whole front of the bank with bruſh-wood, either made into bundles or in the manner of wicker-work, or fixed down in a neat manner by means of long poles and ſtrong hooked ſtakes. And further, they may be laid in the form of cauſeway with ſtones in moſs, or covered with wicker-work applied upon the moſſy material when ſpread out over the bank. And there are ſtill many other modes which may be adopted under particular circumſtances.

In all caſes where the ſides and ſlopes towards the ſea conſtitute angles of from thirty-five to forty-five degrees, with their baſes, as in *fig.* 8, recourſe may be had to ſtones of the flag kind as coverings, which ſhould be jointed with cement mortars formed in ſome of the manners mentioned above. And where theſe ſorts of ſtones cannot be provided, if clay can be found, proper kinds of bricks may be made, and uſed in the ſame way as the ſtones. But where the ſlopes or inclined planes are from forty to forty-five degrees, it is frequently more cheap and economical to have them covered with ſtones of about ſix or eight pounds in weight, applied to the thickneſs of a foot and a half or nearly two feet; or theſe may be uſed on a bed of common moſs of three inches, or of peat-moſs of the flow kind, of ſix inches in thickneſs, ſpread upon the banks, only to the thickneſs of ſix or eight inches. Stones of theſe kinds may likewiſe be formed into a ſort of cauſeway, or be laid in ſtrong clay, and their ſurfaces be jointed with lime or a ſtrong cement mortar, which has the property of quickly hardening, and of enduring the operation of the air and tides, which alternately act upon it.

There may likewiſe be caſes in which it may be the moſt advantageous practice to have the ſides next the ſea or rivers protected by coverings of wood only, in which caſes, larch may be the moſt proper, or ſuch others as are durable, having their ſurfaces covered over with pitch and ſome ſort of ſharp ſand. And old ſail cloth, or oil cloth pitched and coated over with ſand in the ſame manner; or even thin plates of metals have been ſuggeſted as uſeful in particular inſtances.

Expence of forming Embankments.—This muſt obviouſly be very different in different ſituations and circumſtances, according to materials and the price of labour, but though in general pretty conſiderable, it is ſeldom ſo high as is commonly ſuppoſed. It is probable that in cheap diſtricts, and where the materials are plentiful, the expence of forming an earth bank covered with ſand or gravel, ſuch as that ſhewn at *fig.* 1, could not be leſs than from four-pence or ſix-pence, to ten-pence or a ſhilling the cubic yard. And ſuch as have more ſteep and bold ſlopes, as from thirty-five to forty-degrees, and are formed with pavement on the ſurfaces, cannot coſt leſs than from nine-pence to one ſhilling and ſixpence the cubic yard. One made on the plan of that ſhewn at *fig*. 6. could not be conſtructed for leſs than from twelve or fifteen to thirty pounds for every thirty-two yards. And one conſtituted of bruſh-wood, in the ſame method, for ſoft ground which will not admit of a wall, would not be lower than from ſix-pence or eight-pence to ſix or ſeven ſhillings for each foot forward in a lineal manner. In many ſituations the expences would, however, in all ſorts of embankments, ſtand a great deal higher than theſe.

In ſome diſtricts embankments are formed by the rod and the floor, the former being from four to five pounds, and the latter about four ſhillings and ſix-pence, the workmen finding all ſorts of neceſſary things for the buſineſs.

Extent of Land capable of being gained by Embankments.—It is evident, that great quantities of land might in many ſituations be obtained from the ſea and large rivers by the forming of proper embankments. Some notion of this may indeed be formed by a careful examination of ſuch lands, as lie along their ſhores and banks, by aſcertaining the diſtances to which the waters ebb out at common tides, as it is found by experience, that one half of the extent of land, thus uncovered in any particular ſituation, may at leaſt be gained; hence throughout the whole kingdom it could hardly be eſtimated at a leſs quantity than from two to three millions of acres, but it is probably much more than even the laſt quantity, if it were capable of being aſcertained with any degree of accuracy or correctneſs.

Importance of Embankments.—When the extent and value of the lands which are capable of being gained by theſe means are fully conſidered, there can be no doubt of their being of the greateſt conſequence to the intereſts of the country. It has been well remarked by a late writer on this ſubject, that there are numerous places in the kingdom where vaſt improvements may be effected by the judicious application of theſe means. Vaſt tracts of land of the beſt kind may not only be gained from the ſea, but likewiſe from the large rivers and lakes, beſides the beneficial conſequences which muſt neceſſarily ariſe from the prevention of ſuch rivers from overflowing their banks, and injuring the level grounds in their vicinity by ſuch inundations. In ſome caſes, it is ſuppoſed, that by raiſing a bank of only three or four feet in height, at very ſmall expence, ſome thouſands of acres might be prevented from being overflown, the crops from being carried away, and much other miſchief from being produced. In other inſtances the forming of very trifling banks might be the means of obtaining much extent of country, which in its preſent ſtate is of but very little value; yet ſo indifferent are people in general about improvements of this deſcription, that though immenſe tracts are year after year overflown, and the moſt dreadful devaſtations committed, they have recourſe to no means of prevention; nay, even though the ſea itſelf, ſays the writer, as if to rouſe them from their inaction, preſents to their view twice every four and twenty hours large tracts that might by proper means be made of very great value, yet theſe repeated invitations are diſregarded, and no attempts are made to poſſeſs what might, in many caſes, be ſo eaſily and ſo advantageouſly acquired. This is conſidered altogether as extraordinary and unaccountable, while the acquiſition of diſtant poſſeſſions is conceived by them of ſuch great importance, as there can be no doubt but that the addition of portions of ground at home, when brought into proper cultivation, is of far greater national advantage than double the quantities gained in other diſtant countries.

The acquiſition of additional territory at home ſhould, therefore, be more attended to, and have more expence beſtowed upon it than has hitherto been the caſe. In particular ſituations, indeed, a few active and enterpriſing perſons have taken advantage of the opportunities which have been preſented; as in the counties of York, Lincoln, Cambridge, and others, many hundred thouſands of acres have been gained by embankments. In Norfolk, too, a conſiderable extent of land has been gained in this way. In the neighbourhood of Cheſter, the river Dee company have likewiſe gained ſeveral thouſands of acres from the ſea, which have been ſince divided into different beautiful farms, the whole of which pay in rent more than two thouſand pounds *per* annum. And in Holland the whole country has, in a great degree, been obtained by theſe means.

It is ſtated by Mr. Beatſon, in the ſecond volume of Communications to the Board of Agriculture, that large ſums have been expended in ſome places by individuals, with a view of guarding againſt inundations; but owing to the embankments they have made being injudiciouſly placed, and as badly conſtructed, the deſired effect has not always been produced, particularly in the northern parts of Cheſhire, on the banks of the river Merſey, where works of this kind have been thrown up at a great expence, which, from the manner of their being placed, may, in ſome caſes, by confining the courſe of the river, do more harm than good. By the appearance of that part of the country, ſo far as he could judge from the curſory view he had of it, it ſeemed to him that the inundations from that river might have been effectually prevented at a much eaſier rate, if a proper method had been taken at firſt; but from a certain ill-judged and miſtaken tenaciouſneſs of property, the embankments are reared ſo cloſe upon the ſides of the river, that, in many places, it is confined to a ſpace not more than twenty yards over. Owing to this, and to an aqueduct acroſs the river, with only one arch inſtead of two, which it ought at leaſt to have had, the water ſometimes, in great floods, riſes, he was informed, to the height of about twenty feet above its ordinary level, and overflows the embankments, although now, by frequent additions, they are about that height. Inſtead of twenty yards, had theſe embankments been eighty or a hundred yards diſtant from each other, and the river widened in the narroweſt places, one-third or one-fourth of their preſent height would have been quite ſufficient. They would have been much eaſier conſtructed, and leſs liable to damage by the floods, and a great deal of money would have been ſaved, not only in the firſt conſtruction, but in keeping the banks afterwards in repair. Neither would that ſpace of ground between the embankments and the river be altogether uſeleſs; on the contrary, it would have produced the richeſt paſture, or meadow-hay, by its frequent manurings with the fertilizing particles left upon it, when flooded by the ſwelling of the river; and in thoſe places, if any, that are unfit for paſture or hay, willows or other aquatics might have been planted to great advantage; and thus it might have been of more value perhaps than at preſent, and the interior grounds more effectually ſecured from the ravages occaſioned by a ſudden flood. Notwithſtanding the general indolence ſhewn in moſt parts of the country reſpecting the acquiſition of land by embanking, and the ſeeming averſion that moſt people have to engage in ſuch undertakings, there have been, however, ſome ingenious and enterpriſing projectors, whoſe ideas upon that ſubject have ſoared far beyond the bounds allotted to common underſtandings. From the ſpeculations of ſuch people, the moſt important advantages are ſometimes produced; and ſurely the man who is poſſeſſed of a ſpeculative turn of mind, and who conſiders no obſtacles inſurmountable, is a much more uſeful member of ſociety than he who is perpetually ſtarting difficulties againſt every new project, and is for all things remaining *in ſtatu quo*, that is, for leaving the world as he found it. The idea of embanking Lancaſter ſands, for example, never would have occurred to a torpid genius of this kind. A thouſand difficulties and impoſſibilities would have immediately ſtarted up at ſuch a propoſal, which, to a more expanded mind, appear perfectly practicable to overcome. What then, ſays he, muſt thoſe anti-projectors think, when they are told it is propoſed to exclude the ſea entirely from theſe extenſive ſands, which form a bay, expoſed to a ſouth-weſterly wind, more than ten miles acroſs, containing a ſurface of near forty thouſand acres, and where the tide riſes about fourteen to eighteen feet perpendicular height. Some propoſals and eſtimates have already been made for carrying this project into execution. One very public-ſpirited and enterpriſing gentleman; the late Mr. John Wilkinſon, offered to begin a ſubſcription for that purpoſe, by leading off with the princely ſum of 50,000*l.*; but ſo many unexpected obſtacles have come in the way, by the claims of lords of the manors, and in proportioning the tythes, in the event of acquiring ſo large a tract of country, that few people have on that account choſe to embark their fortunes in this immenſe undertaking, ſeeing that their profits may be liable to ſo many deductions; conſequently nothing concluſive has yet been done in it. Ulverſtone and Duddon ſands, on the ſame coaſt, have alſo been propoſed to be embanked. The latter, over which the writer went with major Gilpin, a gentleman who has paid great attention to that buſineſs, appears to be the moſt practicable. According to his opinion, there might be about nine hundred acres of very good land gained there, by laying out a ſum not much exceeding 20,000*l.*. If, on a correct ſurvey being made by perſons properly ſkilled in ſuch undertakings, ſo valuable an acquiſition is proved to be attainable at ſo ſmall an expence, can there be the leaſt heſitation about immediately commencing a project ſo highly advantageous to that part of the country, and to every individual concerned in it.

That there are many large tracts of land in different parts of the kingdom, both on the ſea-coaſts and on the ſides of lakes and rivers, much more eaſily attainable than Lancaſter ſands, or any of the ſands here noticed, there cannot be the ſmalleſt doubt. It is, therefore, an object worthy of the attention of thoſe who are ſo fortunate as to poſſeſs property in ſuch ſituations, to have it aſcertained by perſons of experience in ſuch matters, how far the acquiſition of additional portions of land may be adequate to the expence which it may be neceſſary to incur in procuring it.

But embankments are important in other views than thoſe of gaining ground by them. When rivers are concerned, one material advantage is the deepening of their courſes, by which veſſels of greater burthen than they admitted formerly may be permitted to trade in them.

And further, as embankments become more frequent on the borders of rivers and ſea ſhores, the intervening diſtances may become a ſort of bays, in which accumulations of ſhells, mud, ſand, gravel, and other matters, may take place by the influx of the tides; and theſe, however difficult they may be at firſt to embank, will in time be as eaſy to perform the work on, as the natural bays and creeks are at this period. In this way many rivers, which in their preſent ſtate are eight or ten miles in width at their junction or influx with the ſea, may in the courſe of years be reduced to leſs than half theſe diſtances. Conſequently ſuch embankments would be equally beneficial to the proprietors of land, and the merchant or manufacturer, as many rivers would become more eaſily navigable, and thoſe obſtacles which interrupt their mouths be wholly removed.

Embanking againſt the Sea.—When encroachments of this nature are to be guarded againſt by embankments, the methods of aſcertaining their proper heights have been ſhewn above. But as new works of this ſort, eſpecially where the banks are large, are liable to ſubſide too much, it may be a proper precaution to take the levels frequently for ſome time after they are completed, in order to guard againſt any miſchief which might ariſe in this way. Where the banks are low this is not, however, ſo neceſſary, as the ſettling is always more or leſs according to their height; in low banks it will of courſe be very little. In the making of ſuch embankments, it is ſcarcely poſſible to lay down any general rule in regard to their ſize or dimenſions, as theſe muſt be directed by ſituation and circumſtances, under the management of an expert engineer. In caſes where the embankment to be formed is to exclude the ſea from a piece of low marſhy ground, over which it only flows at ſpring tides, the work is eaſy and capable of being accompliſhed at no great expence. But where it is intended to reclaim a portion of land which is covered every tide, in ſome bay or creek, or on the ſides or windings of ſome large river in which the tide ebbs and flows, the buſineſs will be in ſome degree more difficult, according to the depth and rapidity of the current of the water. And where it is propoſed to exclude the ſea from ſome expoſed ſituation at the mouth of a river, or in a bay or inlet, which is uncovered every tide, the operation will be the moſt difficult and expenſive of all, according as it is expoſed to prevalent winds, and the depth of the water to be reſiſted. Each of theſe ſituations, therefore, requires a different method of management. The buſineſs of embanking againſt the ſea, when at any conſiderable diſtance within high-water mark, is not only the moſt tedious, but at the ſame time the moſt difficult of any; as when the materials are not very good and the work not well performed, the force of the water at every flowing of the tide will quickly undo all that has been effected, eſpecially if the ſoil be of a ſandy nature, as is often the caſe in ſuch ſituations. If it be a ſtrong clay, as is ſometimes the caſe in marſhy places, there will be the leſs riſk of its being waſhed away. In ſandy ſituations it has been adviſed by ſome to lay bundles of ſtraw or reeds well faſtened down, or any other impediment, to hinder the ſoil from being carried away by the ebbing tide. Where a ſufficient ſupply of good ſtrong turf cannot be had, expedients may be tried: but where ſuch turf can be provided, as is the caſe in moſt marſhy ſituations, and where the embankment required is not to exceed the height of four or five feet, it is beſt to finiſh the ſlope with good turf as expeditiouſly as poſſible, as the work proceeds; that is, ſuppoſing the length of thirty, forty, or fifty feet or yards of it can be completed in a tide; it is better to finiſh that length to its intended height, than to trace out or begin a greater extent than can be finiſhed before the tide returns, by which a great deal of the ſoil might be carried away, and much of the work be demoliſhed, which is not ſo likely to be the caſe when the ſlope is finiſhed. Turf which contains the roots of bent or ruſhes is very good for this uſe. The firſt thing, however, to be done in an embankment of this kind, is to ſtrike out the intended line of it, ſetting out the breadth at the baſe, alſo the width of the excavation or trench to be made in the inſide, from which moſt of the materials that compoſe the bank are to be taken: this trench alſo ſerves as a drain to keep the grounds within dry. There ſhould alſo be trunks or ſluices at different parts of it, to ſhut of themſelves againſt any external water, and to open when the tide ebbs, to let out any water from within. The width of it ſhould be proportioned to the quantity of materials required from it for the raiſing of the embankment, as eight, ten, or fifteen feet wide, and three or four feet deep, leaving a *berme*, or ſpace, between the edge of the trench and the inner bottom of the embankment. If the ſoil be ſtrong, one foot or eighteen inches will be ſufficient for this purpoſe; but if looſe or ſandy, three or four feet at leaſt will be required. The more eaſy and gradual the external ſlope is made, and the leſs ſudden the reſiſtance againſt the ſea will be, as has been ſeen above, and of courſe the embankment be leſs liable to injury; this ſlope ſhould therefore be formed according to the expoſure of it to the winds and tides; nothing, however, can be a greater error than the making it too bold or upright. *Fig.* 1. in the plate, is ſuppoſed to be a ſection of an embankment of this nature, in which the baſe or horizontal line *g h* ſhould at leaſt be three times the perpendicular height *h i*, but *l m*, the inſide ſlope, need not be more than three-fourths of the perpendicular height, that is, nine inches for every foot of riſe. The inſide ſlope ſhould be faced with turf likewiſe, laid greenſide downwards, as in building common ſod walls. Some expert ſodders can finiſh this ſort of work extremely neat by ſetting the ſod on edge, according to the ſlope intended to be given, and with proper mallets and beetles ramming the earth hard behind, which conſolidates the work as it advances, and tends to render it durable. As ſoon as the firſt or lower courſe is finiſhed, the upper edge of the ſods is pared with a ſharp knife quite even, by laying a rule to them, and then they go on with the ſecond courſe, which they finiſh in the ſame manner, and thus proceed until the whole height is completed, which, when properly finiſhed, has a ſmooth beautiful appearance, not a joint between the turfs being ſeen. Where turf is uſed in covering the outſide ſlope, it ſhould all be laid with the graſs uppermoſt, as already noticed, and be well beaten down with a flat ſod-beetle for the purpoſe, and in order the better to ſecure them, it may be proper to drive ſmall ſtakes, about eighteen inches in length, through every ſod. In cutting ſods for this uſe, they ſhould be taken up in a careful manner, and be all traced by a line of the ſame breadth; their edges being cut as even as poſſible, that they may make the cloſer joints, which will tend very much to their ſecurity, until they are grown properly together. In laying the different courſes of ſuch ſods, care ſhould alſo be taken that the joints of the one be covered by the other, in the manner that good brick work is made.

Where it is propoſed to reclaim a piece of land, upon which the ſea ebbs and flows every tide, to a greater depth than in the foregoing caſe, as in a creek, or on the ſide of a large river, a different mode of proceeding muſt be purſued, according to the ſoil, and the nature of the materials to be employed. Where plenty of ſtones can be readily procured, a bank may be formed of them, with a mixture of clay, either by means of land carriage, or which, in ſome inſtances, is better, by conveying them in flat bottomed boats, or punts, and throwing them over-board until the bank is formed. Where ſtones cannot be eaſily had, clay, or other materials proper for the buſineſs, may be thrown in, in ſufficient quantity, in the ſame manner, with perhaps nearly equal ſucceſs. It is ſuppoſed that moſt of the embankments in Holland were formed in this way, the clay dug from the canals being made uſe of for the purpoſe. In either caſe it is requiſite to fix up ſtrong poles before the work is begun, as guides for laying down the materials. Proper ſluices muſt likewiſe be laid in ſuitable directions for taking off the back water when the tide ebbs, under the inſpection of the engineer. Much, in all caſes of this ſort, depends on a ſkilful engineer, who is capable of ſuggeſting and contriving various means of facilitating the buſineſs, and of obviating the difficulties that may ariſe in its execution. A perſon of real genius is often capable, by his different contrivances, of rendering the accompliſhment of a great undertaking comparatively eaſy, which to others would be almoſt impracticable, or carried on at ſuch a heavy expence as to counterbalance the advantages to be drawn from it. In caſes of the kind juſt noticed, he might ſuggeſt the erection of ſtages or platforms, in ſuch a manner as to carry on the work at all times of the tide, which would be an immenſe ſaving, as the delays cauſed by the tides in this ſort of buſineſs are both tedious and expenſive. Waggons might likewiſe be contrived in ſuch a way as to carry on ſuch platforms large quantities of materials at once, which could be eaſily emptied and filled; and at the ſame time be drawn by machinery, in ſuch a manner as to ſave much labour and expence, both in carriage and tide work.

There is another ſpecies of ſea-embankment which is, perhaps, the moſt important of any; as there are few eſtuaries or mouths of rivers in which large tracts of land may not be gained by it. The ſhoals, or flats formed at the entrance of ſuch rivers, are moſtly compoſed of the richeſt materials and moſt fertiliſing particles, brought down from the towns and circumjacent country through which they paſs. Such ſhoals and flats may, therefore, under proper management, be in moſt caſes readily converted into the moſt fertile plains. In ſuch ſituations the firſt object is that of collecting the whole river into one ſtream, and preventing its overſpreading a wider extent than is merely ſufficient for its diſcharge, or it may be better, perhaps, to alter its courſe altogether, and cauſe it to be diſcharged at ſome other outlet. It is in this latter method that it has been propoſed to reclaim the extenſive tract covered by the tides, known by the names of the Lancaſter and Milthrop ſands, as well as thoſe of Ulverſton and Duddon. And the principle on which it is founded is this: it has been found by experience that where the courſe of a river is changed in ſuch a manner as to make it diſcharge itſelf into the ſea at a different place to that where it did before, the former place will, in a few years, by the continued accumulation of ſand and mud brought in every tide, be ſo choaked up and raiſed above its former level, as to form of itſelf, in the courſe of time, a bank that, with a very little aſſiſtance, will quite exclude the ſea; for as the current of the river before carried away all that ſediment which the motion of the waves naturally ſtirred up, from its being now removed, it is obvious that all or moſt of the muddineſs will not only be carried further up the old channel of the river, but a great part of it be depoſited there as the tide recedes. It has been found that in ſpring-tides and particular winds, this ſediment is depoſited in larger quantities than at other times, and the writer has been informed that a gentleman in Lancaſhire, who has gained ſome land in this way, has found, on making a perpendicular cut in the ground ſo recovered, that the different layers were ſo diſtinct, he could readily diſtinguiſh thoſe made at ſpring-tides from the reſt. This curious fact is well deſerving of the attention of all thoſe who have lands ſituated at the mouths of rivers, as there may in many ſuch ſituations be conſiderable tracts gained in this manner at a very light expence. But though this fact may exiſt in ſome places, as has been proved by experience, nevertheleſs it is ſuppoſed that the effect cannot be the ſame in all ſituations. Where there is a great extent of flat or muddy ſhores, the motion of the waves will no doubt ſtir up the mud or ſand, and carry great quantities of them along with the current on the flowing of the tide, and when the tide ebbs, though ſome of the lighter particles will be carried away again, yet it is reaſonable to ſuppoſe the heavier ones will be left behind. If the ſhores are bold and rocky, except juſt near the entrance of the river, there will be the leſs of this mud; but on ſuch ſhores there can, indeed, be little or no occaſion for embanking, unleſs perhaps in ſome creeks, narrow at the entrance and ſpreading out wide above. If the ſea were excluded from ſuch creeks, a great deal of land might probably be gained.

It was found, on having a ſurvey made of the Lancaſter ſands, and of the propoſed alteration of the courſe of the river Kent, that the length of the cut, neceſſary to be made from a little below Dalham Tower to the river Lune, was 21,340 yards, or twelve miles and one furlong. This cut was propoſed to be about thirty-four yards wide, and four yards of average depth, making in the whole an excavation of 2,902,240 cubic yards: the expence of excavating which, at 4½*d.* per yard, would amount to 54,417*l.* But perhaps this eſtimate is rather under-rated at 4½*d.* the cubic yard; but on the contrary the average depth of the excavation is preſumed to be conſiderably over-rated at four yards, as a great part of the depth neceſſary may be made up by the ſoil thrown out; conſequently whatever is made up cannot be conſidered as a part of the excavation; beſides if the river Kent, Lindale pool, and the other ſtreams propoſed to be taken into this new cut, require, when united, a ſpace or channel to contain them whoſe tranſverſe ſection is 136 yards ſuperficial, it would be much leſs expenſive, it is ſuppoſed, to add eleven yards to the breadth, and to take one from the depth propoſed, unleſs it be neceſſary, from the level of the bottom of the river, to make the bottom of the new cut of a certain ſtated depth. The whole expence of completing this great undertaking has been eſtimated at only 150,000*l.*, and in the opinion of ſome perſons fifty, or perhaps ſixty thouſand leſs might be ſufficient. It is, however, apprehended, that in this eſtimate there has been no allowance made for the neceſſary buildings on ſo extenſive a tract, or for incloſing and draining; all which, as well as the intereſt of money laid out before any return can be expected, ſhould be conſidered in calculating the expence of bringing into improvement ſuch lands as theſe. And further, there are other eſtimates to be made for neceſſary buildings in its cultivation; beſides in the eſtimates which have been made, it is taken for granted, that if the freſh water be conducted another way, as propoſed, in a few years the ſea will completely exclude itſelf from this extenſive tract of land, and conſequently no allowance whatever is made for any ſort of embankment acroſs thoſe ſands. Experience has not, however, ſo ſufficiently ſhewn the certainty of this method of gaining land from the ſea, as to place that ſort of confidence in it that is requiſite. If, indeed, it could be fully depended on, the ſpeculation would be admirable, as well as the advantage and profits ariſing from ſuch an acquiſition immenſe; but if after laying out nearly perhaps 200,000*l.* in altering the courſe of the rivers, &c. it ſhould be found that the ſea left little or nothing behind, or if it did leave ſome at one time, but carried it all away at another, in what predicament muſt thoſe perſons concerned find themſelves? They muſt either loſe the whole of the money laid out, or they muſt expend at leaſt 200,000*l.* more, perhaps, in performing what they had ſo implicitly truſted to the operation of the ſea. If, however, it were certain that even a fiftieth part of an inch was depoſited every tide, the ſucceſs of the undertaking would be unqueſtionable, and a concern in it highly profitable, as in very little more than eight years ten feet of perpendicular height would be raiſed, and it would be an eaſy taſk to accompliſh the reſt of the buſineſs.

The Duddon ſands are another tract, it is ſuppoſed, where great improvement is capable of being effected at a very eaſy rate, when compared with that juſt noticed. In the preſent ſtate a great deal of land, that is capable of producing the beſt crops, is often overflown and rendered ſo wet and marſhy as to be of little or no value. While, by altering the courſe of that river, and bringing it farther north on the low marſhy ground, it would ſeem from viewing it, without actually taking the levels, that not only the whole of the ground might be completely drained, but a conſiderable tract of lands be reclaimed. The making of the new channel for the river ſeems perfectly eaſy and practicable, the ground being nearly level, with the exception of a ſmall riſe at one place, all the way from where the new cut would begin, which is about two hundred yards above Duddon bridge to Havering pool; where it would empty itſelf into the ſea. The length of this cut would therefore be about ſix miles, which ought to be made navigable all the way, with a lock near the ſea, and a baſin with proper landing places for delivering goods. The quantity of land that might be thus gained, including the ſands and marſhy ground on each ſide, would, it is ſuppoſed, on the authority of major Gilpin, be about 2000 acres, and the whole expence under 20,000*l.* The land, too, has every appearance of becoming one of the moſt fertile kind; in proof of which a farmer, who ſome years ago gained a few acres of it by embanking them againſt the ſea, found that it produced the beſt crops of all kinds, even with little or no manure. So large a tract of valuable land, capable of being gained at ſo very trifling an expence, is therefore an object highly worthy of attention, not only as a profitable concern, but on account of many other advantages that would ariſe from it. It is, therefore, ſurpriſing, that the proprietors in the vicinity or other enterpriſing individuals have not long ago taken the neceſſary ſteps to reclaim theſe ſands. The execution of theſe projects would, it is conceived, be attended with the moſt beneficial effects to a very extenſive tract of country, and be ultimately felt in ſome meaſure by the nation at large. There would not merely be an addition of territory larger than either of the iſlands of Guernſey or Jerſey, but it would tend to improve at leaſt four times that extent of the interior country. A ſafe and ſpeedy communication would be opened between the towns of Lancaſter, Whitehaven, Ulverſton, Ravenglaſs, Dalton, Bootle, Egremont, &c. and all the intermediate country, inſtead of a mountainous and very circuitous route, or a precarious and dangerous paſſage over Lancaſter ſands, in croſſing which accidents are not unfrequent. Independently of the advantage ariſing from the produce of the lands to be acquired, the produce of the interior part of the country, which in many places is extremely fertile and well cultivated, would be eaſily brought to market; whereas it is at preſent, with the utmoſt difficulty and inconvenience, that any commodity whatever can be tranſported over theſe dangerous ſands and almoſt inacceſſible mountains. By diverting the river Duddon into the navigable cut propoſed, it would yield the moſt important advantages to the town of Broughton and all the back country, by facilitating the importation of coal, lime, and other produce of every kind, and the exportation of ſlate, iron, and other productions of the country. But though different public-ſpirited individuals have been active in forwarding theſe highly laudable and important undertakings, the oppoſition which has been given by the proprietors of ſome trifling fiſheries, who were offered a full indemnification, and from ſome lords of manors, who would neither contribute towards ſuch improvements, nor relinquiſh any part of their claims to the ground when improved, they have been for ſome time in a great meaſure in a dormant ſtate. It is hoped, however, that in theſe enlightened times, when the ſpirit for improvements of this kind ſhould be particularly arouſed, theſe important and neceſſary projects may be again taken up in a ſerious and effectual manner, and that every obſtacle which may ſtand in the way of their completion may be ſpeedily removed. And that if the attempt of re-claiming Lancaſter ſands ſhould be conſidered as a too expenſive and too mighty undertaking to begin with, an experiment may be made on Duddon ſands, where the money propoſed to be expended is comparatively trifling, and where, if the ſcheme ſhould ſucceed, there could not be the ſmalleſt reaſon for doubting the ſucceſs of the other.

In the marſhland diſtrict of the county of Norfolk, lying between the rivers Wyn and Ouze, immenſe tracts of the moſt rich land, ſuch as is compoſed of the muddy depoſitions left by the tides and floods, which is there called ſilting, have been obtained by means of embanking. In this important buſineſs, the late count Bentinck, and his ſon, the preſent poſſeſſor, have been largely concerned. This kind of work has ſometimes been undertaken by the tenants on a new piece of marſh, in conſideration of having the land free for twenty-one years. But in theſe caſes the banks have often been very imperfectly made, not having coſt more than forty ſhillings a rod. And thoſe which were conſtructed by the landlords were indeed frequently but little better, being moſtly deficient in not having ſlope enough given them towards the water. Count Bentinck therefore laid his out upon a ſcale never practiſed in that part of the iſland before, and his ſucceſſor has ſtill far exceeded it. That planned by the former extends about four miles, and has added to the old eſtates not leſs than a thouſand acres. The baſe of the embankment, in this caſe, is about fifty feet, the ſlope to the ſea thirty-ſix feet, forming an angle, it is ſuppoſed, of about twenty-five or thirty degrees. The crown is four feet in width, and the ſlope to the fields ſeventeen feet, in an angle ſuppoſed of about fifty degrees; the ſlope towards the ſea being very neatly turfed over. The firſt expence incurred in forming this bank was four pounds per rod, but a very high tide coming before it was finiſhed, not only made ſeveral breaches, but occaſioned an additional height and ſlope to be given to ſeveral different parts, in order to bring it to the dimenſions mentioned above, all of which made the groſs expence to amount to about five pounds the rod. The whole coſt was ſomething more than 5000 *l.* The expence of the houſes, farm buildings, and other things, was about as much more, for five new farms, which was a greater expence than was neceſſary, as the land would have let as well in two or three as five farms. Suppoſing, therefore, the expence at 10,000 *l.* and the new rental as 1000 *l.* a-year, it is juſt ten *per cent.* for the capital laid out. The expence here, however, ſeems to have run too high, when the neceſſary repairs of the bank are taken into the account. The repreſentation, given at *fig.* 11. in the plate, fully explains the nature of the embankment formed in this caſe.

In another new embankment, in which two hundred and ſeventy-three acres of marſh land, and eighteen of bank were gained, the men were paid four ſhillings and ſix-pence a floor of four hundred cubical feet, finding wheeling planks, barrows, truſſels, &c. When it is thus formed, the front ſlope is ſodded, for which they are paid in addition four ſhillings a floor of four hundred ſquare feet, earning from five ſhillings and ſix-pence to ſeven ſhillings a day, and there is ſome little further expence neceſſary for beating it down in a firm manner. The whole of the expence of the bank, ſluice, and every thing elſe, was about 3300 *l.* The land was immediately offered to be rented at four pounds an acre for four years, or three pounds an acre for ſix years; which, in the former caſe, would amount to 4368 *l.* in that length of time, or one thouſand guineas more than the whole of the capital laid out in the undertaking.

On this coaſt the operation of *ſilting* up, or raiſing the ſurface of the marſh land by the repeated depoſitions of muddy matters from the ſea, is performed in a more rapid manner than in many others; and the little hollows and creeks are found from experience to ſilt up much faſter where the tide waters are ſpeedily taken off by proper cuts and channels formed for the purpoſe, than where the contrary is the caſe.

Embanking againſt Rivers.—The embankments againſt rivers may be divided into two kinds; namely, ſuch as are for preventing their encroaching on the adjacent lands, and for protecting thoſe lands and the neighbouring level country from being overflown, when the water riſes above its ordinary level. It may be remarked, that where the courſe of a river is a ſtraight line, or nearly ſo, it hardly ever makes any encroachment upon its banks, unleſs, perhaps, in very large rivers when they riſe above their common level, either owing to an increaſe in the waters, or to their being, in ſome degree, affected by the tides. In either caſe, the waves occaſioned by a ſtrong wind, where the river is wide, will moulder away the banks on that ſide upon which it blows, unleſs prevented in proper time. This may be done either by ſecuring the bank properly with ſtones, or by driving a row of long piles pretty cloſe together at a little diſtance from the ſhore, the piles being of ſuch a length, and ſo driven, that their tops may be always above the higheſt riſe of the water. It is ſurpriſing the effect that piles driven in this manner have in reſiſting the power of the waves in ſuch ſituations.

Some years ago, when Mr. Beatſon was on duty as an engineer at a fort near Portſmouth, built on a point of land much expoſed to the ſea, the waves made ſuch havock, that the walls on that ſide were conſtantly giving way, although built in the moſt ſubſtantial manner, and having bulwarks of large heavy ſtone beſides to protect the foundation: however, all would not do; thoſe bulwarks were ſoon knocked to pieces, and ſeveral times the wall itſelf. At length it was propoſed to drive a number of piles at about forty to fifty yards from the fort. Theſe piles were twelve or fifteen inches in diameter, and driven about one diameter from each other nearly in a ſtraight line, parallel to the wall where the waves did ſo much damage. They were driven into the ground with a pile engine till perfectly firm, perhaps eight or nine feet deep, and about two feet of the top of them left above the level of high-water mark. After this was done the wall received no farther injury, the ſpace between the piles and the fort being always perfectly ſmooth, however tempeſtuous the waves might be without. The ſame ſimple method might, it is ſuppoſed, ſometimes, perhaps, protect the banks of large rivers, if expoſed to the waves, when other methods might fail.

But it is ſuggeſted, that the moſt common courſe of rivers encroaching on their banks, is the reſiſtance occaſioned by a ſudden bend. In flat countries, apt ſometimes to be overflown, where there are any ſuch bends or windings in the rivers, it would be of great advantage to ſtraighten the courſe as much as poſſible, for, as every impediment or obſtruction will naturally cauſe the water to riſe higher than it otherwiſe would do, and as ſuch bends have that effect, conſequently, in the time of a flood the waters will overflow a greater extent of country, and to a greater depth than if the river had a free and uninterrupted courſe ſtraight forward.

If the windings of the river cannot be altered, and encroachments are making on ſome part of the banks, it muſt firſt be conſidered, whether the force of the water can be driven to another place where no injury can be done. If, for example, a river is encroaching on its banks, at *x*, *fig.* 2. a jutty of ſtone, a little way up the river in the direction *y z*, would throw off the current towards *w*, and might totally prevent any further encroachment. On the river Nith, in Dumfriesſhire, it is ſtated that a good deal has been done in this way by Mr. Millar of Dalſwinton, a gentleman of the moſt enterpriſing genius and moſt liberal mind, who has paid more attention, and laid out more money in making important and uſeful experiments, than almoſt any other private individual. The courſe of the river, where Mr. Millar has been carrying on his operations, is ſaid to be nearly as ſhewn at *fig.* 3. by *r s t u*; at *t*, it was encroaching moſt rapidly, and ſeemed inclined to take a new courſe towards *v*, which would have deſtroyed ſome very fine land, and done a great deal of miſchief in that part of the country. To prevent this, Mr. Millar made a large cut about 400 yards in length from *w* to *r*, and threw in a great quantity of ſtones quite acroſs the river at *s*, to direct its courſe in a ſtraight line from *r* to *w*. This had, in a great meaſure, the deſired effect, by totally preventing its progreſs at *t*, but now it began to encroach on its banks at *u*. He at firſt endeavoured to prevent this by driving in at a conſiderable expence a number of piles at a little diſtance from the bank, and wattled them with willow branches, &c. thinking thereby to protect the bank. The piles were drove in with heavy mallets, apparently firm into the ground; they continued ſo for ſome months, till a heavy fall of rain came on, which ſwelled the river, undermined the piles, and carried them all away. But, indeed, it is in vain to think of piles doing any good in ſuch a ſituation, unleſs firmly driven in by a pile engine; for it is not poſſible to drive them in properly with mallets; this muſt have been the cauſe of their giving way ſo ſoon. The piles not ſucceeding, Mr. Millar was reſolved to try another plan; ſeveral of his adjacent fields being covered with an immenſe quantity of ſtones, he ordered them to be gathered and thrown into the river, ſo as to form a jutty at *x*, a little way above the injured bank. Being obliged to go from home about that time, and to leave the execution of the work to ſome country people, they carried out this jutty too much at right angles to the ſtream. It had not, therefore, the deſired effect, but rather made the matter worſe than before; for, if a jutty is carried out at right angles, as at *a* in *fig.* 4, the current will be forced from *a* to the oppoſite ſide of the river at *b*, and from thence it will rebound towards *c*, more violently than it did before. But if a jutty be placed obliquely, as at *d*, it will force the current gradually towards *e*, in which poſition one jutty may do more good than ſeveral placed improperly at right angles. Mr. Millar was, therefore, under the neceſſity of making other jutties in this way, and has now the ſatisfaction to find that they anſwered the purpoſe intended. Theſe he made laterally formed a ſort of convex ſlope, the convexity being parallel to the current. Strong planks were alſo firmly ſet on edge among the ſtones, their ends pointing towards the river, ſo that if ever any current came ſo rapidly as to move any of the ſtones, it muſt move them all in a body the whole length of the plank. Perhaps this precaution was unneceſſary; for although ſtones are thrown into a river looſe in this manner, the fluſh ſand, &c. that come down the river will ſoon fill up all the cavities, and render it as firm and ſolid as a regular built wall. Mr. Beatſon has been the more particular in this deſcription, he ſays, in order to ſhew the errors that Mr. Millar at firſt fell into, and the great expence they occaſioned, whereas, had he been on the ſpot himſelf, and got the work executed as he intended, it would have ſaved a great deal of unneceſſary labour as well as money.

It is ſtated by the ſame writer, that the next ſort of embankments againſt rivers, are thoſe to prevent them overflowing their banks, and inundating large tracts of country. This may be conſidered as the ſimpleſt and eaſieſt of all ſorts of embanking, if judiciouſly executed. It is, therefore, the more inexcuſable to ſee, in ſome places, extenſive tracts of the richeſt meadows completely overflown by every flood for want of them.

Two ordinary ſized rivers riſe no more even in the greateſt flood than five or ſix feet above their common level, unleſs when they meet with ſome conſiderable interruption or confinement in their courſe. But if interrupted or confined, they will riſe twenty feet or more, as is the caſe with ſome parts of the river Merſey already mentioned. If, for example, a given quantity of water is ſix feet deep, when running over a ſpace twenty feet wide, it is clear, if that ſpace was only made ten feet wide, the water would riſe to twelve feet, and if it were made forty feet wide, the ſame quantity of water would only riſe to the height of three feet.

It is, therefore, of great conſequence, in preventing inundations, to give the river as much width as poſſible, by widening every narrow place. All kinds of obſtructions ſhould alſo be removed, whether occaſioned by windings, ſhoals, ſtones, trees, buſhes, or any thing elſe. In ſome caſes this may even preclude the neceſſity of embanking; but where embanking is neceſſary, let the banks by all means be at a ſufficient diſtance from each other, to contain with eaſe, between them, the largeſt contents of the river in great floods. The diſtance and height of the banks may eaſily be aſcertained by meaſuring a ſection of the river when at its higheſt, or when the flood mark is viſible. By not attending to this, a great deal of money has been thrown away on the embankments on the river Merſey, and after all they do not effectually anſwer the intended purpoſe; a great part of the country being ſtill overflown every time the river riſes to any conſiderable height.

Where a ſufficient diſtance is allowed between the embankments their height need not exceed from four to ſix feet. If irremovable obſtacles are in the way, which cauſe the river to riſe higher, the banks muſt be higher in proportion. In either caſe, however, the ſlope of theſe kinds of banks on each ſide may be equal to its perpendicular height, and the breadth on the top about one-third of that height, which, ſuppoſing the bank ſix feet high, the baſe would be fourteen feet, and the breadth of the top two feet, as ſhewn at *fig.* 5. in the plate.

The materials for making theſe banks ſhould be taken as much as poſſible from the ſides of the river, which will have the double effect of widening the river and forming the embankments; and there ſhould be a trench on the inſide (from which materials may alſo be got) with ſome ſluices, as formerly directed, to drain off any water from within; alſo ſluices to let in water from the river, if required, which would very much fertilize the meadows if properly laid out for that purpoſe.

Such farms as are ſituated on the borders of rivers are frequently, it was obſerved by a late writer, liable to much injury and inconvenience from them; 1ſt. From part of the ſoil being carried away in times of flood. 2d. From their overflowing their banks. 3d. From their flowing back in times of flood into the channels of the rivulets and ſtreams that conduct the water from the more elevated and diſtant grounds

grounds to the rivers, whereby theſe rivulets and ſtreams are made alſo to overflow their banks.

In reſpect to the firſt, the danger of the ſoil being carried away in time of floods, it is increaſed or decreaſed according to circumſtances, as the form of the banks, the nature of the ſoil, the rapidity of the river, and the quantity of water that lodges on the margins of the banks, or falls over them into the river. Where the banks of a river are perpendicular, eſpecially if the ſoil be of a rich mouldering nature, the danger of part of them being carried away by floods is much greater than where they ſlope gently from the ſurface of the field to the bed of the river, as has been already fully ſeen.

Where that is not the caſe naturally, they ought to be moulded into that form by art; as when a river, in place of being confined in its progreſs, has a power of efflux and reflux, the damage to be apprehended is inconſiderable, compared with what is likely to happen when, being reſtrained within too narrow limits, it is conſtantly ſtruggling for an extenſion of ſpace. Where the ſoil is rich free mould, and the under ſtratum oppoſite to the greateſt force of the water, ſand, or gravel, this ſtruggle never fails to be attended with bad conſequences. If the ſoil and ſubſoil be one entire maſs of clay or ſtrong loam, and the current of the river does not preſs more upon one part than another, a moſt ſubſtantial improvement may be effected by ſloping the bank, ſo that the declivity may be one foot in three or four from the ſurface of the field to the bed of the river. This ſome may object to, as ſacrificing a certain portion of valuable land; but it ſhould rather, it is thought, be conſidered as a premium paid for the inſurance of the remainder, than as a total loſs. If gravel, mixed with ſmall ſtones, can be conveniently procured, ſpreading theſe materials on the ſloping bank to the depth of eight or ten inches, and till beyond the flowings of the river, will prove a good ſecurity againſt further damage; and if the bank be planted thick with any ſort of willow, eſpecially the Dutch willow, it will in a ſhort time become an impenetrable fence, while the annual cuttings of wood will ſoon be equal to the heritable value of the land thus apparently ſacrificed. Where no gravel can be procured, the new ſloped bank ſhould be immediately covered with well ſwarded turf, which ſhould be preſſed down as hard as poſſible, either with the back of a ſpade, or with wooden mallets. If this be done in the beginning of ſummer, and willows be planted the following autumn, the improvement, it is ſuppoſed, will be both effectual and permanent. In caſe the river run with extraordinary violence againſt any one particular part of the bank, it may be neceſſary to make a fence or bulwark of ſtone in the front of that place; the beſt way of doing which, is, in place of building a wall, to drop the ſtones in a careleſs manner, but ſo as they may lie cloſe together on the ſloped bank, as already ſuggeſted.

This is a much more ſecure mode of fencing, if the bank be made with ſufficient declivity, than any ſtone wall that ever was built for the purpoſe, and while it is the moſt ſecure, it is alſo the leaſt expenſive; but care ſhould be taken to lay the ſtones all the way from the bed of the river, till conſiderably beyond where the river flows in common. Where the ſoil is of a ſtrong adheſive nature, and the under ſtratum is ſand or a pebbly gravel, it becomes in a much greater degree neceſſary to ſlope the banks. The water, when ruſhing violently along, has a powerful effect in undermining the bank, and carrying off thoſe incoherent ſubſtances; ſo that the ſoil, having nothing to ſupport it, naturally gives way, and frequently in ſuch quantities as to occaſion very ſerious loſſes both to proprietors and tenants. In all ſuch caſes, the ſlope ſhould be made much more gradual than where the ſoil and ſubſoil is of the ſame quality, and ſuch as will nouriſh aquatic plants. The banks, having been ſloped according as circumſtances require, a thick coat of gravel, mixed with ſmall ſtones, where ſuch can be procured, ſhould be laid on ſo as to form a kind of natural beach, over which the river, when in flood, may have power to extend itſelf at pleaſure. Should it be difficult or impoſſible to procure ſuch materials as are proper for forming this beſt of all defences, ſtrong thick ſods ſhould be placed on the ſurface in the manner before directed, which, if laid on in ſpring, or early in ſummer, will have time to unite, and to become one compact body before the autumnal floods (which are thoſe whence the greateſt danger is to be expected) begin to flow. If the ſubſoil be of ſuch a nature as that willows will not grow, ſuch ſods as are full of the roots of ruſhes ſhould be made choice of in preference to all others; as where theſe plants thrive and ſpread over the ſurface, it becomes in a great degree impenetrable by water, even in great floods, and when the river runs with conſiderable violence and rapidity.

The directions above given will, it is ſuppoſed, be found more or leſs practicable and uſeful according as the river on ordinary occaſions runs with greater or leſs rapidity. In level, or nearly level diſtricts, all that is neceſſary is to ſecure full ſcope for the rivers to overflow their uſual bounds without interruption; when that is ſecured by either of the methods before mentioned, floods, unleſs very violent, ſeldom do any material damage to the banks of rivers in ſuch ſituations. It becomes in many caſes extremely difficult to fence rapid running rivers in ſuch a manner as to prevent part of the banks from being carried away by inundation. Sloping the banks would be attended with no good conſequences. Even ſtrong bulwarks made of ſtone are often ſwept away by the overpowering flood. A method has, however, been ſuggeſted, of fencing the ſides of a rapid running river, which has been practiſed with ſucceſs, after ſeveral other attempts had failed; it is by means of a ſort of large baſkets, provincially termed creels, formed of hazle, willow, &c. into a kind of open net work, which being placed along the bottom of the banks, were filled with ſtones. This is a very ſimple, and by no means an expenſive expedient; and as theſe baſkets may be made to contain two or three tons of ſtone, it can only be on few occaſions, and in very particular ſituations, that a baſket, containing ſuch a weight, can be diſplaced or carried away. Such a mode of fencing as this, it is imagined, would prove effectual in many parts of Scotland and Wales, where the rivers run with uncommon rapidity. Owing to inattention, or rather to not being aware of the conſequences, much damage is often done to the banks of rivers in level diſtricts, eſpecially if the banks be perpendicular, and of a conſiderable height, by allowing the land floods to fall over them into the river. As the water from the furrows approaches the bank, it is frequently ſtopped in the furrow of the head ridge, which becomes for a time a kind of reſervoir; the conſequence of which is, that a conſiderable proportion of water ſinks and filters through the earth, which being thus ſoftened and ſwelled, is more eaſily undermined and carried off by the river. Sometimes little cuts or openings are made for the furrows acroſs the head ridge, for the purpoſe of conducting the rain water into the river; here, again, the conſequences are equally bad. Whoever will examine the bank of a river where this mode of management is adopted, and it is very common, will obſerve, that at every one of theſe cuts or openings a little creek is formed, in conſequence of the bank having been more ſoftened, and by that means having become a more eaſy prey to the river when in flood. To prevent theſe evils, it is neceſſary, beſides ſloping the banks, to devote a part of the lands adjoining to the breadth of twenty or thirty yards, for inſtance, either to paſturage or the growth of trees, and to form a drain at a proper diſtance from, and parallel to the bank, for the purpoſe of collecting and carrying off the water from the furrows. Were this done, and were the water from this drain conducted into the river by conduits formed a little above its ordinary level; much land, which is annually loſt by neglecting this ſimple precaution, would be ſaved, and preſerved in a proper ſtate.

In the ſecond caſe it is evident that injuries, although of another nature, are often ſuſtained by farmers, from rivers overflowing their banks. Sometimes the farmer is prevented from ſowing his field; at other times the crops of grain and graſs are greatly injured, by being covered for a conſiderable time with water; and at others again, the whole produce of the year, the hay and corn crops are ſwept away. To prevent evils ſo complicated, and ſo ſerious in their nature, is certainly the buſineſs of every man, who, from the ſituation of his farm, has reaſon to apprehend, that without uſing proper precautions, he may be ſubjected to ſuch viſitations. Theſe damages can only happen in level tracts, where the banks of the rivers are low, and where the courſe is not of ſufficient breadth to contain the water in time of flood. Some people, although very improperly, raiſe mounds of earth cloſe to the top of the bank, and of a height exceeding that to which the river can be expected at any time to riſe. Theſe mounds, from being placed ſo near the river, are unable to reſiſt the preſſure of the water, and by giving way, frequently admit a current into the fields, which proves much more injurious in its courſe than if no mound whatever had been erected. Were a mound of earth, formed on the ſide of the drain, propoſed to be made for carrying off the land water, and were that mound well ſloped on the ſide towards the river, it would be the moſt ſecure and effectual guard againſt rivers doing injury to the adjoining lands, of any that could be adopted. By theſe mounds being placed at a diſtance from the river, the force of the ſtream would be much leſſened, and the natural boundaries of the rivers greatly enlarged, as in proportion as the mounds are removed from the centre of the current of the river, in like proportion will they become more ſecure, as being leſs liable to violent preſſure. The propriety of erecting theſe mounds at a proper diſtance muſt, therefore, be ſufficiently evident, as when mounds are erected near the top of the bank, which can only be owing to ill-judged parſimony, they form as it were a part of the bank, and are liable to be undermined and ſwept away. Whereas, when they are placed at the diſtance of twenty, thirty, or forty yards, they ſerve rather as a boundary to confine the overflowing waters which glides along the bottom, than as a barrier to prevent the encroachments of an impetuous river during the time of floods.

In regard to the third caſe it is obſerved, that farmers who poſſeſs lands in low ſituations often ſuſtain damage from rivers, in time of flood, by their flowing back into the channels of the rivulets and ſtreams that conduct the water from the more diſtant and elevated grounds to the rivers, whereby theſe rivulets and ſtreams are made alſo to overflow their banks.

The only precaution that can be adopted, in ſuch a caſe, or at leaſt the one which appears to have the greateſt probability of anſwering the purpoſe, is to erect mounds at a diſtance from the banks, and of a ſize proportioned to the quantity of water which, from the cauſe now mentioned, may be ſuppoſed at any time to ſtagnate in theſe channels. This may be done at a very trifling expence either in money or land. If the proprietors do not chooſe to ornament the county and improve their own eſtates, by planting trees on the borders of the rivulets and ſtreams, the farmers may ſo conſtruct theſe mounds, as that they may become fences to their arable fields, while that portion of the farm, neceſſarily and properly cut off for the protection of the remainder, may be devoted to paſturage.

Several different embankments of a ſucceſsful kind have been lately effected in the northern parts of the kingdom. An important work of this nature has been executed on the eſtate of lord Galloway, ſituated on the mouth of the river Cree, near Cree town, by his lordſhip's tenant, Mr. Thomas Hannay, who ſtates in the third volume of the "Farmer's Magazine," that he "entered to the farm about four years ago, on a leaſe of twenty-one years, and his life; at which time upwards of 100 Scottiſh ſtatute acres were regularly flooded by the higheſt ſpring-tides, excepting about three months in ſummer, when the tides were lower. They were ſeldom, however, covered above the deepneſs of one or two feet, and never above four or five. Eighty acres of the above conſiſted of a rich ſea marſh, or *ings*, as they call them there, almoſt a true level, excepting where hollows were formed by the egreſs and regreſs of the tides, and the paſſage of freſh water from the higher grounds; and about four or five acres, which were about ſixteen inches lower, being a younger marſh, and nothing but what they call ink-graſs growing upon it (as he is no botaniſt he can give it no other name); other graſſes, ſuch as clover, rib-graſs, &c. grew on the reſt of the marſh, forming a very beautiful cloſe cover in the ſummer. The other twenty acres were at an average about eighteen inches higher; conſequently, the ſea did not cover them ſo often. It had formerly been ploughed, but not for about twenty years paſt. Laſt time it was in corn, it was flooded immediately after being ſown, which rendered the crop almoſt entirely uſeleſs, and deterred former tenants from ploughing it again. He began to bank this field in the autumn of the year 1798, by making a dike along the ſide oppoſite to the river, in a direct line facing the eaſt. This dike was made, at an average, about three feet and a half high, and ſix feet broad at bottom, and twenty inches at top, built after the ſame manner with that mentioned below. "He incloſed, along with the ſaid fields," he ſays, "four acres of the marſh adjoining, by making a dike five feet high, and five feet in bottom almoſt wholly of ſolid ſeals or ſods, with a very little ſtuff, properly beat, in the heart of it, which makes an excellent fence, and promiſes to be a very durable one. This dike, together with two ſmall drains, one on each ſide of it, about two feet deep, coſt 3*d.* per yard. He has been more particular in mentioning this dike here, he ſays, as the diviſion dikes of the whole marſh, which is now divided into four parts, are all built after the ſame manner, only that there is no looſe ſtuff in the heart of ſome of them, but all of ſolid ſeal, jointed like brick, as may be ſeen at *fig.* 6, which repreſents an end-view, or ſection of it. This dike, meant as a permanent fence, anſwered as a temporary bank, and enabled him to plough that field in ſpring 1799, although the bank round the whole marſh was not finiſhed till the winter following." He "ſowed oats on this field, and, conſidering the badneſs of the ſeaſon, had a very good crop; particularly ſo on that part which had not been ploughed formerly. On further conſideration, he altered the plan of the bank round the marſh, (which extends in a circular direction facing the north,) by making it, at an average, about four feet and a half high, and allowing about two feet in the baſe for one in height, as at *fig.* 7, where *a b c* repreſent an end-view, or ſection of it, every ſmall ſpan repreſenting the ſection of a feal or ſod; *ab* ſhews the inſide of the bank, with the green ſide of the feal down; *bc* the baſe; *a c* the ſide next the water, with the green ſide of the feal out, (which adds greatly both to the ſtrength and beauty of the bank); and *d* the heart of the dike, made up with ſtuff properly compreſſed with a rammer. The ſtuff was taken from a ditch in the inſide of the bank, leaving a caſement of a foot, which ought to have been three at leaſt; and, where the ground is of a ſandy nature, more; as the freſh water, running in the inſide, was likely to undermine the bank, had he not prevented it, by cutting a new drain, and filling the old one with the ſtuff caſt from it. The only creek worth noticing, through which the bank paſſed, was was one about forty feet wide, and nine feet deep, in the bottom of which a wooden pipe, with a ſtopper, was laid through the bank. No tide offered the ſmalleſt injury to the bank till January laſt, when there was one of the higheſt ever remembered by the oldeſt inhabitant, which broke it at this creek. This, he thinks, was owing to the wooden pipe not being made ſtrong enough, as the weight of the ſtuff and water preſſed in the ſides of it, and thereby admitted the water below. The tide made alſo three ſmall breaches in that part of the bank, which was built after the firſt manner; but in the part made after the manner repreſented in the figure, no breach took place, though it was rather lower than the other part. There are now about fifty acres of the ſame kind of marſh land adjoining his; and alſo about 100 acres on the other ſide of the river, banked in, all neraly in the ſame manner as repreſented in the figure. The bank on the farm adjoining his, ſuffered little from the high tide; but the one on the other ſide of the river was made almoſt a complete wreck, owing to its lying quite oppoſite to the ſouth-weſt winds, which always ſend up the higheſt tides; but this is not the caſe on this ſide, theſe winds blowing right over their bank. In his opinion, the bank on the other ſide of the river, in order to be durable, would require to be thirty feet broad, and eight feet high, covered with feals, with the green ſide out; and that no ſtuff ſhould be lifted within ſix or ſeven feet of it, the ground being of a ſandy nature. It might be made after the form ſhewn at *fig.* 8. He has now got the breaches in his bank made up, and has begun to give the whole a complete repair, by adding, at an average, fifteen inches to its height, and two feet of baſe for each foot in height. The whole bank is about 1500 yards in length, and, when the repairs are completed, will altogether coſt him betwixt 80 and 90*l.*

"In the year 1800, he ploughed another field, he ſays, of about twenty-ſix acres of the marſh, beſides the one formerly mentioned, on which he had an excellent crop of oats, thought by many to be the beſt they had ever ſeen. Laſt year, he had the ſame field, part in oats, and part in wheat: the wheat was a very good crop; and the oats, which were of the Poliſh kind, far exceeded the crop of the former year. Laſt ſummer, he levelled the old ridges of the firſt-mentioned field, all by the ſpade; gave it a complete ſummer-fallow; ſhelled and dunged it well; had part ſown with wheat, part with potatoe-oats, and all with graſs-ſeeds. The other field is ſown, part with wheat, and part with beans drilled; and, what is very ſurpriſing, he ſays, although the wheat was covered ſeveral times by the ſalt water, when the bank was broke, ſome of it to the depth of three feet, yet it is all looking well. The whole marſh is, he ſays, this year, under the plough. It may be worthy of obſervation, that the four or five acres, which he mentioned as being a younger marſh, harrowed eaſier than the reſt, and produced as good, if not better, crops."

Another improvement of the ſame nature has been accompliſhed, on what in Scotland is termed Carſe land, on the farm of Netherton of Grange, belonging to James Peterkin, eſq. by Mr. John Hoyes, his tenant; the eſtate having been let to him on a nineteen years leaſe. The work was undertaken under an agreement with the proprietor, to allow one year's rent of 195*l.* ſterling, with the further allowance of ameliorating the farm-houſes to the extent of 150*l.* more. It is ſtated in the work already mentioned, that, "under theſe circumſtances, the embankment was begun about the 1ſt of June, 1802; and, in November, it was brought to its full height over the whole; ſo that the Carſe has been completely defended from the ſea ever ſince the ſpring tides in October. He cannot poſitively aſcertain, he ſays, the extent of ground gained, as it has not been meaſured ſince the dike was erected; but, from the laſt ſurvey of that part of the eſtate, it would appear fifty acres were improveable; from which is to be deducted the quantity occupied by the baſe of the dike, the border on the outſide, with a few detached ſpots, probably included in the meaſure." The method adopted for carrying on the operations was this: "After looking over the Carſe, and marking out the line or dike, the length of which is 1400 yards, moſtly in a right line, except an angle at the diſtance of 300 yards from the weſt end, and a ſegment of a circle at about 250 from the ſouth-eaſt end, it was reſolved to make the embankment ſix feet of height in the higheſt part of the ground, and to allow two feet of breadth in the bottom of every foot of height, as ſeen by the draught of the mould at *fig.* 9. After taking the level of the Carſe, it was found, he ſays, that where the ground was low, and a good deal of it broken by runs of the ſea and outlets for the water, the dike would require to be eight and ten feet high, to have it on a level at the top; ſo that the average will be nine feet high. The embankment was built in the following manner: It was begun on the higheſt ground, near the weſt end, and two moulds ſet up at the diſtance of ſeventy or eighty yards; the height ſix feet by twelve broad in the baſe; the ſlope on the outſide ſix feet, on the inſide four feet, and the breadth at the top two feet; the ſides made up with feal from the broken ground on the outſide of the dike, which were laid with the graſs-ſide down, two feal deep on each ſide of the dike; the outſide feal of the firſt courſe with the ends out and in, and the other running along; the next courſe, the outſide feal running along, and the inſide out and in, and ſo on alternately, each courſe conſiſting of a head and runner; the body of the dike being made up of the Carſe ground from which the feal had been cut, and packed down by men with beaters. When this was brought to the height of four or five feet, another piece was begun, leaving an intermediate ſpace, where there were any water-runs, for the egreſs of the tide: this was found neceſſary, to draw off the water from the low parts of the Carſe, which would have been filled up in ſpring-tides; and, by coming in at the end and over the high ground, would have been prevented from getting out by the dike, if it had not been done in that way; ſo that the embankment was all in detached pieces, till it was brought near the height. Theſe intermediate ſpaces were then filled up, betwixt the fall of one and riſe of next ſpring-tide, after laying down wooden pipes wih ſtoppers in the dike, to carry off the ſink-water." He adds, that "it was a great labour to get the work carried on; in ſome places having to croſs over lakes and runs made by the tides, which required vaſt quantities of materials, the dike being in ſome places upwards of ten feet high, and twenty-two broad in the baſe; the greateſt part of the dike is ſixteen to eighteen feet broad. There was one lake, of 150 feet in length, and fifty feet in breadth, filled up with earth, clay, and ſand, to the height of five feet; on which the dike was then built. This forms a mound, on the outſide of the dike, of fifteen or ſixteen feet broad; and through this there are pipes laid, to carry off the ſink-water." He further adds, that "a ſtream of water formerly ran this way; but it was turned by the weſt end of the farm, by cutting a canal, which conveys the water through the embankment there, by means of an outlet built of ſtone, with a ſluice on the inſide, raiſed to the level of the running water, and a folding-door on the outſide, to be ſhut by the ſpring-tides. At this place, a road, that formerly led to Findhorn at low water through the Carſe, is carried over the top of the dike, by making a mound of earth at each ſide, with a gradual approach and deſcent." It is ſtated further, that "ſince the Carſe has been encloſed, the tides have been ſo high, that the water, during a ſevere ſtorm, was from ſix to ſeven feet deep at the back of the dike: the wind, being from the north, occaſioned a heavy ſwell and ſurge, but no water came over the top of it." He ſuggeſts, that "it is in contemplation, as ſoon as the enſuing ſeaſon permits, to cover the outſide with feals, the green ſide uppermoſt; and he has no doubt, when finiſhed, it will effectually ſecure the lands from any further viſitation of the ſea. The expences of the embankment cannot be well aſcertained at preſent; but it will be a good deal more than is allowed by the proprietors." He ſays, that "a great part of the land is already ploughed; but, the winter ſetting in ſo ſevere, prevented the whole from being done. It is intended to fallow it, in preparation for a crop of oats in the ſucceeding ſpring; but this intention may not be unalterably adhered to. There are various ſorts of ſoil in it: ſome of it clay, ſand, gravel, black rich earth, and parts of it of a moſſy nature; in ſome places below the gravel, which may, he thinks, have been forced on by the tides, a thin ſtratum of clay, upon ſand; and ſome parts, clay and ſand alternately. There are other parts not ſo rich as might be expected, the ſurface having been carried off by former tenants, for mixing in their dunghills or compoſt heaps. In *fig.* 9, *a* is the breadth of the dike at the top, when finiſhed; *b*, the breadth of dike at bottom, being twelve feet, when it is ſix feet high; *c*, the breadth when eight feet high; *d*, the breadth when ten feet high; *f*, the ſlope on the ſea-ſide of the dike, which is always equal to the half of the breadth of the bottom: the inſide ſlope, and breadth of the dike at top, is equal to the other half; and *e* is a plumb-rule in a frame, made to apply to the mould or dike: the intention of it was, to find if the dike was kept on the proper ſlope, where a line could not be applied from one mould to another, as in a round or turn, or when the moulds were obliged to be taken down; but this one only anſwered for the ſea-ſide, another being uſed for the inſide, to fit its ſlope." *Fig.* 10. is a ſcale of the mould one-eighth of an inch to a foot.

Various other improvements of this nature have been accompliſhed, in particular circumſtances and ſituations; and large tracts of land thereby rendered more than doubly beneficial to their occupiers. The methods which have been had recourſe to, in ſuch caſes, will be fully detailed in ſpeaking of *Hough-land* and *Rivers*.

A curious, uſeful, and highly ingenious method of embanking, and preventing the waters of the tides from ſoaking through the porous banks, formed in fenny and mooriſh ſituations, has been deſcribed by Mr. John Smith, in the fourth volume of "Communications to the Board of Agriculture," who begins by "conciſely obſerving, that the great land of the fens is divided into three large levels; and that each of theſe levels is ſubdivided into numerous diſtricts by banks: but as theſe banks are made of fen moor, and other light materials, whenever the rivers are ſwelled with water, or any one diſtrict is deluged either by rain, a breach of banks, or any other cauſe, the waters ſpeedily paſs through theſe light, moory, porous banks, and drown all the circumjacent diſtricts. The fens have ſometimes ſuſtained 20,000*l.* or 30,000*l.* damage by a breach of the banks; but theſe accidents ſeldom happen in the ſame diſtrict twice in twenty years; the water, however, ſoaks through all fen-banks every year, in every diſtrict; and when the water-mills have lifted the waters up out of the fens into the rivers in a windy day, a great part of the water ſoaks back through the porous banks, in the night, upon the ſame land again." And he adds, that "this water that ſoaks through the bank drowns the wheat in the winter, waſhes the manure into the dikes, deſtroys the beſt natural and artificial graſſes, and prevents the fens from being ſown till too late in the ſeaſon. This ſtagnant water lying on the ſurface, cauſes alſo fen agues, &c. Thus, ſays he, the waters that have ſoaked through the porous fen-banks have done the fertile fens more real injury than all the other floods that have ever come upon them."

Having been much concerned in fen-banking from his youth, he had ſome time ſince deviſed the plan which he now finds to anſwer ſo well; but found it difficult to prevail with any gentleman, who had a proper extent of this ſort of land, to give it a fair trial. However, during the laſt autumn, he prevailed with a perſon in the pariſh where he lives to try it, which ſhewed it to be equal to his higheſt expectations.

This improved method of embanking chiefly conſiſts in this: that "a gutter is cut eighteen inches wide, through the old bank down to the clay, (the fen ſub-ſtratum being generally clay,) the gutter is made near the centre, but a little on the land-ſide of the centre of the old bank. This gutter is afterwards filled up in a very ſolid manner with tempered clay; and to make the clay reſiſt the water, a man in boots always treads the clay as the gutter is filled up. As the fen-moor lies on clay, the whole expence of this cheap, improved, and durable mode of water-proof banking coſts in the fens only ſixpence *per* yard. This plan was tried laſt autumn on a convenient farm, and a hundred acres of wheat were ſown on the land. The wheat and graſs lands on this farm are now all dry, whilſt the fens around are covered with water. This practice anſwers ſo well on this farm, that all the farmers in this pariſh are, he ſays, improving their banks in the ſame manner, and ſome have begun in adjacent pariſhes."

It is unqueſtionably a mode of practice that requires to be fully known and underſtood, in all thoſe diſtricts which have lands of this deſcription; as by it great advantages may probably be derived.

Embanking againſt Lakes.—The buſineſs of forming embankments, in caſes of what are termed lakes, or mires, in this part of the country, and loughs in Scotland and Ireland, is much more ſimple and eaſy than in the preceding caſes. It has been remarked by Mr. Beatſon, that the waters in theſe ſituations generally ſubſide during the ſummer months, riſing conſiderably in winter, and whenever the ſeaſon is very wet. In particular caſes, the extent of ſurface, which is overflown in the winter ſeaſon, ſo far exceeds that which it covers during the ſummer, that it would be an object, and ſometimes a conſiderable acquiſition, to confine the water within its ſummer boundaries, or to cut off ſome of its parts. Where theſe are intended, the principal outlet muſt be firſt carefully examined, and be conſiderably widened and enlarged; which, on the principle already noticed, in ſpeaking of rivers, will prevent the water from riſing ſo high as was formerly the caſe. Where the levels will not admit of much depth being had, or where the ground is of a rocky nature, and would of courſe be difficult and expenſive to deepen, the breadth ſhould be increaſed as much as poſſible, and all obſtacles cleared away, that the water may run freely in a ſhallow ſtream. Where it is required to aſcertain with exactneſs, or to fix with certainty, the future limits of the water, a ſection of the greateſt quantity running out during a flood ſhould be taken. Suppoſe this ſection, for example, be ten feet in width and four feet in depth; by making it forty feet in width, the ſame quantity of water will not riſe above one foot: conſequently, by this means alone, three feet in height will be gained all round the lake, which, in caſe of embanking it, would be a great object. During the ſummer ſeaſon, when the water is loweſt, is the moſt proper time for carrying on theſe, as well as other embankments. When, however, any materials are to be brought from a diſtance, they may be laid down or be prepared at other ſeaſons, with the exception of turf, which ſhould always be uſed as ſoon as poſſible after it is cut. The manner of conſtructing embankments of this kind may be ſufficiently underſtood, from what has been already ſaid in the other deſcriptions of embankments: obſerving, however, as a general rule, that when the materials on the ſpot will anſwer the purpoſe, they ſhould invariably be made uſe of, although at the expence of digging a trench larger and deeper than would otherwiſe be neceſſary. It ſhould conſtantly be attended to, in executing all ſorts of embankments, that the greateſt care be taken to make them perfectly firm and ſolid, by continually beating them, and examining them carefully, during the whole of the time they are in the ſtate of being formed.

The various methods and plans of management, which are neceſſary to be adopted in the improvement of ſuch lands as have been gained from the ſea, will hereafter be more fully conſidered and explained. See Marsh-*Land.*

Embankment, in *Canal-making*, is a term for any large mound of earth, either for confining the water of a canal or reſervoir, or upon which a canal or aqueduct is formed acroſs a valley or low piece of ground. It may have arches under it, for the paſſage of a road, a river, or brook: ſuch are called *aqueduct-arches*, and ought by all means to be conſtructed on the true curve of equilibration, for avoiding the great expence and diſgrace which attends the failure of leſs ſcientific arches, as at Wolverton on the Grand Junction Canal. See Canal.

EMBAR, in *Geography*, a town of Africa, in the country of Senegal.

EMBARCADERO, in *Commerce*, a Spaniſh term, much uſed along the coaſts of America, particularly thoſe on the ſide of the South ſea.

It ſignifies a place which ſerves ſome other conſiderable city farther within land, for a port, or place of ſhipping, *i. e.* of embarking and diſembarking commodities. Thus Calao is the embarcadero of Lima, the capital of Peru; and Arica the embarcadero of Potoſi. There are ſome embarcaderos forty, fifty, and even ſixty leagues off the city which they ſerve in that capacity.

EMBARGO, a reſtraint or prohibition, laid by a ſovereign on merchant-veſſels, to prevent their going out of port; ſometimes to prevent their coming in; and ſometimes both, for a limited time. See Proclamation.

Embargoes are uſually in time of war; in apprehenſions of invaſions, &c. One great occaſion of embargoes is, that the government may make uſe of the merchant-veſſels, with their equipage, &c. in armaments, expeditions, tranſporting of ſoldiers, &c.; another is, to ſtop the communication of intelligence at ſuch critical ſeaſons. Embargoes are of very miſchievous conſequence to commerce.

EMBARKATION *of Ordnance and Stores.* The firſt thing neceſſary is to prepare a liſt of all the articles to be embarked, with the weight of each. This liſt muſt have an ample column for remarks; and the reputed tonnage muſt have an allowance of one-third added, for all articles whoſe weights and meaſures are not alwaye the ſame, but receive, or loſe, in conſequence of damp, dirt, &c.; ſuch as tents, &c.: but the tonnage of ordnance, ſhells, ſhot, &c. ſhould be ſet down at their actual weight, according to their natures, calibres, &c. reſpectively. If veſſels are paid for according to the tonnage they carry, the maſter will, of courſe, ſtow away to the beſt advantage, and load with as much as the veſſel can poſſibly contain; whereas when freighted for a voyage, upon the eſtimated tonnage of the hold, they will ſtow ſo very looſely, as both to carry leſs, and to ſubject the cargo to conſiderable injury. It is, therefore, proper that a naval officer ſhould be appointed to ſuperintend every embarkation, and to ſee that every thing is ſtowed to the beſt advantage. It may be uſeful, in this place, to ſhew how tonnage is eſtimated. The uſual method of finding the tonnage of any ſhip is,—Multiply the length of the keel by the length of the beam, and half that product by the breadth of the beam; divide the laſt product by 94, and the quotient will be the ſhip's tonnage. Thus, ſay a ſhip's keel meaſures 90 feet, and that her beam, *i. e.* her extreme breadth, be 30:

$$90 \times 30 = 2700 \times 15 = \frac{40500}{94} = \overset{\text{Tons.}}{430.8}$$

The tonnage of goods and ſtores is taken ſometimes by weight, and ſometimes by meaſurement; and that method is allowed to the veſſel which yields the moſt tonnage: were it otherwiſe, the owners would be conſiderably loſers in the freight of bulky, light articles, on which the calculation by weight would give them but little claim to charge; and, *vice verſâ*, if ordnance, ſhot, &c. were to be carried by meaſurement, they would be under a ſimilar diſadvantage. In tonnage by weight, 20 cwt. make a ton; and in tonnage by meaſurement, 40 cubic feet make a ton, the ſame as in timber computations. All carriages, or other ſtores to be meaſured for tonnage, ſhould be reduced to their ſmalleſt dimenſions, by taking to pieces, and packing into as little ſpace as poſſible. All ordnance is ſhipped according to actual weight; as are alſo muſket cartridges in boxes or barrels, and other ſuch ponderous articles. The following table will exhibit the rates of tonnage allowed for the embarkation of the moſt material ſtores in the ordnance department.

EMBARKATION.

NATURE.	Number of Articles or Quality.	Tons.	Cwt.	Qrs.
Axes complete with Handles	Pole ſort 264	0	10	0
	Pick 100	0	9	0
	Felling 176	0	14	0
Barrows, Wheel, Packed	20	2	2	0
Do. Unpacked	7	1	0	0
Do. Hand, Single	20	0	18	0
Budge (or Bouche) Barrels	32	1	0	0
Bricks	1000	2	5	0
Buckets of Leather	20	0	2	0
Carabines, 25 in a Cheſt is 11 Square Feet.				
Carriages, Standing	42 Pieces	1	13	0
Do. Do.	32 Pieces	1	10	0
Do. Howitzer	10 Inch	1	10	0
Do. Do.	24 Pieces	1	9	3
Do. Do.	18 Pieces 8 Inch	1	7	0
Do. Do.				
Do. Do.	12 Pieces	1	4	0
Do. Do.	9 Pieces	1	3	0
Do. Do.	6 Pieces	1	0	0
Do. Do.	4 Pieces	0	17	0
Carriages, Travelling, complete, with Limber Boxes, Ladles, Sponges, and Rammers	24 Pieces	5	10	0
	12 Pieces	4	10	0
	9 Pieces	4	7	2
	6 Pieces	3	7	2
	3 Pieces	2	19	0
	Medium 24 Pieces 12 Pieces	2	9	2
Carriages, 6 Pieces, Light, with Ammunition Boxes, and 5½ Inch Howitzer do.	—	2	3	0
Carriages for 5½ Inch Howitzer of 10 Cwt.	—	3	2	0
Do. for 8 Inch do. common	—	3	7	2
Sling-Cart complete	—	3	0	2
Forge-Cart, with Limber	—	4	0	0
Pontoon and Carriage, with Appurtenances	—	11	0	0
Ammunition Waggon	—	4	18	1
Gravel Cart	—	2	16	2
Duke of Richmond's cloſe-bodied Waggon	—	5	0	0
Road Waggon, with upright Sides	—	7	10	0
Gin; Triangle complete	—	0	14	0
Grate for heating Shot	—	0	4	2
Hand-Spikes	120	1	0	0
Hand-Crows, Lever of 5 Feet	120	1	0	0
Hand-Screws	Large 15	1	0	0
Do.	Small 17	1	0	6
Helves, Picking or Felling	300	0	14	0
Do. Sledge	300	1	0	0
Do. Pin-Maul	360	1	0	0
Junk	Cwt. 20	1	5	0
Linſtocks, with Cocks	600	1	0	0
Do. without	1000	1	0	0
Muſquets, a Cheſt of 25 is 16 Cubic Feet.				
Do. Do. of 20 is 11 do.				
Match	Cwt. 6	1	14	0
Powder, whole Barrels	11	1	0	0
Do. half do.	22	1	0	0
Pitch or Tar, 1 Barrel is 7 Cubic Feet.				
Piſtols, a Cheſt of 50 or 60 is 10 Cubic Feet.				
Park-Pickets	40	0	9	1
Pikes	280	1	0	1
Sheep-Skins	Dozens 12	1	1	0
Shovels, of Iron	100	1	0	0
Spades, of Iron	184	1	0	0
Shovels ſhod with Iron	138	1	0	0
Sand-Bags, in Bales, 1 Buſhel	500	0	12	0
Do. half Buſhel	500	0	7	1
Do. 2 Buſhels	250	0	8	1

When ordnance and ſtores are embarked, all appertaining to the ſame ſpecies ſhould be claſſed and divided into the ſeveral veſſels, in ſuch manner as may inſure the ſafe arrival of a certain portion; thereby avoiding that great inconvenience which could not fail to ariſe, were any one veſſel, containing the whole of any particular ſtores, to be loſt, taken, or unable to make the place of deſtination. With each piece of ordnance ſhould be embarked every thing neceſſary for its ſervice; ſo as to be inſtantly come at, when required to be landed. This principle ſhould be carried to the fulleſt extent: even the platforms for the battering cannon ſhould be in the ſame veſſel with them; and, in ſhort, every precaution ought to be taken to obviate delay, or omiſſion, or imperfection. In general, all the heavy ſtores ſhould be put in firſt; both to prevent their cruſhing leſs ſubſtantial articles, and to ſerve as ballaſt: the lighter ſtores, being generally moſt periſhable, ſhould be ſtowed uppermoſt, and be all numbered according to their ſeveral natures, and to their ſeveral intentions. Thus, every piece of ordnance, its carriage, and even all the parts of that carriage, together with its ſponges, rammers, limbers, and boxes, ought to bear the ſame number; ſo that, when about to be landed, the whole may be diſcharged at one time from the ſhip, and be ſent on ſhore in that regular manner, which may enable the artillery men and artificers to mount every one in ſucceſſion with promptneſs and exactitude. All the cheſts, barrels, &c. muſt be lettered and numbered diſtinctly, in ſuch manner as may indicate their reſpective contents. The numbers, &c. ought to be painted in clear white on a black ground, thereby to be legible at night: for the ſame purpoſe, it would perhaps be found uſeful to have the letters marked with white-headed tacks; ſo that, when not legible, for want of light, as often happens, they may be traced with the finger. In ſhipping gun-carriages, it is eligible to ſend them down into the hold, &c. without taking off the axle-trees from the cheeks; as they cannot be replaced without proper workmen, and a tedious operation. When a carriage is diſmounted, all the ſmall articles, ſuch as elevating-ſcrews, linch-pins, drag-waſhers, &c. ſhould be carefully collected, and ſecured either in a ſmall box, or in a bag of leather, tarpaulin, &c. duly marked.

In order to give more room, all articles, of the ſame deſcription in particular, ſhould be placed ſo as to lock into each other, or to fit in ſuch manner as may leave the leaſt poſſible intervals. A perſon ſhould attend to regiſter, not only the ſeveral articles as they ſhould be ſhipped, but to note the exact part of the hold, &c. where each might be ſtowed. Theſe precautions, added to the affixment of particular marks, ſuch as numbers, in white paint, on each bow, and each quarter of every tranſport, ſo as to be diſtinguiſhable at ſeveral miles diſtance, will tend conſiderably to facilitate the debarkations, and enable the ſeveral commanders and public officers to aſcertain with perfect preciſion the amounts of loſſes, and the ſituations of the ſeveral ſtores, according as veſſels may lie to windward, or to leeward, &c. It is a matter of conſiderable importance in embarking ſtores, to have them ready at hand which would be the firſt wanted in caſe of emergency: as well as to arrange them in ſuch manner as ſhould anſwer the purpoſes of the expedition in the moſt efficacious manner. Thus, if it is expected that troops will have to diſembark in the preſence of an enemy, the light field-pieces, and howitzers, in lieu of being ſent below, ought to be kept, together with all their implements, and a certain portion of their ammunition in ſome ſecure part, whence they could be lowered into the boats at a ſhort notice. Entrenching tools ſhould alſo be held in equal readineſs, together with abundance of ſand-bags. When troops are to be embarked, every precaution muſt be taken to prevent confuſion, and to obviate danger. Certain corps ſhould be appointed to be in readineſs on given days at particular ports; taking with them only ſuch baggage as ſhould be allowed on the occaſion. The ſtores of every deſcription and the diſpoſable lumber ſhould be previouſly ſent on board, under charge of the quarter-maſter, who ſhould be particular in ſeeing that every thing neceſſary to the comfort and efficiency of the troops were duly arranged. The tranſports being in readineſs, they ſhould, if poſſible, be brought up to a pier, ſo that, by the aid of gang-boards, the files might march on board at once; otherwiſe recourſe muſt be had to boats and ſmall craft, in which the troops muſt proceed from the ſhore to the ſhipping. The lee-ſide is generally preferred for embarking; it being the ſmootheſt water, and often the aſcent up the gang-ladder leſs difficult. The ſafeſt mode is for the arms to be handed up into the main chains, and from thence into the veſſel. The bayonets ought to be well ſecured to their ſcabbards, and the pouches ſhould be buttoned down. The men neareſt the gang-ladder ſhould be the firſt to aſcend; the others taking care to balance the boat, &c. as ſhe becomes lighter, and requiring equipoiſe in conſequence of being quitted by the troops. It ſhould be obſerved as a ſtanding regulation never to let one boat lie abreaſt of another that is diſcharging her crew into a veſſel: otherwiſe there will not only be danger of broken-legs, but of being upſet: each boat ſhould range up under the lee-quarter, in ſucceſſion, and when evacuated by the troops ſhould pull a-head, by means of a painter, or a boat-hook, ſo as not to impede its ſucceſſor. When the troops are on board boats, they ſhould ſit as low as poſſible, keeping their muſkets perpendicular, and reſted on the bottom, or on their own feet. In going on board the men ſhould proceed very leiſurely and ſilently to their places, ſpreading ſo as to preſerve the due time of the boat, and ſitting down ſo ſoon as duly arranged. In caſe of accident, or running foul of any other veſſel, they ſhould be particularly enjoined to remain ſeated, and not to obſtruct the boat's crew in their endeavours to remedy the miſhap. Where troops are to embark in the face of an enemy, the greateſt order and coolneſs will be requiſite; eſpecially when within the reach of their cannon. If the embarkation in boats is to be made from a ſhip, they muſt all be manned from that ſide leaſt expoſed to the enemy's fire; the ſhip covering them as they ſucceſſively put off, and reſt on their oars, until the whole may be ready to ſtart together by ſignal; after which no time ſhould be loſt in gaining the ſhore, and in forming on the beach. It ſometimes occurs, that a river is to be croſſed in boats for the attack of an enemy poſted on the oppoſite bank: in ſuch caſe, the number of boats being previouſly aſcertained, the troops muſt be told off into as many diviſions as there may be veſſels to convey them, the ſtrength of each diviſion correſponding with the tonnage of that it is to occupy. Each diviſion then proceeds on board with rapidity, but with perfect regularity, and the whole put off without delay. Where the water is rather ſhallow, the boats muſt lie out ſo far as to be afloat after the men have, by wading, got on board. All debarkations from boats and ſhipping ſhould be conducted with as much order as circumſtances may admit; and even when troops are driven back to their boats, as much ſhould be preſerved as the preſſure of purſuit may allow. It is a well-known fact, that many re-embarkations have taken place in the preſence of a ſuperior force without diſorders, or allowing the enemy to make a ſingle priſoner. The greateſt danger generally ariſes from allowing the boats to lie in ſo cloſe, as to touch the ground, whereby, when the troops have got on board, they have been unable to puſh off, and thus remained ſubject to a galling fire. When re-embarking after a repulſe, it ſhould be ſtudied to man ſome of the craft, (eſpecially a few of the lighteſt conſtruction, and any gun-boats whoſe draught of water may allow them to lie near the beach,) for the purpoſe of covering the retreat, and to take in flank ſuch of the enemy as ſhould follow the fugitives into the water. When ſuch a precaution is obſerved, the embarkation will proceed quickly, and the enemy will content themſelves with a diſtant fire on the retreating force; in lieu of mixing pell-mell, as they would do if there exiſted no pre-eſtabliſhed check. Troops embarked on board tranſports, or ſhips of war, are only allowed three-fourths of a ſeamen's ration of proviſions; unleſs when acting as marines, when they are on a footing. The meſſes are formed of ſix men in each, for each of which a ſpace of ſix feet ſquare is allowed, that is, 36 ſquare feet; but only four are ever there at the ſame time, it being a rule that one-third of each meſs ſhould always remain on deck. When embarked for foreign ſervice, ſix women are allowed proviſions for every hundred men; and when on home ſervice, ten women are allowed with the ſame number. That part of the charter-party which relates to the proviſion, firing, candles, utenſils, &c. intended for the uſe of the troops, is always ſubject to the inſpection of their commanding officer on board; and is ſometimes copied out, and hung up in the cabin, open to the peruſal of all. The regulations regarding ſmoking, extinction of lights, &c. are alſo poſted up in various parts, together with the whole allotment in regard to births, meſſes, and particularly the accommodations for the officers of the veſſel, and thoſe attached to the troops. It being neceſſary to eſtabliſh ſome limit for the quantities of baggage taken on board, the following proportions were fixed for that purpoſe.

For a field-officer - - -	five tons.
For a captain - -	three tons.
For a ſubaltern - -	a ton and a half.

General officers are rarely limited, but it is uſually intimated to all embarking, that the quantity of baggage ſhould be reduced as much within bounds as might be practicable.

The embarkation of horſes is uſually effected by means of ſlings of canvas, which paſſing under their bellies, and being duly ſecured with cords, enable the crew to hoiſt them in, and to lower them down between decks without doing the ſmalleſt injury to the animals; which, however ſpirited they may be while on terra firma, generally become perfectly paſſive under ſuch circumſtances. On arriving at the place of deſtination they are debarked in the ſame manner. It certainly is among the moſt important improvements in this branch of ſervice, that the horſes can be ſlung, during bad weather, to the beams in ſuch manner as to prevent their ſuffering in conſequence of the ſhip's motion. Yet we cannot but judge, from the crippled ſtate in which cavalry are ſometimes debarked, that much room remains for improvement.

EMBARRAS, EMBARRASMENT, a French term, though now naturalized; denoting a difficulty, or obſtacle, which perplexes or confounds a perſon, &c.

EMBASIS, in the writings of the *Ancient Phyſicians*, the name of a large veſſel, in which they prepared their medicated baths, and which was capable of holding the perſon to be bathed at his full length.

EMBASSADOR, or AMBASSADOR, is a public miniſter ſent from one ſovereign prince or independent ſtate to another, as a repreſentative of that prince or ſtate, and furniſhed with credentials which verify his miſſion as an embaſſador.

Such a public miniſter is called in Latin *legatus*, or *orator*, but the meaning of the word embaſſador is much more extenſive. The only circumſtance in which the modern embaſſador and the ancient legatus agree is the protection of the law of nations. See LEGATION.

The Engliſh word embaſſador is probably derived from the Spaniſh *embaxador*, the ſame as the French *ambaſſadeur*, which comes from *ambaſciator*, a Latin word of the middle age, formed of *ambactus*, or *ambact*, an agent, domeſtic, or client among the Gauls. The term *ambaſcia* is found in the Salic law, Tit. xix. and in the law of Burgundy.

The cuſtom of ſending embaſſadors dates from the origin of civil ſocieties. As ſoon as mankind were divided into diſtinct nations, differences would ariſe which muſt be amicably ſettled by the interference of neighbours, guarded againſt by the protection of the more powerful, or decided by wars ending in reconciliations. The negociating of theſe mediations, alliances and treaties of peace is entruſted to public miniſters; and ſovereign princes having, like private perſons, intereſts to diſcuſs with other princes regarding their own concerns as individuals, ſuch as the contracting of matrimonial alliances; the management of theſe tranſactions is likewiſe confided to public miniſters, or negociators. See NEGOCIATION.

Among the public miniſters ſent as negociators, from one independent ſtate or ſovereign prince to another, embaſſadors hold the firſt rank. Envoys, miniſters plenipotentiary, and reſidents, are negociators of leſs eminence. (See ENVOY, PLENIPOTENTIARY, and RESIDENT.) Their functions are the ſame; they are equally under the protection of the law of nations, and they enjoy nearly the ſame privileges.

The pre-eminence of embaſſadors manifeſts itſelf chiefly in the particular ceremonial of their reception in the country where they are appointed to reſide. They are entitled to be ſaluted with the firing of guns; to be complimented by deputies of the prince or ſtate to which they are ſent; to make a ſolemn public entry; to ſpeak at the audiences they obtain with their heads covered; to have places of honour aſſigned to them at all public ceremonies; to keep a canopy or throne in their dwelling; and, ſince the year 1593, when this title was firſt given them at Rome, to be ſtyled excellencies. The name of embaſſador, Cicero obſerves, is ſacred and inviolable: "non modo inter ſociorum jura, ſed etiam inter hoſtium tela incoluma verſatur:" (In Verr. orat. 6.)

The privileges which embaſſadors ſhare with other public miniſters, ſent as negociators, are.

1. The right of being received by the prince or ſtate to which they are deputed, unleſs there be a juſt cauſe for refuſing to receive them. The duke of Buckingham, ſays Hume, had Engliſh familiarity, and French levity, two of the moſt offenſive qualities in an embaſſador. When, in 1626, he was deſirous of being once more embaſſador at the French court, it was ſignified by the French embaſſador to the court of St. James's that for reaſons well known to the duke his perſon would not be agreeable to his moſt Chriſtian majeſty. His preſumption to talk of love to the queen in a former embaſſy had given offence, and would have been a juſt cauſe for his non-admiſſion.

The correſponding obligation of receiving foreign embaſſadors has its foundation in the deareſt intereſts of ſociety and of humanity. As nations are in continual need of mutual aſſiſtance, they could never freely communicate, if the law of nations had not made it an imperious duty to all ſtates to admit the embaſſadors who are ſent to them. Even the embaſſadors of an enemy have a right to be received and to be heard, ſince it is the duty of nations at war with each other to endeavour by all poſſible means to re-eſtabliſh the accuſtomed relations of peace and amity.

2. The inviolability of their perſons. Embaſſadors repreſent the ſovereign or chief magiſtrate of an independent ſtate; their miſſions are frequently of the moſt delicate nature, and could not be accompliſhed if the ſecurity of their perſons were not expreſsly provided for. Thoſe who inſult an embaſſador infringe not only the civil law, which forbids the doing of injuries in general, but more particularly the public law of nations, which extends its ſpecial protection to public miniſters, that the harmony of nations may not be diſturbed, or if unfortunately the ties of friendſhip have been broken, that the effecting of a reconciliation may labour under no reſtraint. The ſmalleſt inſult offered to an embaſſador ought to be puniſhed with the greateſt ſeverity; the neglect to puniſh the offender is a juſt cauſe of war.

If an embaſſador groſsly offends, or makes an ill uſe of his character, he may be ſent home, and accuſed before his maſter: who is bound either to do juſtice upon him, or avow himſelf the accomplice of his crimes. (Mont. Sp. of L. 26. 22.) But writers on the law of nations are not agreed, whether this exemption of embaſſadors extends to all crimes, as well natural as poſitive: or whether it only extends to ſuch as are *mala prohibita*, as coining, and not to thoſe that are *mala in ſe*, as murder. Our law ſeems formerly to have taken in the reſtriction, as well as the general exemption. For it has been held, both by our common lawyers and civilians (1 Roll. Rep. 175. 3 Bulſtr. 27.) that an embaſſador is privileged by the law of nature and nations; and yet if he commits any offence againſt the law of reaſon and nature, he ſhall loſe his privilege (4 Inſt. 153.); and therefore, if an embaſſador conſpires the death of the king in whoſe land he is, he may be condemned and executed for treaſon; but if he commits any other ſpecies of treaſon, it is otherwiſe, and he muſt be ſent to his own kingdom. However, the general practice of this country, as well as of the reſt of Europe, ſeems now to purſue the ſentiments of the learned Grotius, that the ſecurity of embaſſadors is of more importance than the puniſhment of a particular crime. And therefore few, if any, examples have occurred within a century paſt, where an embaſſador has been puniſhed for any offence, however atrocious in its nature.

Even the domeſtics and the perſons in the retinue of an embaſſador are inviolable. If any one of them were inſulted, the puniſhment ought to be as ſevere as if the inſult had been offered to the embaſſador himſelf. The domeſtics of the duke of Créqui, French embaſſador at Rome, having been inſulted by the Corſican guards of Pope Alexander VII. Louis XIV. inſiſted upon their being ſeverely puniſhed.

But this inviolability extends only to the perſons who compoſe the embaſſador's family, as his wife and children, and who being actually in his retinue are regiſtered as ſuch by the police of the country where he reſides. Should, however, any of them be guilty of a great crime, as a forgery, theft, or murder, it would be no violation of the law of nations to claim the offender, and to puniſh him according to the laws of the country. When Sully reſided in England as embaſſador of Henry IV of France, he was informed that one of his gentlemen had killed an Engliſhman in a houſe of ill fame. He immediately got him arreſted, and ſent word to the magiſtrates of London that they might ſeize the murderer. The latter having been tried, the king of England granted him his pardon and his liberty.

In conſequence of this inviolability the actions of an embaſſador or of any perſon in his retinue are not ſubject to the controul of the private law of the country in which he is appointed to reſide; and with regard to civil ſuits they cannot be proſecuted for any debt contracted in that country as long as the embaſſador continues in it in his public capacity. This privilege is allowed in the Engliſh courts of law, and, the more effectually to enforce the law of nations in this reſpect, when violated through wantonneſs or inſolence, it is declared by the ſtatute 7 Ann. c. 12. (an act paſſed in 1708, in conſequence of the arreſt of an embaſſador from Peter the Great, czar of Muſcovy, for a debt of 50*l*.) that all proceſs whereby the perſon of any embaſſador, or of his domeſtic or domeſtic ſervant, may be arreſted, or his goods diſtrained or ſeized, ſhall be utterly null and void; and that all perſons proſecuting, ſoliciting, or executing ſuch proceſs, being convicted by confeſſion on the oath of one witneſs, before the lord chancellor and the chief juſtices, or any two of them, ſhall be deemed violators of the laws of nations, and diſturbers of the public repoſe; and ſhall ſuffer ſuch penalties and corporal puniſhment as the ſaid judges, or any two of them, ſhall think fit. But it is expreſsly provided, that no trader, within the deſcription of the bankrupt laws, who ſhall be in the ſervice of any embaſſador, ſhall be privileged or protected by this act; nor ſhall any one be puniſhed for arreſting an embaſſador's ſervant, unleſs his name be regiſtered with the ſecretary of ſtate, and by him tranſmitted to the ſheriffs of London and Middleſex. Theſe exceptions are ſtrictly conformable to the rights of embaſſadors, as obſerved in the moſt civilized countries. In conſequence of this ſtatute, thus declaring and enforcing the law of nations, theſe privileges are now held to be part of the law of the land, and are conſtantly allowed in the courts of common law. (Fitz. 200. Stra. 797.) Blackſtone's Commentaries, vol. i. and iv.

3. The moſt perfect freedom and independence in the diſcharge of their official duties. This is a further conſequence of their inviolability. If an embaſſador ſhould even excite diſturbances, or enter into any conſpiracy againſt the prince, or the ſtate to which he is ſent, the general practice of Europe is in favour of the opinion of the learned Grotius, in his book "De Jure Belli et Pacis," that the inviolability of an embaſſador is of greater importance than the puniſhment of a particular crime. His public character ought to be conſtantly and invariably reſpected; but he may be diſmiſſed, and ſent back to the prince or ſtate whoſe repreſentative he is. The biſhop of Roſs, embaſſador of the queen of Scotland at the court of Weſtminſter, having engaged in a conſpiracy with the duke of Norfolk againſt the queen, he was arreſted, confronted with his accomplices, and ſent back to Scotland. In the reign of Henry IV. of France, the Spaniſh embaſſador took a part in the conſpiracy of the count d'Auvergne and duke d'Angoulême, who were both tried; but no mention was made of the embaſſador. A certain Mérargues had agreed, with the ſecretary of the ſame embaſſador, to deliver Marſeilles into the hands of the Spaniſh monarch. The French parliament condemned Mérargues to death; but the Spaniſh ſecretary was delivered to the king of France, who gave him up to the Spaniſh embaſſador, and obliged the latter to ſend the ſecretary out of the kingdom.

If an embaſſador be diſmiſſed and eſcorted to the frontiers, he is entitled to the privileges and immunities of his dignity, as long as he is on the territory of the ſtate that ſends him back. He ought alſo to be allowed a convenient time to prepare for his departure. This indulgence muſt even be granted to the embaſſador of a power againſt which a declaration of war has been iſſued, and he muſt be furniſhed with paſſports to return home unmoleſted. The cuſtom of the Turks, who, in the caſe of war being declared, confine the embaſſador of the power againſt which it is declared in the caſtle of the Seven Towers, is in direct violation of the law of nature, and of the public law of nations. The enlightened ſovereigns of Europe ſhould join in remonſtrating againſt ſo unjuſt a practice, and inſiſt upon its abolition.

4. The inviolability of the houſe in which they reſide. An embaſſador's dwelling is a ſacred aſylum, where no perſon can be arreſted without the embaſſador's conſent. Any felon, however, that might have taken refuge in an embaſſador's houſe, ought to be given up to the criminal juſtice of the country.

Neither have embaſſadors the right of trying or puniſhing, within the walls of their manſion, perſons of their retinue who have been guilty of any crime. Though independent of the criminal and civil laws of the country in which they reſide, they cannot exerciſe any judicial functions, becauſe the judicial power of the ſovereign they repreſent does not extend to that country.

5. The right of having divine ſervice performed in their houſes, at a chapel of their own, according to the rites of the worſhip of their country: but embaſſadors cannot claim the free acceſs of others to their chapel than the ſubjects of the country they repreſent, who are under their ſpecial protection in this reſpect. At the time when the Proteſtants were cruelly oppreſſed and perſecuted in France, the French Proteſtants reſiding at Paris have frequently been moleſted in going to and coming from the chapel of the Dutch embaſſador; but he had no right to remonſtrate againſt this cruelty, becauſe it was exerciſed on the ſubjects of the king of France.

6. The right of being exempt of all duties, charges, taxes, impoſts, exciſe and cuſtom dues. This right has ſometimes been reſtricted in countries where it had been abuſed by embaſſadors, who, forgetful of their dignity, had not ſcrupled to make it a cover to an illicit trade.

7. The privilege, that in caſe of death, the houſehold furniture, moveables, and perſonal property of embaſſadors, or of any individual in their retinue, devolve to their heirs, though aliens, without being liable to any deduction, tax, or alien duty, commonly called "Droit d'Aubaine." But this right does not extend to immoveables, or landed property.

8. The right of legalizing or certifying the authenticity of documents or writings which are to be tranſmitted to the ſtate or country which they repreſent, and that of granting paſſports to the natives of that country.

9. The right of following the court at which they are appointed to reſide, to whatever place that court is removed to, unleſs the prince ſhould declare his abſence to be merely temporary, and requeſt the embaſſador's non-attendance. During the ſeven years' war in Germany, from 1756 to 1763, the Engliſh embaſſador at the court of Berlin attended the great Frederick of Pruſſia at all his head-quarters.

10. Laſtly, embaſſadors conſider themſelves as entitled, and indeed cuſtom appears to have ſanctioned it as a right, to receive ſome valuable trinkets as preſents at their laſt audience, when they take leave of the prince at whoſe court they have reſided.

Embaſſadors ought to be very attentive not to ſuffer any of their privileges or immunities to be infringed upon; neither ought they to paſs over any attack on the perſon or dignity of the prince, or on the character of the ſtate they repreſent. Whenever they have a complaint of a breach of privilege to prefer at the court where they are appointed to reſide, they are ſupported in their demands of redreſs by the whole diplomatic body, or corps diplomatique, that is to ſay, by the aggregate of all the foreign miniſters reſiding at the ſame court.

But embaſſadors cannot claim their privileges and immunities, unleſs they have proved their miſſion as embaſſadors by the delivery of their credentials; nor can they diſplay their character of public miniſters in any other country than that to which they are ſent in that quality. When they are under the neceſſity of traverſing the dominions of any other ſovereign prince, they muſt provide themſelves with the permiſſion to travel through that country by means of regular paſſports, for the law of nations does not oblige a prince or nation to reſpect an ambaſſador on his journey through their country, if he ſhould attempt to traverſe that country without having previouſly obtained their permiſſion.

At Athens the embaſſadors from foreign princes and ſtates always mounted the tribunal, or pulpit, of the public orators, and there opened their commiſſion, and acquainted the people with their buſineſs. At Rome they were introduced to the ſenate, and delivered their commiſſion to them. Among us they make their addreſs immediately and ſolely to the king.

Athens and Sparta, ſays M. Tourreil, when in all their glory, were never ſo much delighted as to ſee and hear a number of embaſſadors in their aſſemblies, ſuing for their protection or alliance. It ſeemed to them the nobleſt homage that could be paid them; and that ſtate which received the moſt embaſſies, was judged to have the advantage over the other.

There are ſome uſages to which embaſſadors ought to conform. They ſhould never attend at any marriage, chriſtening, funerals, or other private ſolemnity; nor muſt they even go into mourning on any occaſions of their own, becauſe they are no longer private individuals; they are the repreſentatives of a ſovereign prince or independent ſtate.

Embaſſadors, in modern times, are either *ordinary* or *extraordinary*.

An *embaſſador ordinary* is he who conſtantly reſides at the court of a ſovereign prince or independent ſtate, to maintain a mutual good underſtanding between the two ſtates, to watch over the permanent intereſts of his country, to tranſact ſuch affairs as may occur, and to give a regular account of his proceedings and obſervations to the prince or ſtate which he repreſents. The practice of keeping embaſſadors ordinary in foreign courts is but of modern invention. It is generally aſcribed to the cardinal de Richelieu. Raymond de Beccaria, baron de Forquevaux de Pavie, knight of the order of St. Michael, was one of the firſt public miniſters who reſided permanently at a foreign court. He was ſent to Spain in 1565, as embaſſador ordinary of Charles IX. of France at the court of Philip II. probably on account of the miſunderſtanding which prevailed between the Spaniſh monarch and his conſort Elizabeth, who was a French princeſs.

The frequent intercourſe which takes place between modern nations; the many relations in which they ſtand to each other; their mutual intereſts; their political and commercial jealouſies; the wiſh of being rapidly and confidently informed of their reſpective projects, enterpriſes, connections and partialities, of the ſprings by which their governments are ſet in motion, and of the general adminiſtration of their concerns abroad and at home; and laſtly, the want of a powerful protection for individuals trading in foreign countries, are indeed circumſtances which confer on the permanent reſidence of public miniſters in foreign courts a high degree of public convenience and utility. Every independent European ſtate has adopted the practice, except the Helvetian Republic, and the ſublime Ottoman Porte. Theſe two ſtates have hitherto at leaſt employed only embaſſadors extraordinary.

An *embaſſador extraordinary* is he who is ſent from one ſovereign prince or independent ſtate to another on ſome particular occaſion or emergency, and who retires as ſoon as the buſineſs of his miſſion is terminated. Hence it follows that an embaſſador extraordinary may be diſpatched to a court or country where an embaſſador ordinary of the ſame prince or ſtate is permanently reſiding. Thus the king of Great Britain appointed Mr. Roſe embaſſador extraordinary to the United States of America in 1808, for one particular purpoſe, whilſt the honourable Mr. Erſkine continued as Britiſh embaſſador ordinary at Waſhington.

In ancient times, all embaſſies were extraordinary. They were generally undertaken from motives of neceſſity, policy, or adulation, ſometimes even from the mere love of magnificence, and commonly compoſed of a great number of embaſſadors. This uſed alſo to be the caſe with the extraordinary embaſſies of the Swiſs, becauſe every canton appointed its embaſſadors. The embaſſy which Switzerland ſent to the king of France in 1663, conſiſted of forty-two embaſſadors.

In our days, extraordinary embaſſies of more than one embaſſador, are very rare; at leaſt they never conſiſt of more than three embaſſadors. Their number, however, is noways limited by the public law of Europe; neither is the retinue or train of an embaſſador extraordinary reſtricted to any particular number of perſons. It ought only not to be ſo numerous as to create any uneaſineſs in the country where the embaſſador extraordinary is appointed to ſojourn for a ſhort time. The duke of Feria, who went to France as embaſſador extraordinary of the king of Spain, to compliment Louis XIII. on his acceſſion to the throne, after the death of Henry IV. had ſo numerous a retinue, that the governor of Bordeaux refuſed to admit him in that city. He aſſigned him his quarters in one of the ſuburbs, and wrote to inform him, that he could not admit him in the place, becauſe his train formed a ſmall army, which might eaſily aſſail the governor with a thouſand firelocks. This cautious conduct of the governor was fully approved of at the French court.

Extraordinary embaſſies are generally very brilliant. The earl of Mancheſter's public entries into Venice as extraordinary Engliſh embaſſador in 1698 and 170 , are deſcribed as uncommonly magnificent. His excellency was attended by ſixteen footmen, and ſix pages, dreſſed in velvet and gold brocade, beſides his ſecretary, and a conſiderable number of Engliſh gentlemen.

The embaſſador extraordinary has the precedency before the embaſſador ordinary of the ſame power. When it happens that an embaſſador extraordinary is ſent to the ſame court after another embaſſador extraordinary, he who is laſt arrived has the precedency, unleſs the prince or ſtate by which they are appointed determines their rank differently. When embaſſadors ordinary are relieved, he who is going to quit the court or country where he has reſided walks at the right of his ſucceſſor in proceeding to the audience: but, in returning, he gives the right to the new embaſſador, becauſe his functions are terminated by the farewell audience.

With reſpect to the rank of foreign embaſſadors reſiding at the ſame court among themſelves, the nuncio of the pope was always conſidered as holding the firſt rank at the French court before the eſtabliſhment of the French republic in 1792. He uſed to compliment the king on particular occaſions in the name of the whole diplomatic body. In other courts the French embaſſador had the precedency before the embaſſadors of any other kingdom. The Spaniards alone diſputed his pre-eminence for a time: but it was ſolemnly recognized by Spain in 1662, and no other power did ever diſpute it. The French embaſſador claimed even the precedency before the Ruſſian imperial embaſſador. Mr D'Eſterno, the French embaſſador at the court of Berlin in 1786, found himſelf highly offended, that the queen of Pruſſia, conſort of the late Frederick William II. ſat down to cards with the Ruſſian embaſſador, whilſt he was only invited to take a hand with the princeſs Friderika, eldeſt daughter of the king of Pruſſia, at preſent ducheſs of York.

The right of ſending embaſſadors is generally veſted in the prince or chief magiſtrate, to whom the exerciſe of the executive power is entruſted in independent ſtates. It is an eſſential attribute of ſovereign power. Yet it is not abſolutely neceſſary that a prince be in the actual poſſeſſion of this power to appoint embaſſadors; provided he have not abdicated the crown, his embaſſadors ought to be received at other courts, unleſs there be ſome political motives for refuſing their admiſſion: but even in that caſe they are like other public miniſters, under the ſpecial protection of the public law of nations.

The actual poſſeſſion of the ſovereign power, whatever may have been the means by which it has been acquired, is conſidered as a ſufficient title to the right of ſending embaſſadors, and the embaſſadors of an uſurper have often been admitted in courts where thoſe of the lawful prince have been refuſed. The embaſſadors of Cromwell were received in France, when Charles II. himſelf could not obtain an audience.

To admit an embaſſador, is to acknowledge the ſovereignty of the prince, or the independency of the ſtate which he repreſents. France acknowledged the independence of the United States of America, by admitting Franklin as their embaſſador before they were declared independent by Great Britain.

During the minority of a monarch the regent may appoint embaſſadors, but always in the name of the king. They repreſent him in whom the executive power is veſted by the conſtitution and not his ſubſtitute. It is this repreſentative dignity which ſubjects the proceedings and motions of embaſſadors to formalities and ceremonies that frequently impede and obſtruct their negociations. Hence it is not unuſual to appoint a ſimple miniſter plenipotentiary to carry on an important and difficult negociation, but to furniſh him at the ſame time with the credentials of an embaſſador extraordinary, with the ſtrict injunction not to make any uſe of them unleſs he ſhould be ſucceſsful in his miſſion. In that caſe he delivers them only at the cloſe of the negociation, juſt before the ſigning of the treaty, which derives a certain additional ſolemnity for being ſigned by an embaſſador extraordinary.

As the functions of an embaſſador conſiſt in watching in the country where he is appointed to reſide over the intereſts of the ſtate which he repreſents, in making regular reports of his proceedings, and in communicating every circumſtance, the knowledge of which is deemed of importance to the miniſter at the head of the department for foreign affairs in his own country, it follows that an embaſſador ought to be well acquainted with the political ſtate and

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the language of the country in which he reſides, with the temper and diſpoſition of the prince or chief magiſtrate by whom it is governed, with the particular character of the miniſter who manages its foreign affairs, with the relations of that country with the other powers of Europe, and with the particular policy which influences them towards that country. To this indiſpenſible political information an embaſſador ought to join a conſummate knowledge of mankind in general, an incorruptible integrity, an enlightened prudence, a ſagacious judgment, mild and refined manners, an inſinuating addreſs, a generous diſpoſition, ſound diſcretion, and dignified firmneſs, and above all a great command over himſelf. This catalogue of qualities, which are rarely combined, ſhews how difficult it muſt be to find fit ſubjects for embaſſies. There is in France a ſort of diplomatic gradation through which all individuals employed in miſſions to foreign courts are generally obliged to paſs. The firſt ſtep is that of ſecretary of legation of the ſecond claſs, then follows that of ſecretary of legation of the firſt claſs; the third ſtep is that of miniſter plenipotentiary, and the fourth that of embaſſador. Frequent exceptions, however, take place with regard to the appointment of embaſſadors, who are ſometimes taken from the army. (Wicquefort. l'embaſſadeur et ſes fonctions. Pecquet. diſcours ſur l'art de négocier. L'eſprit de Leibnitz, tome ii. Cheſterfield's letters ccii. ccxix. clii. cclxxxviii.)

EMBASSADRESS, in French *Ambaſſadrice*, is, in the common acceptation of the word, the wife of an embaſſador, who as ſuch ſhares his rank and privileges. But there have been embaſſadreſſes in their own right, or female embaſſadors. The famous league of Cambray was ſigned, in 1508, on the part of the emperor, by Margaret of Auſtria his daughter, to whom he had given full powers for that purpoſe. The peace concluded at Cambray, in 1529, in confirmation of that of Madrid, was alſo ſigned by the ſame Margaret of Auſtria, ducheſs of Parma, in the name of Charles V. and by Louiſa ducheſs of Savoy, mother of Francis I. by virtue of full powers given to theſe two illuſtrious ladies by the emperor and the king of France. In the year 1645, Louis XIV. expreſſedly appointed Madame la Maréchale de Guébriant his embaſſadreſs extraordinary, to conſign Mary de Gonzagues, daughter of the duke of Nevers, to the arms of her royal huſband, the king of Poland, who had married the princeſs by procuration. Circumſtances might indeed ariſe in which a lady might with great propriety be appointed embaſſadreſs at the court of a ſovereign princeſs, into whoſe confidence ſhe might more eaſily inſinuate herſelf than an embaſſador. In ſuch caſes ſhe would be under the ſpecial protection of the law of nations, and enjoy all the rights and immunities of an embaſſador.

EMBASSY, formerly *Embaſſage*, in French *Ambaſſade*, *legatio*, is the charge or office of an embaſſador, or any other public miniſter ſent to repreſent one ſovereign prince or independent ſtate at the court of another. It alſo denotes the ſolemn meſſage, miſſion, or errand, on which ſuch a public miniſter is ſent.

F. Daniel obſerves, that under the ancient French kings, their embaſſies conſiſted of a body, or number of perſons, joined together in commiſſion, and who compoſed a kind of council; ſomething like which is ſtill retained at treaties of peace. Thus the French embaſſy at Nimeguen, for the peace conſiſted of three plenipotentiaries; that of Utrecht, of two, &c. See EMBASSADOR.

EMBATTLED, a term in *Heraldry*, when the outline of any ordinary is notched ſo as to repreſent the battlements of a wall, or caſtle. See BATTLEMENT.

None were ſuffered, in ancient times, to embattle their houſes, but thoſe who had great dignities, as the barons, and the like. Camden proves this in his account of Tunſtal's ſeat in England, in which he expreſſes it as a ſignal mark of the royal favour, that he had liberty given to embattle it. The heralds expreſs this embattled line by the term *crenelle;* and when it has the embattling on both ſides, which is the more rare, they call it *bréteſſe*; which ſee.

EMBAUL, in *Geography*, a town of Africa, in the kingdom of Damel. N. lat. 15° 15′. W. long. 15° 37′.

EMBDEN. See EMDEN.

EMBELIA, in *Botany*, corrupted from the Ceylon name Aembilla. Burm. Ind. 62. t. 23. Juſſ. 427. (Ribeſioides; Linn. Fl. Zeyl. 190.) Claſs and order, *Pentandria Monogynia*. Nat. Ord. uncertain. *Juſſ.*

Gen. Ch. *Cal.* Perianth ſmall, five-cleft, inferior. *Cor.* Petals five, regular, undivided. *Stam.* Filaments five, equal; anthers . . . . *Piſt.* Germen ſimple, ſuperior; ſtyle one; ſtigma . . . . *Peric.* Berry . . . .

A ſmooth ſhrub, without thorns. *Leaves* alternate, oblong, entire. *Flowers* in terminal panicled cluſters. *Fruit* white, acid, uſed for making rob or jelly. Native of Ceylon. Schreber, by his index, ſeems to refer this plant to *Antideſma*, but their characters do not accord.

EMBER-GOOSE, in *Ornithology*, the *colymbus immer* of Linnæus; which ſee.

EMBER-*weeks*, are thoſe wherein the ember or embering days fall.

In the laws of king Alfred, and thoſe of Canute, theſe days are called *ymbren*, that is, *circular days*, from whence the word was probably corrupted into ember days. By the canoniſts, they are called "quatuor anni tempora," the four cardinal ſeaſons, on which the circle of the year turns; and hence Henſhaw takes the word to have been formed, *viz.* by corruption, from *temper*, or *tempora*. The ancient fathers called them "quatuor tempora jejunii."

Mr. Somner thinks they were originally faſts, inſtituted to beg God's bleſſings on the fruits of the earth. Agreeably to which, Skinner ſuppoſes the word ember taken from the aſhes, embers, then ſtrewed on the head.

The ember days are the Wedneſday, Friday, and Saturday, next after Quadrageſima Sunday, or the firſt Sunday in Lent, after Whitſunday, after Holyrood-day in September, and after St. Lucy's day in December; which four times anſwer well enough to the four quarters of the year, ſpring, ſummer, autumn, and winter. Theſe days are mentioned by Britton, c. 53, and other writers; and particularly in the ſtat. 2 and 3 Edw. VI. c. 19.

Theſe ember weeks are now chiefly taken notice of on account of the ordination of prieſts and deacons; becauſe the canon appoints the ſundays next ſucceeding the ember-weeks for the ſolemn times of ordination; though the biſhops, if they pleaſe, may ordain on any ſunday or holiday.

EMBERIZA, in *Ornithology*, a genus of the Paſſerine order, the character of which conſiſts in the bill being conic; mandibles receding from each other from the baſe downwards, the lower with the ſides narrowed in, and a hard knob within the upper mandible. This laſt-mentioned proceſs in the mouth is adapted in a very peculiar degree to the manners of the emberiza tribe; all the ſpecies feed on ſeeds, and by the aid of this knob they are able to break and comminute the ſhells of the harder kinds with facility. The genus is extenſive, and includes ſome very beautiful birds.

Species.

NIVALIS. Quill-feathers white, primaries black on the outer edge; tail-feathers black, the three lateral ones white. Linn. *Hortulanus nivalis*, Briſſ. *Ortolan de niege*, Buff. *Pied mountain finch*, Albin. *Snow bunting*, Lath. Donov. Brit. Birds.

Inhabits the northern parts of Europe, Aſia, and America, during ſummer, and migrates to warmer climates in the winter. Its ſize rather exceeds that of the chaffinch; it builds in cavities of rocks and lays five eggs, which are of a white colour, ſpotted with brown. The ſpecies varies conſiderably in its plumage at different ſeaſons of the year, and three diſtinct kinds are deſcribed as permanent varieties. One variety is white, with the feathers daſhed with yellow, and the chin and throat marked with very ſmall brown ſpots. This is called by Friſch Weiſs Fleckige Ammer. Another (hortulanus nivalis pectore nigro of Briſſon), is yellowiſh-white above, beneath with the breaſt black; wings and tail black and white intermixed. The pied chaffinch of Albin is the third; the body of this is reddiſh-brown; head and neck white, breaſt with a blueiſh ſpot; wings and tail varied with black and white.

MUSTELINA. Quill-feathers duſky, white at the baſe, the laſt entirely black; tail-feathers black; middle ones at the edge, and three lateral ones each ſide, white with a duſky ſpot without. Gmel. *Emberiza nivalis*, Linn. *Emberiza glacialis*, Lath. *Tawny bunting*, Brit. Zool.

About the ſame ſize as the former, and is by ſome writers erroneouſly confounded as a variety of it. The ſpecies occurs rarely in the northern parts of Britain.

MONTANA. Five firſt quill-feathers blackiſh-brown, the reſt white, ſpotted with brown at the tip; tail-feathers brown; three lateral ones each ſide entirely white. Gmel. *Leſſer mountain brambling*, Willughby. *Mountain bunting*, Lath. Donov. Brit. Birds.

Found in Yorkſhire and Lincolnſhire.

HYEMALIS. Black, belly white. Gmel. *Fringilla hyemalis*, Linn. *Paſſer nivalis niger*, Kalm. *Ortolan jacobin*, Buff. *Snow bird*, Cateſby. *Black bunting*, Lath.

The length of this bird is about ſix inches and a half. During winter, and more eſpecially in ſnowy weather, it is ſeen in Virginia and Carolina; its ſummer place of reſidence is unknown. By ſome it is called the chuck-bird. The fleſh is held in eſteem as an article of food.

MILIARIA. Brown, beneath ſpotted with black; orbits rufous. Linn. *Alaudæ congener*, Aldr. *Strilozzo*, Olin. *Cynchramus*, Briſſ. *Gerſt-ammer*, Gunth. *Le Proyer*, Buff. *Common bunting*, Lath. Donov. Brit. Birds, &c.

Common during the ſummer and autumn in moſt parts of Europe; in England they remain throughout the winter, but in the more ſouthern climates migrate at the approach of that ſeaſon. They aſſociate in flocks. The females build their neſt in a low hedge, or on a ſtump near the ground, and lay from five to ſix eggs. Theſe birds are rather larger than the yellow-hammer, and in the appearance of their plumage ſo cloſely reſemble the lark, that they are commonly ſold under the name of bunting larks in the London markets. They are caught in vaſt numbers for ſale during the winter ſeaſon; the fleſh is bitter, and inferior to that of the true lark.

HORTULANA. Quill-feathers brown, the firſt three whitiſh at the edges; tail-feathers brown, the two lateral ones black on the outer ſide. Linn. *Hortulanus*, Geſn. *Ortolano*, Olin. *Ortolan*, Lath.

The varieties of this ſpecies are numerous; the principal are β (ortolan jaune of Buff.); the plumage of which is yellowiſh, with the quill-feathers edged with white; γ (ortolan blanc) ſnowy white; δ (hortolanus quintus of Ray) which has the tail white; and ε (ortolan noiratre of Buff.) the colour of which is blackiſh, head and neck greeniſh, bill red, and legs cinereous.

Theſe birds are found chiefly in the ſouth of Europe, from whence they migrate northwards as far as Sweden, but have not been known to viſit England. The ſize is that of our yellow-hammer, and its ſong is not very diſſimilar to the notes of that common bird, but more melodious; its neſt is uſually built in a low hedge, or on the ground, and contains five eggs of a greyiſh colour. The celebrity of the ortolan for the tables of epicures is perfectly well known: they are caught for this purpoſe in vaſt number at the times of their periodical migrations in ſpring and autumn, and fattened in a peculiar manner. Their feeders place them in a dark room, with an abundance of oats and millet, upon which they feed with avidity, and become in a very ſhort time extremely fat, in which ſtate they weigh ſometimes three ounces each. When thus fed they are conſidered exquiſitely delicious, and fetch a high price. Ortolans are taken in great numbers in the ſouth of France and Italy, ſome parts of Germany, and the ſouthern provinces of Ruſſia and Siberia; and are potted or otherwiſe preſerved, and form an article of exportation to thoſe countries where theſe delicious birds are leſs commonly found.

SINENSIS. Reddiſh brown, beneath pale yellow; leſſer wing-coverts yellowiſh; quill and tail-feathers with the longitudinal ſtreak on the belly brown. Lath. Ind. Orn. *Ortolan de la Chine*, Sonner. *Chineſe bunting*, Lath.

Inhabits the ſouthern provinces of China during the months of October, November, and December. Size not mentioned.

CITRINELLA. Tail-feathers blackiſh, the two outer ones on the inner edge with a pointed white ſpot. Linn. *Emberiza flava*, Geſn. *Zivolo*, Olin. *Braunt*, Buff. *Yellow-hammer*, Ray. Donov. Brit. Birds.

A general inhabitant of Europe, in every part of which it appears to be common. The male differs from the female in having the colours of the plumage more obſcure, and the head only tinged with yellow; in the male the head is of a very vivid yellow, whence its name. The neſt of this common bird, as is well known, conſiſts of hay, and other dry ſubſtances, ſlightly put together, and placed either on the ground or in a buſh cloſe to it: the eggs from four to five in number, and of a grey colour with ſtreaks, and a few blotches of brown. Theſe birds are eaten in Italy.

OLIVACEA. Olive, beneath whiter; chin orange; pectoral band blackiſh. Gmel. *Emberiza dominicenſis*, Briſſ. *Olive*, Buff. *Olive bunting*, Lath.

Inhabits St. Domingo, and is about the ſize of the common wren.

PASSERINA. Above grey-ferruginous; middle of the feathers black beneath, whitiſh-aſh ſpotted on the ſides; tail-feathers black, the middle ones edged with ferruginous; the outer one each ſide nearly to the baſe, the next as far as the middle obliquely white. Pallas. *Paſſerine bunting*, Lath.

Size of the reed ſparrow. The head and chin in the male black; behind the eyes a pale ſtreak; tail rather forked; legs browniſh fleſh colour. Inhabits Ruſſia near the Ural, and Jaick.

PUSILLA. Above grey-ferruginous; beneath whitiſh; throat ſpotted; head with alternate longitudinal teſtaceous and black bands. Pallas.

A ſmall ſpecies, found among the ſnowy mountains of Dauuria.

RUSTICA. Head black, with three longitudinal white bands, chin, body beneath, and two outmoſt tail-feathers each ſide obliquely white. Pallas.

Inhabits Dauuria, chiefly in woody ſituations.

FUCATA. Grey-ferruginous; ears with a round rufous ſpot; eye-brows, line beneath the eyes and throat white; chin ſurrounded with a brown ſpotted circle. Pallas.

Frequent in rocky parts of Siberia.

SPODOCEPHALA. Grey-ferruginous, beneath pale ſtraw colour; frontlet black; head and neck hoary-aſh. Pallas.

Inhabits near the waterfalls in the Alpine regions of Dauuria. Size of the reed bunting.

CHRYSOPHRYS. Grey-ferruginous; crown black; eye-brows citron, from the middle of the crown to the nape a white band. Pallas.

Found with the latter; ſize of the common yellow-hammer.

MAELBYENSIS. Head and neck lead-cinereous; chin whitiſh; belly ferruginous. Sparrman, Muſ. Carl.

Deſcribed from a ſpecimen taken at Maelby, in Sweden, a ſeat of count Carlſon, in the dukedom of Sudermania. Some writers ſuggeſt that the bird mentioned might be either the female or young of the pine bunting.

RUTILA. Sanguineous rufous; beneath ſulphur; wings grey ruſty. Pallas.

Inhabits Siberia, and is the ſize of the yellow-hammer.

FERRUGINEA. Ferruginous; belly, and two ſpots on the primary quill-feathers, white. Arct. Zool. *Ruſty bunting*, Lath.

Native of North America.

AMERICANA. Above cinereous, ſtreaked with brown; beneath yellow; chin white; quill and tail-feathers black, with pale edges. Gmel. *Black throated bunting*, Arct. Zool.

Found in New York. Size of the yellow-hammer. The female is like the male, but has no black ſpot on the throat, nor ſtreak of yellow above the eye. Dr. Latham deſcribes a variety met with in Hudſon's bay, the colour of which is aſhy brown, beneath whitiſh, front and eyebrows yellow; band under the eyes, and the creſcent on the front, black; chin, as in the male of the other, with a triangular black ſpot in the middle.

BRASILIENSIS. Crown, neck, and body beneath, yellow; back, wings, and tail greeniſh, varied with yellow and brown. Gmel. *Guiram heemgata*, Ray. *Guirnegat*, Buff. *Braſilian bunting*, Lath.

Size of a ſparrow. The ſpecies inhabits Brazil.

MEXICANA. Above browniſh, beneath whitiſh, ſpotted with brown; head and throat yellow. Gmel. *Théreſe jaune*, Buff. *Mexican bunting*.

Length ſix inches and a half; the legs and bill pale; wings and tail browniſh. Native of New Spain.

MILITARIS. Head, wings, tail, and back brown; lower part of the back and breaſt yellow; ſhoulders greeniſh; belly white. Haſſelq. *Military bunting*, Lath.

Inhabits Malta.

MELANOCEPHALA. Yellow, head black; back rufous. Scop. *Black-headed bunting*, Lath.

Size of the yellow-hammer, and inhabits Europe.

BRUMALIS. Body beneath; front and region of the eyes citron; hind head and neck cinereous. Scop.

Native of the Tyroleſe country. This and the two following are ſmall ſpecies.

COCCINEA. Body above ſilvery, beneath crimſon; vent white; bill, head, and quill-feathers black; hind head and tail black-blue. Sander.

Found in the woods about Baden.

BADENSIS. Olive, ſtriated with blackiſh, beneath paler; throat orange; breaſt with black ſtreaks. Sander.

Inhabits Baden. The bill is black above, beneath yellowiſh, with a ſingle obtuſe tooth in the middle.

ERYTHROPHTHALMA. Black, with a red gloſs; belly reddiſh; wings with a white ſpot. Gmel. *Fringilla Carolinenſis*, Briſſ. *Towhee bird*, Cateſby.

This ſpecies inhabits Carolina, frequents ſhady woods, and is generally ſeen in pairs. Called by ſome the American bulfinch. Length eight inches.

LEUCOPHRYS. Ruſty brown, beneath white; vent yellow; crown black, with a white fillet in the middle; eye-brows white. Forſt. *White crowned bunting*, Arct. Zool.

Inhabits Canada, feeds on graſs, ſeeds, and worms, ſings melodiouſly, and lays three or four chocolate-coloured eggs. Length rather exceeding ſeven inches.

LUCTUOSA. Black; beard on the cheſt, front, breaſt, belly, rump, and vent white. Scop. *Wreathed bunting*, Lath.

Size of the greater titmouſe.

AUREOLA. Rufous, beneath yellow; tranſverſe pectoral band ferruginous; crown, cheeks, and chin black. Pallas. *Emberiza Sibirica*. Lepechin. *Yellow breaſted bunting*. Lath.

Size of the reed ſparrow, and inhabits the pine groves of Siberia.

SANDWICHENSIS. Brown, beneath whitiſh, ſpotted with brown; eye-brows yellow; temples duſky. Gmel. *Unalaſha bunting*, Arct. Zool. *Sandwich bunting*, Lath.

Length ſix inches; bill and legs black; under the eyes a duſky line; middle of the belly whitiſh and immaculate. Native of Sandwich bay.

AOONALASCHKENSIS. Reddiſh brown; beneath whitiſh, ſtreaked with brown; middle of the belly white. Gmel.

Length ſeven inches, inhabits Aoonalaſchka, and reſembles the former.

ATRICAPILLA. Cheſnut, beneath cinereous; chin white; crown pale yellow, front and ſtreak through the eyes to the nape black. Gmel. *Black crowned bunting*, Lath.

Native of the Sandwich iſlands; its neck is ſeven inches, the bill black, and legs brown. A variety is deſcribed in Cook's laſt voyage, which has the breaſt waved with black; the female without the yellow ſpot on the crown.

PITHYORNUS. Middle of the crown with an oval white ſpot; nape varied with white; chin red-teſtaceous; two exterior tail-feathers, each ſide with an oblique white band. Pallas. *Emberiza leucocephala*, S. G. Gmelin. *Emberiza alia ſpecies*, Lepechin. *Pine bunting*, Lath.

Inhabits the pine foreſts of Siberia, from the Uralian chain of mountains to the Lena; it lives among reeds on the ſhores of rivers, and paſſes the winter ſometimes on the borders of the Caſpian ſea. The ſize is that of the yellow-hammer, and it has the note of the reed ſparrow.

CINEREA. Bay, beneath whitiſh, ſpotted with bay; tail and quill-feathers brown, edged with grey; rump grey; tail-coverts reddiſh white. Gmel. *Emberiza canadenſis*, Briſſ. *Cul-rouſſet*, Buff. *Cinereous bunting*, Arct. Zool.

Length five inches and a half, and inhabits the juniper woods in Canada.

CÆRULEA. Rufous and blue varied; crown rufous;

greater wing-coverts, quill-feathers, and tail-feathers, brown, with the outer edge rufous. Gmel. *Emberiza canadenſis cærulea*, Briſſ. *Azuroux*, Buff. *Blue bunting*.

Inhabits Canada, and rarely New England. Its length is four inches and a half.

Cyanea. Blue; crown deeper; quill, and tail-feathers brown edged with blue. Lath. Ind. Orn. *Emberiza cyanea, rectricibus fuſcis*, Gmel. *Tanagra cyanea*, Linn. *Miniſtre*, Buff. *Blue linnet*, Cateſby. *Indigo bunting*, Lath.

Size of the ſiſkin. The male, when in full plumage, is blue, at other times reſembles the female, which is nearly throughout of a browniſh colour; in the latter, however, the edge of the wing is tinged with green, and by this peculiarity the female may be diſtinguiſhed from the male, the edge of his wing being blue. In Carolina, the inland parts of which this ſpecies inhabits, it is called the parſon, and by ſome the biſhop; and the Spaniards at Mexico, which country it inhabits, alſo name it azul lexos, or "far-fetched blue bird." It feeds on ſeeds, and is ſaid to have the note of the common linnet.

Cyanella. Shining blue-interſcapulars and ſhoulders varied with blue and rufous; quill and tail-feathers edged with blueiſh. Sparrm. Muſ. Carlſ. *Emberiza cyanella*, Gmel. *E. cyanea*, β Lath.

Deſcribed by Sparrman as a ſpecies. Gmelin admits it with doubt, and Latham conſiders it as a variety only of cyanea; it is a native of North America.

Quelea. Grey; front black; bill ſcarlet. Gmel. *Moineau à bec rouge du Sénégal*, Buff. *Black faced bunting*, Lath.

The bill of this bird is thick; cheeks and chin black; reſt of the head, ſhoulders, and back varied with black and grey; breaſt and belly reddiſh white; quill and tail-feathers blackiſh, edged with cinereous. The ſpecies inhabits Senegal, and is four inches and a half in length. The female reſembles the male, but wants the black about the head. The bird deſcribed by Buffon, under the name of Moineau du Senegal, is conſidered as a variety.

Tetrix. Cheſnut, beneath yellow; eye-brows and rump yellow; middle of the head and breaſt with a broad black band. Gmel. *Weaver bunting*, Lath.

Size of the houſe ſparrow, which bird it reſembles in the browniſh colour of the plumage during winter. The name of weaver bunting was given to this bird from its propenſity to interweave ſilk between the wires of its cage, like the weaver oriole, and, it is conjectured, the neſt of the weaver bunting is compoſed in a manner ſomewhat ſimilar to that of the above-mentioned oriole, which conſiſts of leaves curiouſly ſewed together with the filaments of plants. This bird inhabits Africa.

Rubra. Crimſon; neck and back varied with olive and black, and a few crimſon marks; belly and vent cinereous; quill and tail feathers black, edged with grey-green. Gmel. *Moineau de l'iſle de France*, Buff. *Crimſon bunting*, Lath.

Size of the laſt, and inhabits the iſle of France. The bill is black; legs pale fleſh colour; female olive and paler beneath.

Capensis. Grey; throat whitiſh; ocular band and another beneath blackiſh. *Hortulanus capitis Bonæ Spei*, Briſſ. *Ortolan du Cap de Bonne Eſperance*, Buff. *Cape bunting*, Lath.

Native of the Cape, and in ſize reſembles the ſparrow. Three varieties of this ſpecies are deſcribed in Buffon's "Planches Enluminees," namely, β, the body of which is yellow beneath, and the ſides of the head and neck marked with three black ſtripes; γ, having the body beneath whitiſh; and δ, which is whitiſh beneath, and has the throat varied with cinereous. The two firſt of theſe are conceived to be merely varieties of the Cape kind, the laſt is a native of Cayenne, where, according to Buffon, it is called *Bonjour-commandeur*, from being accuſtomed to commence its ſong at the break of day.

Fusca. Browniſh; wings and tail brown with duſky bands; belly white; noſtrils, cheeks, and chin with feathered tufts. Gmel. *Barred-tailed bunting*, Lath.

Deſcribed by Dr. Latham from a figure met with among ſome Chineſe drawings. The ſize is ſaid to be that of the common bunting. The beak is fleſh-coloured; legs roſy.

Ludovicia. Rufous ſpotted with black; beneath pale; breaſt rufous; head with a black creſcent. Gmel. *Hortulanus ludovicianus*, Briſſ. *Ortolan de la Louiſiane*, Buff.

Length five inches and a quarter. The bill rufous ſpotted with black, head and throat reddiſh; rump and cuneated tail black; breaſt rufous; legs cinereous. Native of Louiſiana.

Cia. Reddiſh; head with a few blackiſh lines; eye-brows white. *Emberiza barbata*, Scop. *Emberiza pratenſis*, Geſn. *Bruant fou*, Buff. *Bruant de ſprés*, Buff. *Fooliſh bunting*, Lath.

Native of the warmer parts of Europe, and delights moſt in mountainous ſituations; it is a ſilly bird, and eaſily caught in any ſnare, whence its name; its note is only a repetition of ſounds, like the pronunciation of the words zi-zi-zi-zip-zip. The Genoeſe call it Cia montanina.

Cirlus. Fuſcous; breaſt ſpotted; eye-brows pale yellow; two outmoſt tail-feathers with a white cuneated ſpot. Gmel. *Emberiza ſepiaria*, Briſſ. *Cirlus*, Aldr. *Cirl bunting*.

Size of the yellow-hammer, and inhabits Italy and France; the ſpecies has been lately found in Britain.

Familiaris. Cinereous ſpotted with brown; tail-feathers white at the tip; hind part of the back yellow. Gmel. *Bruant familier*, Buff. *Familiar bunting*.

Oſbeck deſcribes this ſpecies under the name of Motacilla familiaris. This writer ſpeaks of it as a docile bird, and ſays, if the cage-door was opened it would jump out upon the perſon's hand who releaſed it, and if any one whiſtled in its hearing, it ſang ſweetly in return. If a diſh of water was placed before it, the bird inſtantly plunged into it, and bathed itſelf. It was fed with rice.

Flaveola. Grey; face yellow. Gmel. *Flaveole*, Buff. *Yellow-faced bunting*.

Native of warm climates, and very ſmall.

Amazonia. Brown; crown fulvous; vent whitiſh. Gmel. *Amazone*, Buff. *Amazon bunting*.

Size of the titmouſe, and inhabits Surinam.

Oryzivora. Black; crown reddiſh; belly black; tail-feather daggered. Gmel. *Agripenne ou Ortolan de riz*, Buff. *Rice bird*, Cateſby. *Rice bunting*, Arct. Zool.

About the ſize of the ſparrow. The ſpecies is confined to the continent of America, and is of the migratory kind, paſſing in flocks at particular ſeaſons from one part to another. The Americans call it Bob Lincoln and Conquedle. Its food conſiſts of grain and inſects, and the maize eſpecially; they are remarkably fond of this plant, and prove highly deſtructive to the crops, by unneceſſarily perforating the huſks after ſatisfying their appetites, and thus leaving openings through which the rain penetrates, and effectually deſtroys the plants. Some, for this reaſon, call it the maize thief, or white backed maize thief. Its note is much admired. There is a variety of this bird of an olive-brown colour, beneath yellowiſh; rump yellow, tranſverſely lined with brown; greater wing-coverts and quill-feathers edged with white.

Schoeniculus. Head black; body grey and black; outmoſt tail-feathers with a white wedged ſpot. Linn Fn. Suec. *Junco turneri*, Geſn. Buff. *Reed bunting*, Lath.

Native of Europe and the ſouthern parts of Siberia. The female differs from the male in having the head browniſh inſtead of black.

Lesbia. Beneath white; face white with three black bands; breaſt and rump browniſh; tail-feathers white, the two middle ones duſky, edged with rufous. Gmel. *Mitilene de Provence*, Buff. *Leſbian bunting*, Buff.

Length about four inches and a half; it inhabits Provence, where it is called Chic de Mitilene, being rare in that part, and known to be common in the Greek iſle Mitylene, or Leſbos. They are ſaid to exert a peculiar kind of ſcream on the approach of any bird of prey, a circumſtance which the Greeks turn to ſome advantage, for they place one or more of theſe birds incloſed in ſtrong iron cages in their poultry yards, and the approach of the hawk, or any other bird of prey, is loudly announced by theſe little centinels the moment it appears in ſight; and by this means the poultry are allowed ſufficient time to effect their eſcape.

Provincialis. Beneath white; band acroſs the eyes and on the wing and chin white; ſpot under the eyes, ſtreak each ſide the chin, and breaſt browniſh ſpotted with black; quill and tail-feathers duſky, edged with rufous. Gmel. *Gavoué de Provence*, Buff. *Muſtachoe bunting*, Lath.

Size of the laſt, and inhabits Provence.

Lotharingica. Spotted with black; above rufous, beneath cinereous, abdomen rufous; ſtreak acroſs the eyes and on the mandibles black; tail-feathers black and white, middle ones rufous; exterior ones nearly all white. Gmel. *Ortolan de Lorraine*, Buff. *Lorrain bunting*.

Inhabits Lorrain; the female is white beneath, and has a whitiſh ſpot above and a rufous one beneath the eyes. Length ſix inches and a half.

Psittacea. Browniſh-aſh; wings tawny; two tail-feathers very long. Gmel. *Fringilla braſilienſis*, Seba. *Veuve éteinte*, Buff. *Pſittaceous bunting*, Lath.

Size of a ſparrow, and inhabits Braſil.

Paradisea. Black; breaſt red; four middle tail-feathers long, and pointed; two very long, bill black. Scop. *Vidua*, Briſſ. *Indian long-tailed ſparrow*, Will. *Red-breaſted long-tailed finch*, Edw. *Whidah bird*, Lath.

Native of Angola in Africa.

Serena. Head black; crown red; tail cuneated; two middle tail-feathers very long; legs grey. Gmel. *Vidua minor*, Briſſ. *Veuve dominicaine*, Buff. *Dominican bunting*, Lath.

Like the reſt of the long-tailed buntings, this bird is deſtitute of the two long tail-feathers during winter, and changes its plumage twice in the year.

Vidua. Blackiſh; beneath whitiſh; four middle tail-feathers long and pointed, two of them very long; bill red. Gmel. *Vidua major*, Briſſ. *Grande veuve*, Buff. *Long-tailed ſparrow with a ſcarlet bill*, Will.

The body of this ſpecies is leſs than that of the ſparrow; the ſpecies inhabits Angola in Africa and India.

Principalis. Variegated; breaſt rufous; four middle tail-feathers very long; bill and legs red. Gmel. *Vidua angolenſis*, Briſſ. *Variegated bunting*, Lath.

Inhabits Angola.

Regia. Middle tail-feathers very long, equal, feathered only at the tip; bill red. Gmel. *Veuve à quatre brins*, Buff. *Shaft-tailed bunting*, Lath.

Inhabits the maritime parts of Africa. Length four inches and a half. The body above and vent black; throat, temples, orbits, and body beneath rufous; legs red.

Longicauda. Black; ſhoulders orange, edged with white; tail-feathers long, the ſix middle ones very long. Gmel. *Veuve à épaulettes*, Buff. *Yellow-ſhouldered oriole*, Brown.

Native of the Cape of Good Hope.

Panayensis. Black; breaſt with a large ſcarlet ſpot; four middle tail-feathers very long, pendulous, pointed and equal. Gmel. *Veuve en feu*, Buff. *Veuve de l'iſle de Panay*, Sonnerat. *Panayan bunting*.

Inhabits the iſle of Panay.

Angolensis. Black; crown and collar yellow; tail long. Gmel. *Gros-bec à poitrine couleur de feu*, Salerne. *Angola bunting*.

Size of a finch, and inhabits Angola.

Ciris. Head bule; abdomen fulvous; back green; feathers green brown. Gmel. *Painted finch*, Cateſby. *China bulfinch*, Albin. *Painted bunting*, Arct. Zool.

Length five inches and a half, varies in colour, and inhabits South America; they build in the orange trees, and feed on plants of various kinds. In Holland, and ſome other parts of Europe to which they have been tranſported, they are reared in cages like the Canary with us, and are ſaid to live eight or ten years in this ſtate of captivity.

Quadricolor. Head and neck blue; back, wings, and tail at the tip green; tail and abdomen in the middle red; breaſt and remainder of the belly browniſh. Gmel. *Groſbeak de Java*, Buff. *Red rump bunting*, Lath.

Native of Java. Length five inches.

Cyanopis. Green; rump and abdomen rufous; front, cheeks and chin blue; quill-feathers brown, edged with green; tail-feathers edged with red; middle ones green, the reſt brown. Gmel. *Chloris javenſis*, Briſſ. *Toupet bleu*, Buff. *Blue faced bunting*, Lath.

Length four inches; inhabits ſame country as the laſt.

Viridis. Above green; beneath white; wings and tail blue. Gmel. *Chloris indica minor*, Briſſ. *Parement bleu*, Buff. *Green bunting*, Lath.

Size of a ſparrow; the bill greeniſh brown; ſhafts of the quill and tail-feathers white; and legs black. Native of India.

Platensis. Above greeniſh-brown; beneath whitiſh-aſh; back varied with black; quill, and lateral tail-feathers edged with yellow. Gmel. *Emberiſe à cinq couleurs*, Buff. *Plata bunting*, Lath.

Length eight inches. This ſpecies inhabits near the river Plata in South America.

Borbonica. Rufous red; wings, tail, and legs cheſnut. Gmel. *Mordoré*, Buff. *Bruant de l'iſle de Bourbon*, Buff. *Bourbon bunting*.

Inhabits the iſle of Bourbon.

Calfat. Hoary; beneath vinaceous; head, chin, and edge of the tail black; bill and orbits roſy. Gmel. *Calfat*, Buff. *Red-eyed bunting*, Lath.

Leſs than the common ſparrow, and inhabits the iſle of France.

Chlorocephala. Fuſcous; head and neck olive; back and wing-coverts varied with brown and black; tail forked. Gmel. *Green-headed bunting*. Brown's illuſtr.

A very ambiguous kind; probably an accidental variety of ſome European bunting. The bird deſcribed was caught in Mary-le-bone fields, and preſerved in the Tunſtal Collection.

Grisea. Grey; wing-coverts and breaſt varied with red; quill and tail-feathers within white, without varied with grey and red. Gmel. *Emberiza Surinamenſis*, Briſſ. *Gonambouch*, Seba. *Grey bunting*, Lath.

Inhabits Surinam, where it is common, and its note is ſaid to be equal to that of the nightingale. Its food is chiefly maize. The natives call it gonambucho.

Surinamensis. Grey, beneath pale-yellow; breaſt with oblong black ſpots. Gmel. *Prayer*, Fermin. *Surinam bunting.* Lath.

Rather larger than the lark. Inhabits Surinam.

Ruficapilla. Body above fuſcous, beneath cinereous; chin ferruginous; frontlet white; above reddiſh; tail black. Sparm. Muſ. Carlſ.

Asiatica. Cinereous; wings and tail brown. Lath. Ind. Orn. *Gaur bunting.*

Inhabits the Eaſt Indies, where it is known by the name of gaur.

EMBLEM, Εμϐλημα, a kind of painted ænigma, which, repreſenting ſome obvious hiſtory, with reflections underneath, inſtructs us in ſome moral truth, or other matter of knowledge.

The word is pure Greek, formed of the verb εμβαλλειν, *to caſt in, to inſert.* Suetonius relates, that Tiberius cauſed the word to be eraſed out of a decree of the Roman ſenate, becauſe it was borrowed from another language.

Such is that very ſignificant image of Scævola, holding his hand in the fire; with the words, "agere & pati fortia, Romanum eſt:" "to do and ſuffer courageouſly is Roman."

The emblem is ſomewhat plainer, and more obvious, than the *ænigma;* which ſee. Gale defines emblem an ingenious picture, repreſenting one thing to the eye, and another to the underſtanding.

The Greeks alſo frequently gave the name emblems, εμϐληματα, to inlaid or moſaic works, and even to all kinds of ornaments of vaſes, moveables, garments, &c. And the Latins uſed emblema in the ſame ſenſe. Accordingly, Cicero, reproaching Verres with the ſtatues and fine wrought works he had plundered from the Sicilians, calls the ornaments fixed thereto (and which, on occaſion, might be ſeparated from them) emblemata. Add, that Latin authors frequently compare the figures and ornaments of diſcourſe to theſe emblemata: thus, an ancient Latin poet, praiſing an orator, ſays, that all his words were ranged like the pieces in moſaics,

> "Ut teſſerulæ omnes,
> Arte pavimenti, atque emblemate vermiculata."

We do not uſe the Engliſh word emblem in this ſenſe; though the ancient juriſconſulti always retain the Latin emblema to expreſs ſuch ornaments; becauſe the Greek εμϐλημα literally denotes any thing applied, or added to a body by way of enrichment.

With us, emblem ordinarily ſignifies no more than a painting, baſſo relievo, or other repreſentation, intended to hold forth ſome moral or political inſtruction.

What diſtinguiſhes an emblem from a device is, that the words of an emblem have a full, complete ſenſe of themſelves; nay, all the ſenſe and ſignification which they have together with the figure. But there is yet a farther difference between emblem and device; for a device is a ſymbol appropriated to ſome particular perſon, or that expreſſes ſomething which concerns him particularly; whereas an emblem is a ſymbol that regards all the world alike.

Theſe differences will be more apparent from comparing the emblem above quoted with the device of a candle lighted; and the words, "juvando conſumor," "I waſte myſelf in doing good." See Device.

According to lord Bacon, emblems are of uſe in the art of memory, as ſenſible objects ſtrike the mind ſtronger than what is intellectual. Thus, it is eaſier to retain the image of a ſportſman hunting a hare, of an apothecary ranging his boxes, an orator making a ſpeech, a boy repeating verſes, or a player acting his part, than the correſponding notions of invention, diſpoſition, elocution, memory, and action. Works abr. vol. i. p. 136. vol. ii. p. 475. and vol. iii. p. 106.

Emblems, *Hagiographical.* The ſtatues and pictures of the apoſtles, martyrs, and other ancient ſaints, are diſtinguiſhed by their reſpective emblems. Theſe appear to have been fixed upon by the artiſts of the 12th and 13th centuries. Sometimes they repreſent the inſtruments of their death or torments, as the Burgundy croſs of St. Andrew, the gridiron of St. Laurence, the cardine comb of St. Blaſe, the wheel of St. Catharine; at other times they relate to ſome circumſtances in the life or legend of the ſaint, as the organ of St. Cecily, the dove of St. Gregory the Great; frequently they bear alluſion to the name of the holy perſonage, as the lamb of St. Agnes, the gigantic ſtature of St. Chriſtopher, bearing the infant Chriſt upon his ſhoulders.

EMBLEMATICAL Characters. See Character.

EMBLEMENTS, *Fr.* from *emblaver*, q. d. *ſemer en blé*, to ſow with wheat, a term ſtrictly ſignifying the profits of lands ſown; though ſometimes uſed more largely for any profits ariſing, and growing naturally from the ground; as graſs, fruit, &c.

If a tenant for life ſow the land, and die before harveſt, his repreſentatives ſhall have the emblements to compenſate for the labour and expence of tilling, manuring, and ſowing the lands, and alſo for the encouragement of huſbandry; and not he in reverſion. But if the tenant for years ſow the land, and before ſeverance the term expires, or the eſtate for life be determined by the tenant's own act, as by forfeiture for waſte committed, or if a tenant during widowhood thinks proper to marry, there the leſſor, or he in reverſion, ſhall have the emblements, and not the leſſee.

The advantages of emblements are particularly extended to the parochial clergy by 28 Hen. VIII. cap. 11.

All the caſes of emblements turn upon the point of uncertainty; ſince the tenant could not poſſibly know when his landlord would determine his will, and therefore could make no proviſion againſt it; and having ſown the land, which is for the good of the public, upon a reaſonable preſumption, the law will not ſuffer him to be a loſer by it. But it is otherwiſe, and upon reaſon equally good, where the tenant himſelf determines the will; for in this caſe, the landlord ſhall have the profits of the land. (Co. Litt. 55, 56.) Theſe emblements are diſtinct from the real eſtate in the land, and are ſubject to many, though not all, the incidents attending perſonal chattels. They were deviſable by teſtament before the ſtatute of wills (Perk. § 412.); and at the death of the owner, ſhall veſt in his executor, and not his heir; they are forfeitable by outlawry in a perſonal action (Bro. Abr. tit. emblements, 21. 5 Rep. 116.); and by the ſtatute 11 Geo. II. c. 19. though not by common law (1 Roll. Abr. 666.), they may be diſtrained for rent arrear. Although the emblements are aſſets in the hands of the executor, are forfeitable upon outlawry, and diſtrainable for rent, they are not in other reſpects conſidered as perſonal chattels; and particularly, they are not the object of larciny, before they are ſevered from the ground. (3 Inſt. 109.)

EMBLICA, in *Botany*, Gærtn. t. 108. f. 2. See Phyllanthus and Myrobalanus.

EMBODY, in the *Military Art*. To *diſembody*, relates to the ſeparation of thoſe individuals forming a regiment, &c. when its ſervices are no longer required. This term is totally diveſted of that diſgrace which is conveyed under the terms *diſmiſſed*, or *broken*. Thus we find, that, during times of danger, the militia are called out; and on the return of peace, that orders are iſſued for their being "diſembodied." Hence, in that admirable ſatire, "the Mayor of Garrat," major Sturgeon ſays, "Our corps is diſembodied, ſo the French may ſleep in ſecurity."

When a regiment is diſembodied, or, in other words, diſbanded, (though the latter term is often, but erroneouſly, intended to convey reproach,) the arms are lodged in the proper ſtore-rooms; and every thing is numbered or ticketted, in order that when the regiment may again be called out, all may be in readineſs for its equipment.

EMBOLE, in *Surgery*, the reduction or ſetting of a diſlocated bone. The term is derived from the Greek εμβαλλειν, *to put in*.

EMBOLI, in *Geography*, a town of European Turkey, in the province of Romania, a colony from Athens. It is called by the Chriſtians "Chriſtopolis," but is little better than a heap of ruins; 48 miles E. of Saloniki.

EMBOLIMA, in *Ancient Geography*, a town of India, on this ſide of the Ganges. It was ſituated S.W. of Petra Aornos, upon the right of the Indus, and N. of Taxila.

EMBOLIMÆAN and Embolismic, *Intercalary*, is chiefly uſed in ſpeaking of the additional months which chronologiſts inſert to form the lunar cycle of 19 years.

The 19 ſolar years, conſiſting of 6939 days, and 18 hours; and the 19 lunar years only making 6726 days; it was found neceſſary, in order to render the 19 lunar years equal to the 19 ſolar, which make the lunar cycle of 19 years, to intercalate or inſert 7 lunar months, containing 209 days; which, with the 4 biſſextile days happening in that interval, make 213 days, and the whole, 6939 days. See Cycle.

By means of theſe ſeven emboliſmic, or additional months, the whole 6939 days and 18 hours of the ſolar years are employed in the calendar.

In the courſe of 19 years there are 228 common moons, and 7 emboliſmic moons. Their diſtribution is thus: every 3d, 6th, 9th, 11th, 14th, 17th, and 19th, years, are emboliſmic, and conſequently contain 384 days a-piece. And this was the method of computing time among the Greeks, when they uſed the enneadecæterides, or cycle of 19 years. But they did not keep regularly to it, as the Jews ſeem to have done. The Greeks were followed by the Romans till the time of Julius Cæſar.

The emboliſmic months, like other lunar months, are ſometimes 30 days, and ſometimes only 29. See Year.

The emboliſmic epacts are thoſe between XIX and XXIX; which are thus called, becauſe, with the addition of the epact XI, they exceed the number XXX: or rather, becauſe the years, which have theſe epacts, are emboliſmic; having 13 moons a-piece, whereof the 13th is the emboliſmic.

EMBOLISMUS, Εμβολισμος, in *Chronology*, ſignifies intercalation.

The word is formed of εμβαλλειν, *to inſert*. See Embolismic.

As the Greeks made uſe of the lunar year, which is only 354 days, in order to bring it to the ſolar, which is 365 days, they had every two or three years an emboliſm, *i. e.* they added a thirteenth lunar month every two or three years; which additional month they called embolimæus, εμβολιμαιος, becauſe inſerted, or intercalated.

EMBOLUS, the immoveable part of a pump, or ſyringe; called alſo the *piſton*, and popularly the *ſucker*. See Piston, Pump, and Syringe.

The pipe, or barrel of a ſyringe, &c. being cloſe ſhut, the embolus cannot be drawn up without a very conſiderable force; which force being removed, the embolus returns again with violence. This phenomenon the Ariſtotelians attribute to nature's abhorrence of a vacuum.

But the modern philoſophers finding, that in an exhauſted receiver the embolus is eaſily drawn up, though the orifice be ſtopped, prove that it is the preſſure of the atmoſphere on the external parts of the embolus, that makes the difficulty of drawing it up. See Air, Atmosphere, and Suction.

EMBORDERED, in *Heraldry*, a term applied to a border, when it is of the ſame metal, colour, or fur, with the arms.

EMBORISMA, an aneuriſm.

EMBOSSING, or Imbossing, the act of forming, or faſhioning works in relievo, whether they be caſt, or moulded, or cut with the chiſſel, &c.

Emboſſing is one great part of ſculpture; being that which has to do with figures raiſed, or prominent from the plain, or ground; the other part, which makes figures, &c. that are indented, or cut in below the ground, is called engraving. See Enchasing.

Embossing, or *Imboſſing*, in *Architecture*, is that kind of ſculpture wherein the figure is made to ſtand in relief beyond a plane or naked from which it ſeems to riſe. It has three denominations, according to the degree with which it riſes from the ſurface, as baſſo-relievo, mezo-relievo, alto-relievo; or low-relief, mean-relief, high-relief.

EMBOTHRIUM, in *Botany*, ſo named by Forſter from εν, *in*, and Βοθριον, a *little pit*, or *hollow*, alluding to a ſmall cavity towards the point of each petal, in which the almoſt ſeſſile anthers are ſeverally placed. Forſt. Gen. 8. t. 8. Linn. fil. Suppl. 16. Schreb. 62. Willd. Sp. Pl. v. 1. 537. Juſſ. 79. Mart. Mill. Dict. v. 2. Sm. Bot. of N. Holl. 19—29. t. 7—10. Claſs and order, *Tetrandria Monogynia*. Nat. Ord. *Proteaceæ*.

Gen. Ch. *Cal.* none. *Cor.* Petals four, cohering by their lower part into a tube, linear, oblique, at length revolute; their ſummits dilated, concave, bearing the ſtamens. *Stam.* Filaments four, very ſhort, inſerted into the hollow in the tip of each petal; anthers rather large, kidney, or heart-ſhaped. *Piſt.* Germen ſuperior, ſtalked, linear, aſcending, inflexed; ſtyle incurved; ſtigma large, obtuſe, lateral. *Per.* Follicle ſtalked, ſomewhat cylindrical. *Seeds* in two rows, imbricated, compreſſed, each with a membranous wing, generally numerous.

Eſſ. Ch. Petals four. Stamens inſerted into the limb. Follicle containing ſeveral winged ſeeds.

This is a fine genus of the Proteaceous order, chiefly found in New Holland. One of the two original ſpecies, indeed, E. *coccineum*, Linn. Suppl. 128, Cav. Ic. v. 1. 47. t. 65, grows on the cold hills bordering the ſtraits of Magellan, even in Terra del Fuego. Yet this appears by Commerſon's and Forſter's ſpecimens to be a very handſome ſhrub, with all the air of a North American *Kalmia* or *Rhododendron*. The *leaves* are elliptical and entire, ſmooth, pale beneath. *Flowers* ſcarlet, in a denſe terminal cluſter, with ſmall linear *bracteas*. *Follicle* ſhort, and rather ſemi-ovate.

E. *ſpecioſiſſimum*, Sm. Bot. of New Holland 19, t. 7, is a ſtill finer ſpecies, a native of New South Wales, where the natives call it Waratàh. Living plants were ſent many years ago to the dowager lady de Clifford. This is remarkable for the numerous large ſcarlet *bracteas*, which envelop its denſe ſpike of the ſame colour. The *leaves* are obovate and ſerrated, remarkably obtuſe.

E. *ſilaifolium*, Sm. Bot. of N. Holland, 23. t. 8. flowered at Mr. Grimwood's nurſery, Kenſington, in 1792, being forced in the ſtove. It comes alſo from New South Wales, and has finely divided rigid *leaves*, with looſe ſpikes of white *flowers*.

E. *ſericeum*, ibid. 25. t. 9, and ſome of its varieties are now not rare in the greenhouſes about London. See Curt. Mag. t. 862, and Andr. Repoſ. t. 100 and t. 272.

Mr. R. Brown, in paper on *Proteaceæ*, read laſt winter before the Linnæan Society, has new-modelled and greatly ſubdivided the genus *Embothrium*, he having had opportunities of ſtudying its ſpecies alive in their native ſituations, which no other botaniſt has ſo fully enjoyed.

EMBOUCHURE, a French term in *Muſic*, literally the hole in the upper joint of a German flute, in which the performer breathes; but when it is ſaid that a flute player has a good embouchure, it means that his tone is good.

EMBOUL, in *Geography*, a town of Africa, in the country of Senegal.

EMBOWELLING Alive, in *Law*, is part of the puniſhment of high treaſon.

EMBRACE *a* Volt, in the *Manege*, is uſed when a horſe, in working upon volts, makes a good way every time with his fore legs. The oppoſite term to embracing a volt, is beating the duſt, which is putting his fore-feet near the place from whence he lifted them.

Embracing the ground is uſed in the ſame ſenſe with embracing the volt. A horſe cannot take in too much ground provided his croupe does not throw out; that is, does not go out of the volt. See Beat.

EMBRACEOR, in *Law*, a perſon who, when a matter is in trial between party and party, comes to the bar with one of the parties (having received ſome reward ſo to do), and ſpeaks in the cauſe, or privately labours the jury, or ſtands there to overlook, awe, or put them in fear; or, who makes any attempt to influence a jury corruptly to one ſide by promiſes, perſuaſions, intreaties, money, entertainments, and the like. (1 Hawk. P. C. 259.) The puniſhment for the perſon embracing is by fine and impriſonment; and for the juror ſo embraced, if it be by taking money, the puniſhment is (by divers ſtatutes of the reign of Edward III.) perpetual infamy, impriſonment for a year, and forfeiture of the tenfold value.

EMBACERY, the act or offence of embraceors. See Embraceor.

EMBRASURE, in *Architecture*, an enlargement of the gap or aperture of a door, or window, within-ſide the wall. See Door.

Its uſe is to give the greater play, for the opening of the door, wicket, caſement, &c. or to take in the more light.

The embraſure coming ſloping inwards, makes the inner angles obtuſe. When the wall is very thick, they ſometimes make embraſures on the outſide.

Embrasure, in *Fortification*, is an opening made through the upper part of the defences, called the *parapet*, for the purpoſe of pointing the cannon, ſo as to be as little as poſſible expoſed to the fire of the enemy. The embraſure muſt vary in dimenſions with the ſeveral ſizes, or, as they are technically termed, the "natures" of the cannon to be employed in them reſpectively. It is, however, generally found, that about 2½ diameters of the muzzle of the cannon intended to be mounted give ſpace enough for traverſing, and at the ſame time afford but little opening for the ſhot from oppoſing batteries. The embraſure muſt be cut down in that proportion which may ſuit the height of the carriages on which the cannon may be mounted: thus, for all under 24 pounders, the height, between the front of the platform, and the creſt, *i. e.* the interior, or higheſt part of the ſlope, over which the cannon is levelled, ought not to exceed 28 inches, unleſs the trucks on which the carriages run are unuſually high; for all cannon of 24 pounds calibre, and upward, the ſpace above deſcribed, and which is called the *genouillere*, ought to be from 34 to 40 inches. The beſt rule is, to allow eight inches between the creſt of the ſlope and the under part of the cannon, when horizontally laid, thereby to command freedom of action, even when the depreſſion of the line of fire may be conſiderable: were this not attended to, the cannon might, at ſuch times, be levelled after each diſcharge, before it could be run up to the *genouillere*; whereby conſiderable delay would be created. The ſlope, by which we mean that part under the muzzle of the cannon, is ordinarily made with a deſcent of about ten or twelve degrees from the creſt outwards, to allow of depreſſion, ſo as to fire either into the ditch, or over the glacis; this ſlope muſt neceſſarily vary according to the ſituation, and intention of the battery. Thus, in ſome ſituations it is found neceſſary even to invert the ſlope, the cannon being always pointed above the horizon: this occaſionally happens in erecting batteries while beſieging a place, where it would be both uſeleſs and diſadvantageous to cut the embraſures any lower than the loweſt direction to which the cannon ſhould be pointed. On the other hand, we ſometimes ſee the ſlopes made at full forty degrees of depreſſion, in conſequence of the battery being intended to command ſome work, of approach, far below its own level. But, as before obſerved, when works are conſtructed upon an ordinary *defilement*, (or branching out,) originating from a level at the exterior of the *glacis*, and proceeding without any increaſe of elevation to the centre of the place, then from 10 to 12 degrees of depreſſion in the ſlope will be fully adequate to all the purpoſes of depreſſion of the cannon. The expanſion of an embraſure, that is, its becoming wider exteriorly, than it is interiorly, muſt depend on circumſtances; but we generally find their ſides to diverge at an angle of about 12 or 15 degrees from a line paſſing through the centre of the ſlope, in a direction with the chace of the cannon when brought up ſquare to the *genouillere*. It ſhould, perhaps, ſeem proper to make the embraſure ſpread as widely as poſſible, for the purpoſe of including a greater extent of direction; but were ſuch to be practiſed, the *merlon*, *i. e.* the body of parapet left between any two embraſures, would be ſo conſiderably diminiſhed as to afford little protection from the enemy's ſhot, which would, at the ſame time, gain admiſſion, obliquely, into the battery, and diſmount the cannon by a plunging fire. On the other hand, it is abſolutely neceſſary to give ſuch an expanſion as may not only allow the reaſonable traverſing of the cannon, thereby to cover a greater extent of the approaches, but to prevent the *merlons* from being deſtroyed by the fire of their own cannon, of which the exploſion would ſpeedily bring down the revetements, whether of maſonry or of turf, unleſs ample ſpace were allowed for the concuſſion of the air created by the diſcharge to be ſufficiently weakened. We have heard of defences that were deſtroyed rather by the want of this conſideration, than from the enemy's fire. Where the *merlons* are of ſolid maſonry, and conſequently the thickneſs of the parapet inconſiderable, when compared with that attendant upon *merlons* made of ſoil, there may be allowed rather more contraction than in the latter caſe, becauſe the exploſion is not confined for ſuch a diſtance. Few caſes, however, can occur, in which the divergence of the ſides can come under ten, or exceed fifteen degrees. Where it is not adviſeable to keep all the intended embraſures open, or where deception is an object, they are either left unfiniſhed, the parapet being left entire, or their fronts are filled up with the ſame materials as the front of the parapet. The former is common in ſituations where the ſoil is looſe, and the difficulty of ſuſtaining the merlons conſiderable. When embraſures are cut through ſuch parapets, their ſides muſt be ſuſtained by *faſcines*, as in the caſe of field batteries, and approaches during a ſiege. The latter deſcription, *i.e.* the concealed embraſures, form what is called a maſked battery, which generally opens by ſurpriſe; the firſt diſcharge generally ſerving to clear away the ſlight work built up for the purpoſe of concealing the ſituations of the cannon. Where it is abſolutely neceſſary that cannon ſhould be allowed to traverſe freely in various directions, ſuch, for inſtance, as ſea-lines, where every gun ſhould be made to follow a ſhip paſſing with a rapid tide, and likewiſe in block-houſes mounting heavy ordnance on their roofs, no embraſures ſhould be made; but the cannon ſhould be mounted on carriages traverſing on pivots, and elevated above the body of the ramparts, which may nevertheleſs be made high enough to cover the defenders very completely. Cannon mounted in this manner command a great range of direction, and, though not ſo well ſecured from being diſmounted as when placed in embraſures, are pre-eminently ſerviceable in ſome ſituations. Batteries of this deſcription are called *barbet batteries*, and ſhould, with little exception, be invariably preferred, wherever they are not liable to be oppoſed by cannon, or where the force to be acted upon is expected to paſs with velocity, without being able to take a ſettled aim at the *barbet*. Mortar batteries have no embraſures, they requiring only a given line of direction, aided by due elevation, to effect their object; and, as both may be given without ſeeing it, the parapets of ſuch batteries are left entire. What are called embraſures on board bomb-ketches, are nothing more than temporary openings made by unſhipping hatches, and by fitting ſtout planks at the ſides to confine the ſparks from ſpreading within the veſſel. In caſemates, eſpecially thoſe in the *curtain*, &c. the embraſures are made like the portholes in a ſhip; that is, nearly ſquare, and allowing the muzzles of the cannon to paſs completely through.

EMBREGMA, an embrocation. The term is derived from εμβρεχω, *to make wet.*

EMBROCATION, or rather Embrochation, *Embrocha*, Εμβροχη, formed from βρεχω, *irrigo*, *I ſprinkle*, or *moiſten*, in *Pharmacy*, denotes the application of remedies, as oils, ſpirits, decoctions, and other liquids, by ſprinkling, or even rubbing them on the part affected: this is alſo called irrigation.

Embrocations are only a kind of lotions; they are uſed to remove obſtructions, and to relieve pains, numbneſs, and palſies. The pumping uſed in natural baths is properly an embrocation.

Embrocation, *gall.* See Gall.

EMBROIDERY, the enriching of a cloth, ſtuff, or muſlin, by working diverſe figures thereon with the needle, and thread of gold or ſilver.

The word embroidery is derived from the French *broiderie*, of *broider*, *to embroider;* which ſome deduce, by tranſpoſition, from *bordeur*, becauſe they formerly embroidered only the borders of ſtuffs, whence the Latins alſo call the embroiderers *limbularii*. Du-Cange obſerves, that they anciently wrote *aurobruſtus* for embroidered with gold, or *bruſtus brudatus*, and *brodatus*; whence *broderie*.

That done with ſilk, flax, or the like, is not now called embroidery; though anciently, and properly, the word denoted all kind of figuring or flouriſhing.

The chief uſe of embroidery is in church veſtments, cloaths, houſings, guidons, ſtandards, &c. The invention of embroidery is attributed to the Phrygians; whence the Latins call embroidered garments "veſtes Phrygioniæ," and embroiderers *Phrygiones*. In the "Menæchmi" of Plautus, (act ii. ſcene 3), a young woman, deſirous of ſending her mantle to be embroidered, ſays: "Pallam illam ad phrygionem ut deferas, ut reconcinnatur atque ut opera addantur, quæ volo." The Greeks ſeem to have uſed the words κεντειν and καταστιζειν, as we uſe the word embroider.

The embroidery of ſtuffs is performed in a kind of loom; that of muſlin is done by ſtretching it on a pattern already deſigned; the former kind is the moſt eaſy, but the latter admits of the greateſt richneſs and variety. The thinneſt muſlins are the beſt for this purpoſe; and they are embroidered to great perfection in Saxony.

There are diverſe kinds of embroidery; as *embroidery on both ſides*, that which appears on both ſides. *Guimped embroidery*, performed either in gold or ſilver. In this work, a ſketch is firſt made on the cloth, then they put on a cut vellum, and afterwards ſew on the gold and ſilver with ſilk thread, interſperſing ſilver and gold cord, tinſel, and ſpangles. *Embroidery on the ſtamp*, where the figures are very high and prominent, being ſupported on wool, cotton, hair, &c. *Low and plain embroidery*, where the figures are low and flat, and without any enrichment between them. It is probable that the covering of the ſword of Goliath, which was laid up in the tabernacle as a conſecrated memorial of the victory gained by David over that vain-glorious idolater, or the wrapper that enveloped it, was ſome beautiful piece of embroidered work. (1 Sam. xxi. 9.) By ſtatute 22 Geo. II. c. 36. no foreign embroidery, or gold or ſilver brocade, ſhall be imported, upon pain of being forfeited and burnt, and penalty of 100*l.* for each piece. No perſon ſhall ſell or expoſe to ſale any foreign embroidery, gold or ſilver thread, lace, fringe, brocade, or make up the ſame into any garment, upon pain of having it forfeited and burnt, and penalty of 100*l.* All ſuch embroidery, &c. found, may be ſeized and burnt, and the mercer, &c. in whoſe cuſtody it was found ſhall forfeit 100*l.*

EMBRUN, or Ambrun, in *Geography*, a town of France, in the department of the Upper Alps; chief place of a diſtrict of the ſame name, ſituated upon a high rock on the right ſhore of the river Durance, 66 miles S.W. of Grenoble, and 480 miles S. by E. of Paris, is chiefly remarkable for its cathedral, and has a population of 3138 individuals. The canton contains 8 communes and 9667 inhabitants, on a territorial extent of 285 kiliometres.

As chief place of a diſtrict Embrun has a ſub-prefect, two courts of juſtice, and a regiſter office. The whole diſtrict is extremely mountainous, but the vallies and the declivities of the mountains are uncommonly fertile. It contains five cantons, 36 communes, and 26,968 inhabitants, on a territorial extent of 1472½ kiliometres.

EMBRYO, or Embryon, in *Anatomy* and *Phyſiology*, is the child, with its coverings, as contained in the uterus previouſly to the time of birth. It is ſuppoſed at firſt to be in an imperfect ſtate, but to contain rudiments of all the parts, which, when fully developed, make up a perfect animal. The term is derived from the Greek word εμβρυον, which has the ſame ſignification, and is formed from εν, *in*, and ϐρυω, *I ſhoot out;* conveying a notion, that the living germ buds forth and expands in the uterus of the mother, as a ſeed is developed in the earth. The term embryo is employed, in its moſt ſtrict acceptation, during the firſt ſix weeks only after conception, but it is often uſed more generally during the whole time of utero geſtation. The young animal, after the firſt ſix weeks, is called a *fœtus;* but we uſe this word alſo to denote the ſame object as ſoon as it can be diſtinctly perceived. By the *ovum*, we underſtand the fœtus, together with its ſurrounding membranes; but that term is ſometimes applied to the latter only, in contradiſtinction to the former. We ſhall conſider, under the preſent article, the progreſs of the uterine contents, until the time of utero-geſtation is completed; the changes, which they paſs through, in the different ſtages of this period; the peculiarities of ſtructure belonging to the fœtus; and the mode of its nutrition and exiſtence.

A ſketch of the progreſs of the germ, after impregnation, from the ovarium into the uterus, and of its developement in the latter cavity, will be found in the article CONCEPTION; a more detailed hiſtory of the anatomy of the ovary and uterus, together with a ſtatement of all the facts that can be aſcertained concerning the mode of impregnation, and its immediate conſequences, will be contained under the head of GENERATION.

When the germ is detached from the ovarium, the mode of its exiſtence differs in the different claſſes of the animal kingdom. In the greateſt number of inſtances it is accompanied by an organized maſs, to which it adheres by means of veſſels, and the abſorption of which is ſufficient to nouriſh and develope it, until it is brought forth into the world. It requires no ſupply therefore from the body of the mother; and is even ſeparated from her by more or leſs numerous and ſolid coverings. The germ, together with the nutritious ſubſtance, and the common envelopes, conſtitute an *egg*, and the animals which propagate their ſpecies in this way, are called *oviparous*. In many of theſe, the germ contained in the egg is not developed and hatched, until the egg has quitted the body of the mother, or has been *laid;* in which caſe fecundation may be performed afterwards, as in many fiſhes, or external heat only may be required, as in the incubation of birds: or, laſtly, the natural temperature of the climate may ſuffice, as in reptiles and inſects. All theſe are *oviparous* animals, properly ſo called. In ſome others, the egg, after having been fecundated, and detached from the ovary, remains in the mother's body, until the young one is developed and hatched, as in the viper, and in ſeveral fiſhes: ſuch are falſely viviparous, or *ovo-viviparous* animals. Mammalia only are truly *viviparous;* their germ is provided with no ſupply of aliment, but derives the materials of its growth from the juices of the mother. For this purpoſe it is attached to the internal ſurface of the uterus, and occaſionally, by accident, to ſome other part, by a kind of root; by an infinite ramification of blood-veſſels, conſtituting the *placenta*. Inſtead, therefore, of being ſeparated by its coverings from the body of the mother, theſe are the medium of a moſt intimate connection between them, eſſentially neceſſary to the life of the germ. Through them there is a conſtant influx of nutritious juices until the embryo is completely developed. At that time the membranes are torn, and the young animal comes into the world, capable of enjoying an independent organic exiſtence, and free from all external covering. The very rare occurrence, of the child being born with its membranes entire, cannot be regarded as an exception to this aſſertion: Wriſberg only ſaw it three times in 2000 births; (ſee his Obſervat. de Structurâ ovi, p. 76.) and it is probably ſtill leſs common on the average. In the mammalia then there is no *egg*, in the ſenſe already explained: the membranes of their *ovum* being an intimate connection between the mother and the germ, by which the former ſupplies the latter with nouriſhment; while the *egg* is entirely detached, and contains, with the germ, the nouriſhment neceſſary for its growth. Hence we ſee that the old and much-conteſted maxim of "omnia ab ovo," cannot be received without great limitation, and is more likely to perplex, by confounding together things eſſentially different, than to impart any additional light to a ſubject already very obſcure.

The following parts, which are of courſe contained in the cavity of the pregnant uterus, make up the human ovum; *viz.* the *placenta, membranes, navel-ſtring, liquor amnii,* and *fœtus*. The three firſt are called alſo the ſecundines or after-birth; as they are expelled, in the act of parturition, after the child. The placenta and membranes every where line the cavity of the uterus, and the former muſt undoubtedly have ſome communication with the veſſels of the mother, although anatomiſts have not yet ſucceeded in demonſtrating the preciſe mode of that connection. In the membranous bag formed by the ſecundines, there is found, beſides the fœtus, a greater or ſmaller quantity of clear fluid, called the liquor amnii. The umbilical chord contains blood-veſſels, by which the circulating organs of the fœtus communicate with the arteries and veins of the placenta.

The ſecundines are all more or leſs gelatinous and tranſparent, and contain no manifeſt fibrous ſtructure. Being deſtroyed after every pregnancy, their exiſtence is temporary; and their organization correſponds to this limited term of duration. They never contain any fat, either in the ſound, or in the morbid ſtate of parts, at any period of utero-geſtation, however the mother or child may be circumſtanced in this reſpect.

The cavity of the uterus, examined immediately after conception, exhibits nothing which can be regarded as the fruits of that proceſs. In a few days, we perceive a tranſparent membranous veſicle, filled with a gelatinous liquor, but offering no appearance of organization or life. Some writers have aſſerted that ova may be found in the uterus of the human ſubject, or of animals, immediately after conception; and have even publiſhed delineations of them in the firſt days of pregnancy. Such ſtatements deſerve no credit. Thoſe modern phyſiologiſts, in whom we can place the greateſt confidence, have found, during the firſt ſeventeen days, nothing but a fluid like white of egg, in which there was no trace of any more conſiſtent body. Mr. Cruikſhank, however, has met with ova in the tubes and uteri of rabbits, at a much earlier period. He found them in the former ſituation on the third day after coition: they were mere points, but the diſtinction of the chorion and amnios could be diſcerned by the aid of magnifying powers. The fœtus was rendered viſible on the eighth day, by pouring vinegar on the ovum. We may regard all obſervations in which an ovum is ſaid to have been diſcovered in the human ſubject, earlier than the twentieth day, as extremely ſuſpicious: indeed, we know of no inſtance, in which it has been obſerved, before this time, by any perſon whoſe teſtimony has ſufficient authority. A round little body is gradually developed in the cavity of the uterus, and may be recognized at the end of the third week. This is the covering of the future, but not yet diſcernible fœtus. The ſurface of ſuch an ovum is probably flocculent from the firſt; this at leaſt is the caſe in the ſmalleſt hitherto delineated, and in well preſerved ſpecimens of very ſmall and early abortions. The flocculi are very fine vaſcular ramifications, connecting the ovum to the decidua, which reſembles in appearance a layer of coagulable lymph produced by inflammation. The reſemblance of theſe villi to the roots of a plant, the mode of their inſertion in the decidua, and the analogy of their function, in draining from the uterus and conveying to the child, the materials of its ſupport, to the office which roots perform, in extracting nouriſhment from the ſoil, has led almoſt every writer to compare the rudiment of the future animal to a ſeed, and to conſider its connection with the mother's body as ſimilar to that between a plant and the earth. The vaſcular proceſſes are ſmall in very young ova, but enlarge afterwards rapidly till the ſecond month: they gradually diſappear from two-thirds of the ſurface of the ovum, and are collected together on the remainder, to be united into a maſs, and form the placenta.

It has not been hitherto determined at what period the ovum becomes connected to the uterus; indeed it is ſo ſmall, at its firſt arrival in the cavity, that the inveſtigation is difficult. Cruikſhank ſays, that the ovum increaſes in the rabbit, to one hundred times its original ſize, before it becomes fixed to the uterus. The ſize of the ovum, at different periods of pregnancy, cannot be determined with much accuracy, becauſe many abortions are not well formed, and their exact age cannot be well aſcertained. Hence different writers contradict each other conſiderably in this point. Within the firſt month it is not larger than a hazel nut; in the ſecond and third it may equal a pigeon's or hen's egg. At the latter period its developement is complete, and the future changes are chiefly in ſize. It increaſes in proportion to the augmentation of the uterus.

Particular deſcription of the component parts of the ovum.— The membranous covering including the fœtus, within the uterus, conſiſts of ſeveral diſtinct parts, which admit eaſily of artificial ſeparation. The number of theſe has been very variouſly repreſented. The older anatomiſts only deſcribe two; *viz.*, the chorion and amnios; and divide the former into two laminæ. Moſt moderns deſcribe three coverings, adding the decidua of Hunter to the two former. Haller mentions four;—the membrana exterior ovi, chorion, membrana media, and amnios. Blumenbach's diviſion into the proper, and adventitious coverings is a good one: the latter are the chorion and amnios; the former, the decidua, which covers the ovum and lines the uterus.

The *decidua*, or *membrana caduca*, is the medium of connection between the embryo and the mother. In its appearance, as well as in its mode of formation, it reſembles the lamina of coagulating lymph, which is formed by inflamed ſurfaces. Both membranes are of a yellowiſh white colour; both are tender, pulpy, and vaſcular. The lamina of lymph is formed by an inflamed membrane; the uterus, before the appearance of the decidua, becomes much more vaſcular, and is probably in a ſtate of increaſed action analogous to inflammation. The developement of this membrane is probably anterior to the arrival of the germ in the uterus, and may be regarded as a meaſure of preparation for its reception. It is not neceſſary for the formation of the decidua, that the ovum ſhould reach the uterus. For when it grows in the ovarium, or in the Fallopian tube, the decidua is formed in the uterus, and that organ is conſiderably enlarged; ſo that it undergoes, to a certain degree, changes exactly ſimilar to thoſe which take place in natural pregnancy. It lines the whole internal ſurface of the uterus, being perforated at the Fallopian tubes, and cervix uteri. Numerous ſmall arteries and veins, often ſeen containing red blood, ramify from its outer ſurface inwards through its ſubſtance, and are derived from the veſſels of the uterus. It is very thin, and has no perceptible veſſels near the cervix uteri; but grows thicker and more vaſcular towards the placenta, at the very edge of which it acquires a conſiderable thickneſs, and ſplitting into two ſtrata, is continued over both ſurfaces of the placenta, but eſpecially the inner ſmooth ſurface, blending itſelf there inſeparably with the umbilical portion of the placenta. The layer of the decidua, which lies between the chorion and placenta, is in one caſe much thicker than in another. It ſometimes forms a ſmooth, tender, opaque membrane; but is more frequently reticulated, eſpecially towards the edge of the placenta, looking ſomewhat like lace. Occaſionally there are portions of it a good deal thicker than the reſt; which, ſhining through the tranſparent chorion, bear ſome reſemblance to pieces of fat. This layer is generally thicker than that which adheres to the rough, external, lobulated ſurface of the placenta. It communicates with that other, by means of the proceſſes of the decidua, which paſs between the lobules of the placenta, and along the external ſurface of the umbilical veſſels.

We have already obſerved, that the decidua adheres cloſely, on its external ſurface, to the uterus, and that this adheſion is effected by means of blood-veſſels paſſing to the former from the latter. By its means the whole external ſurface of the ovum grows to the uterus. Its internal ſurface is very cloſely attached to the chorion, ſo that their ſeparation is difficult in recent ſecundines. Gentle putrefaction makes them part eaſily; and we obſerve, on the ſeparation, numerous white ſlender threads, emerging from the ſubſtance of the chorion, and ramifying into ſmaller filaments upon the decidua. Theſe appear like veſſels by the aid of a magnifying glaſs.

As this membrane is an adventitious production of the internal ſurface of the uterus, formed for the temporary purpoſe of a connecting medium between the mother and the child; its office ceaſes as ſoon as the fœtus has quitted its original ſituation; and it is conſequently ſhed whenever a woman bears a child, or ſuffers a miſcarriage. Hence its names of *decidua* and *caduca*. As it may be partially ſeparated into two ſtrata, one of theſe is left on the uterus after delivery, and afterwards diſſolves, and comes away with the lochia. Frequently a thicker ſtratum ſeparates from the uterus in one part, and a thinner in another. The adheſion of the decidua to the uterus and chorion is ſtronger than that of the two layers of the membrane to each other; and hence, probably, we may explain the circumſtance of a ſtratum being left upon the uterus after parturition. The beſt method of ſeeing the decidua after labour, is to waſh the ſecundines well in warm water, to remove the looſe coagulated blood, and then put them into cold water, that the blood, which remains in the veſſels, may congeal. The decidua will then be very diſtinguiſhable by its yellowiſh appearance and pulpy conſiſtence; and numerous veſſels may be clearly diſcerned in its ſubſtance. The number and ſize of the veſſels, paſſing from the uterus to the decidua, ſufficiently account for the bleeding which always takes place on the ſeparation. Theſe veſſels are repreſented as filled with blood in Hunter's 29th plate, fig. 4: and in their injected ſtate in ſeveral other figures of the ſame work; *viz.* the arteries in fig. 3, tab. 24; the veins in tab. 24, fig. 4: and both kinds of veſſels coming from the uterus, in tab. 31. The ſecond fig. of tab. 29. of the ſame work, exhibits the reticulated lace-like appearance of the membrane, when viewed with magnifying powers: in this reſpect it much reſembles the adventitious productions of coagulating lymph.

The preceding deſcription applies to the decidua, as it is found in ova of ſeven, eight, or nine months. The membrane is very different in the earlier periods; and as the deſcriptions of anatomiſts have been derived chiefly from abortions, in which more or leſs of the decidua may come away with the ovum, and as the appearance of the membrane differs very much in the different periods, the accounts of it are very perplexed, and difficult to underſtand. The thickneſs of the membrane is in an inverſe ratio to the age of the embryo. In an early ſtate, too, its external ſurface is covered with numerous looſe and floating flocculi, by which it adheres to the ſurface of the uterus; theſe are not ſeen at more advanced periods: they are excellently repreſented in an abortion of the ſeventh week, in two beautiful figures, forming the vignette of the title page of Soemmerring's Icones Embryonum Humanorum: alſo in Hunter, figs. 1, and 2. pl. 33.

From the time that the ovum has acquired ſome ſize, until about the fourth month, the decidua not only lines the whole cavity of the uterus, but alſo gives another covering to that part of the chorion, which is not occupied by the placenta. This ſecond inveſtment is continuous with the former at the edge of the placenta; and, as it appears at this part as if reflected from the exterior layer over the ovum, Dr. Hunter, to whom we are indebted for the moſt accurate obſervations on the whole ſubject, called it *decidua reflexa;* the addition of Hunteri is often made by foreign anatomiſts. He compares, in the explanation of pl. 33, fig. 1, the reflection of the decidua over the ovum, to that of the pericardium over the heart; and the compariſon might be correct, if the exterior portion of the pericardium covered the whole of the heart, as the outer layer of decidua does the whole ovum. According, then, to the preceding deſcription, we may diſtinguiſh three portions of decidua, all, however, completely connected together; 1ſt. The exterior portion, covering the whole ovum, and lining the whole uterus, excepting the apertures correſponding to the Fallopian tubes and cervix; *decidua uteri, d. vera, membrana ovi exterior* of Haller, membrana caduca *craſſa* of Mayer (Beſchreib. des menſchlichen Körpers, v. 5. ſ. 272.) becauſe it is thicker than the reflected portion, firſt membrane of the ovum of Mekel, decidua externa of Sandifort, and external lamella of the Hunterian decidua of ſome authors. 2dly. A production over the concave ſurface of the placenta. 3dly. D. *reflexa*, covering the chorion, and continuous at the margin of the placenta, with the D. uteri. This is Blumenbach's acquired membrane, Mekel's ſecond membrane, villoſa membrana placentæ, involucrum membranaceum of Albinus, membrana filamentoſa of Wriſberg and Roderer, chorion of Haller, chorion fungoſum, flocculentum, &c., ſpongy chorion, reflected vaſcular membrane, &c. Denman calls it connecting membrane, and Baillie decidua chorii. A cavity muſt neceſſarily be intercepted between this and the d. uteri. The diſtinction of theſe two parts, and their relative poſition, are beſt ſeen in the plates of Hunter; as in fig. 1, of tab. 28: alſo in a perpendicular ſection of the uterus, containing an ovum of three months, repreſented in tab. 32, where the letters *k*, *l*, *m*, *n*, *o*, repreſent the two deciduæ, the angle of reflection, and the cavity left between them. The ſame facts are alſo repreſented in two abortions, figs. 1, 2, 3, and 4, of tab. 33. The d. reflexa covers the ſhaggy veſſels of the chorion, which ſeem to be implanted in it. In proportion as pregnancy advances, it becomes gradually thinner and thinner, ſo that at the fourth month it forms an extremely fine layer covering the chorion. It comes at the ſame time into more cloſe contact with the d. uteri, and, at length, the two adhere together. Yet the membrane diminiſhes in thickneſs, and continues to decreaſe until parturition. How it comes to paſs, that the decidua ſhould envelope the ovum in the way already deſcribed, is mere matter of ſuppoſition, and does not admit of being ſhewn by direct demonſtration. In two examinations, mentioned by Dr. Baillie as having been performed with great care at an early period of pregnancy, the decidua was already formed, but no ovum could be diſcovered.

In the 18th fig. of his work already quoted, Soemmerring has given an excellent view of the external ſurface of an ovum of five months. It appears on cloſe inſpection covered with fine and thinly ſcattered flocculi, which are the moſt numerous and long in the ſituation of the placenta. The firſt, or external coat, (the decidua,) is continued into the placenta, or the placenta is extenuated into this membrane, in ſuch a way, that we might, with equal propriety, either regard the placenta as the thickeſt portion of the decidua, or the decidua as an extenuated production from the placenta. The decidua grows gradually thinner as we recede from the placenta, ſo that its thinneſt portion is preciſely oppoſite to the placenta.

The *chorion* is that covering of the ovum which is placed next in order to the decidua. It is the firſt proper membrane of Blumenbach, the third membrame of Mekel, and the ſecond of many anatomiſts; the membrana media of Haller, chorion pellucidum or læve.

It is a firm and ſtrong membrane, forming a complete bag, which includes the amnios and child. It adheres firmly to the concave ſurface of the placenta, and in that ſituation is thicker, and covers the great diviſions of the umbilical veſſels; being cloſely attached to the amnios at the inſertion of the umbilical chord. At firſt it is nearly tranſparent, and tender in its texture: as the ovum increaſes, it becomes more opaque, ſtronger, and of a yellowiſh colour. We have mentioned already how its external ſurface adheres to the decidua, and the threads connecting them together, which ſeem to be veſſels. Theſe are the only veſſels which the membrane poſſeſſes.

The external ſurface of the chorion is covered completely with flocculi in the firſt month of pregnancy. A great abundance of thin tender threads of different thickneſs ariſe from it. Theſe divide and ſubdivide in a very minute manner, and the neighbouring ramifications join each other. They are extremely ſmall on very young ova; but they cover the whole ſurface at the end of the firſt, and in the ſecond month. They diſappear from ſome parts in the third month; and collect cloſer together towards the upper part of the ovum, in order to form the placenta.

The decidua reflexa, covering this external ſurface of the chorion, unites the flocculi together; which penetrate it, and are implanted in the decidua uteri. Many erroneous names and repreſentations have ariſen from this ſtructure, becauſe the proceſſes of the chorion have been regarded as belonging to the d. reflexa; and hence many of the names applied to that membrane have ariſen.

In the fourth, fifth, and ſixth months the chorion is ſmooth on the greateſt part of its external ſurface. The d. reflexa, which is now thin and ſcarcely recognizable, is cloſe upon it. When the placenta is formed, the external ſurface of the chorion is firmly attached to its concavity.

The internal ſurface of the chorion is ſmooth, and united to the amnios: In the firſt month there is a conſiderable interval between the two membranes, filled with a clear aqueous fluid, probably produced by the veſſels of the chorion: this ſpace is ſoon diminiſhed; the amnios growing faſter than the chorion, the two membranes ſoon come in contact. In the third month they lie near together, and are looſely connected by a tender gelatinous medium.

Twins have a double chorion, as well as amnios; but are covered by a common decidua reflexa.

Amnios; the ſecond proper membrane of Blumenbach; and fourth membrane of Haller and Mekel; is found univerſally in animals. In man it forms an oval bag, including a certain portion of fluid, and the fœtus. It is a thin tranſparent membrane, of tolerably firm conſiſtence. Its external ſurface is connected, in the way already deſcribed, with the chorion, from which it is eaſily ſeparable. It lines the concave ſurface of the placenta, and terminates, apparently, by a cloſe adheſion at the inſertion of the navel-ſtring, where the chorion alſo ſeems to end. The gelatinous ſubſtance connecting the two membranes adheres more cloſely to the amnios than to the chorion, and hence the former membrane has a rough appearance, when ſeparated. The internal ſurface is every where perfectly ſmooth. In birds and quadrupeds it poſſeſſes manifeſt veſſels; but none in the human ſubject.

The allantois, which was formerly enumerated among the membranes of the human ovum, is now known to be peculiar to quadrupeds.

There is, however, a ſmall membranous bag, named *veſicula umbilicalis*, found in the early months of pregnancy between the amnios and chorion. This poſſeſſes an elliptical figure, and contains a clear fluid. It contracts into a thin and round thread, which runs along the navel-ſtring, and divides into two at the inſertion of the umbilical chord in the child's body. They are afterwards loſt upon the viſcera. This veſicula can only be ſeen until the third month, and in very freſh abortions; for it is ſo delicate that it decays very quickly; and it is extremely difficult to trace the thread from it through the umbilical chord. Its ſize is in an inverſe ratio to the age of the embryo.

Liquor amnii is the name given to the fluid which fills the cavity of that membrane. This is perceivable as ſoon as the ovum can be diſcerned; it diſtends the membranes, and preſerves their rounded form. Its quantity is the largeſt, in proportion to the ſize of the embryo, in the firſt month of pregnancy; ſo that in the firſt and ſecond it conſiderably exceeds the weight of the fœtus, which muſt conſequently be looſely ſuſpended in the fluid. The fœtus weighs more in the third month than the liquor amnii; and, as it touches the membranes in the fifth, the proportional quantity of the water has very greatly decreaſed; ſo that it merely filled up the intervals cauſed by the inequalities of the child's body. Stein, an experienced German writer, ſtates that the weight of the fœtus and the amniotic fluid ſhould be equal about the middle of pregnancy; and that it muſt be regarded as an unnatural appearance, if the latter exceeds the former in the ſixth month. It continues afterwards conſtantly decreaſing relatively to the increaſe of the child. The quantity varies greatly in different ſubjects; from one to two pounds is the ordinary proportion at the period of nine months; but it may be much more or leſs. It is a clear yellowiſh fluid; but ſometimes differently coloured and obſcure. In its pure ſtate it poſſeſſes no ſmell, and a mild ſaltiſh taſte. Heat and alcohol coagulate it in the recent ſtate; but the chief bulk of it is aqueous. The ſources of the ſecretion are unknown. The abſurd opinions, by which it has been ſuppoſed to proceed from the ſkin or various other parts of the fœtus, are ſufficiently refuted by the fact of its exiſtence when there is no fœtus. The amnios poſſeſſes no apparent veſſels. For an account of the chemical properties of this fluid, ſee the article AMNIOS.

The old opinion of the uſe of the amniotic fluid in nouriſhing the fœtus cannot be ſuſtained; for deglutition could not be performed without the preſence of air; many fœtuſes are born with the mouth cloſely ſhut, and others have grown to the full ſize without any mouth at all. The great uſe of the fluid ſeems to be that of protecting the fœtus from external violence; and hence we find it moſt copious when the child is youngeſt and moſt delicate in texture, to prevent its different parts from adhering together, or to the ſurrounding membranes. The buſineſs of parturition, as far at leaſt as the dilatation of the os uteri is concerned, is alſo facilitated by the liquor amnii.

The *umbilical chord*, *funis* or *funiculus umbilicalis*, or navel-ſtring, made up of three large veſſels twiſted together, united by more or leſs gelatinous ſubſtance, and conſtituting, in conſequence of certain convolutions of the veſſels, an irregular rope, rather leſs in general than the ſize of the little finger, is fixed at one end to the child's navel, and at the other to the placenta. This being the organ of communication, through which the materials of growth and nouriſhment are derived to the fœtus from the mother, conſtitutes a moſt eſſential part of the ſecundines, and can never be deficient. It paſſes through the liquor amnii, from the child to the reſt of the ſecundines; is commonly about two feet long, but may be no more than one foot, or on the contrary exceed four feet. Wriſberg once ſaw it only ſeven inches long; and it was neceſſary to cut it in the courſe of the delivery. Its moſt frequent length is between 18 and 22 inches. The younger the fœtus, the ſhorter is the chord proportionally. It is alſo thicker relatively to the ſize of the fœtus, as that is younger. It is uſually turned round ſome part of the child's body; very commonly round the neck, which it has been ſeen to encircle four times and a half.

From the important function performed by the navel-ſtring, we ſhall expect to find it as ſoon as the embryo itſelf is perceptible; and conſequently it is ſeen as ſoon as the fœtus itſelf is viſible.

The veſſels of the chord are two umbilical arteries, and one umbilical vein. The two arteries are of equal ſize, and poſſeſs ſtrong coats, ſo that their ſection preſents a circular area. In rare inſtances there is only one. The umbilical arteries are a continuation of the internal iliacs; which, inſtead of deſcending into the pelvis, aſcend along the ſide of the bladder to the umbilicus. When there is only one umbilical artery, the internal iliac of one ſide only is reflected along the bladder. The internal iliac, which in the adult is no larger, but rather ſmaller than the external, is conſiderably the largeſt of the two in the fœtus. It paſſes obliquely from the ſide of the pelvis to that of the bladder, and takes the name of umbilical or hypogaſtric; croſſing the ureter in ſuch a manner that that tube lies internally, and the artery externally. It aſcends along the ſide to the fundus of the bladder, and proceeds over the ſurface of the peritoneum, to the umbilicus. Theſe veſſels make very numerous convolutions and turnings which differ conſiderably in different ſubjects: and hence they are much longer than the length of the chord. In the ſituation of theſe turns, the diameter of the veſſels will appear contracted, and theſe contractions are the *quaſi-valvulæ* of Hoboken.

The third veſſel of the chord is the umbilical vein, which ariſes from the placenta, forms numerous convolutions, in company with the arteries, and enters the child's body at the umbilicus. Paſſing over the ſurface of the peritoneum, it arrives at the ſuſpenſory ligament of the liver; deſcends along its anterior margin to the foſſa, dividing the two lobes; and there enters the ſubſtance of the liver. It diſtributes ſeveral branches to this viſcus, particularly to its left lobe, and ends by an anaſtomoſis of its trunk, with the left branch of the vena portarum. From the veſſel formed by this union a ſmall canal, about three quarters of an inch in length, is continued into the inferior vena cava, under the name of *ductus venoſus*.

The umbilical vein is much larger than the artery, and its ſides collapſe when divided. It is ſaid that two veins have been ſeen; but Dr. Hunter never met with a caſe; quadrupeds have two. The umbilical veſſels give off no viſible branches till they come to the placenta; then the two arteries anaſtomoſe, commonly by a croſs canal, nearly of the ſize of one of the arteries.

“ There is a great variety,” ſays Dr. Hunter, “ in the twiſting of the veſſels of the navel-ſtring. Sometimes they are uniformly and cloſely twiſted like a rope, in their whole courſe; and ſometimes they run almoſt ſtraight and parallel, eſpecially in that part of the ſtring which is towards the placenta; for near the fœtus it is almoſt always more or leſs twiſted. In ſome navel-ſtrings there is a great irregularity, from ſolitary turnings of particular veſſels, commonly called knots, as we ſee in twiſting a cord, where ſome of the conſtituent threads are longer and therefore looſer than others. The end of the navel-ſtring which is next the placenta, is always leſs twiſted, and more uniform than the end which is next the fœtus.

“ Whatever be the cauſe, in moſt which I have attended to, the twiſting of the navel-ſtring has been in the ſame direction, *viz.* ſuch as would be produced in turning the child round upon the navel, as a centre, by puſhing its head towards the right ſide, and its feet to the left. In two and thirty preparations now before me, four only are twiſted the contrary way; and of the twenty-eight which are twiſted in the common way, three have the contrary twiſt for ſome inches, at the extremity, which was towards the fœtus.” The veſſels appear to be ſtraight in young embryos. When the chord is very long, *true* knots are formed in it; as diſtinguiſhed from thoſe which ariſe merely from projections of particular veſſels. Theſe are not ſuppoſed in general to affect the communication between the mother and child, but Dr. Hunter thinks he has ſeen two caſes in which it was obſtructed from this cauſe. The true knots are ſometimes double, as if twice tied; and in very rare caſes treble.

The *urachus* is another part belonging to the umbilical chord; it is a ſmall fibrous ſtring aſcending from the fundus of the bladder to the navel, between the umbilical arteries, and growing more ſlender as it proceeds. In the navel-ſtring it is hardly perceptible, except near the fœtus; it is like a fine thread, a little more white and opaque than the reſt. When once found near the fœtus, it may be traced, with a little trouble, nearly the whole length of the ſtring. This part is a canal in the embryo of animals, leading from the bladder to the allantois; but the latter membrane not exiſting in the human ſubject, the urachus is ſolid. Portal, who has inveſtigated the matter very attentively, found the urachus to conſiſt of four threads in embryos of five and ſix months. Theſe paſs together from the navel to the bladder; then ſeparate and expand over the latter organ. In the eighth and ninth month, theſe threads can hardly be ſeparated. The urachus altogether is largeſt in the youngeſt embryos.

The covering of the navel-ſtring, which is ſmooth and poliſhed, is conſidered to ariſe from a reflection of the amnios. Both that membrane and the chorion are firmly adherent to the chord, at its connection with the placenta; and the covering of the chord itſelf is moſt firmly connected with the ſubjacent ſubſtance, ſo that it cannot be ſeparated like a diſtinct membrane. The integuments of the abdomen are continued for a ſhort ſpace over the chord, and there is an abrupt line obſerved at their termination, beyond which not even the cuticle is continued. The ſeparation is much more ſtrongly marked, when the integuments are minutely injected, by the ſudden ending of the injection, no veſſel extending into the chord. The tying of the chord without the leaſt pain is a ſufficient proof that it has nothing to do with the ſkin.

The ſtrong connection between the abdomen of the child, and the chord, is produced by the three umbilical veſſels, penetrating the tendinous opening of the linea alba. They run externally to the peritoneum, which lies behind them entire and unperforated. The oppoſite end of the funis is connected with equal ſtrength to the placenta, both by the continuation of the veſſels into that body, and by the cloſe adheſion of the chorion and amnios.

Beſides the veſſels, the urachus, and the coat of the navel-ſtring, it contains nothing but a fine cellular ſubſtance, loaded with a tranſparent ropy fluid, giving the part both firmneſs and bulk. By touching the cut ſurface of the freſh funis, and removing the finger ſlowly, we ſee the fluid ſo tenacious and ductile, as to be drawn out into fine threads ſome inches in length. When it has been kept ſome days, the fluid loſes entirely that glutinous quality, and tranſudes like water; by which means the ſtring loſes much of its bulk. In this ſtate, if a ſmall blowpipe be puſhed into the interſtices of the veſſels, and proper ligatures be made, the whole interſtitial ſubſtance may be rendered emphyſematous and white. In this condition it may be dried, and then cut up to ſhew the cellular ſubſtance more diſtinctly. The great variety that is obſerved in the thickneſs or ſize of the navel-ſtring in different parts, and in different caſes, depends principally on the quantity of the cellular ſubſtance, and not on the bulk of the child.

Dr. Hunter thinks that “ the winding courſe of the veſſels in the navel-ſtring prevents their being much affected by any ſtretching force, and the firmneſs of the interſtitial ſubſtance, protects them againſt dangerous compreſſion. Theſe accidents might otherwiſe perhaps have occaſioned frequent miſchief, eſpecially where there is a large child, and a ſmall quantity of the liquor amnii. In ſuch a caſe the navel-ſtring paſſing under the arm or ham, or in the groin, might have been compreſſed, ſo as to prevent the return of the venous blood at leaſt. The ſame thing might have eaſily happened, where a knot is formed upon the navel-ſtring.”

The umbilical arteries divide in the placenta into ſmaller and ſmaller ramifications; and their ultimate branches communicate with the umbilical veins; injected fluids at leaſt return very readily by this courſe. The vein is made up by the union of the minute branches into larger and larger trunks. In the early periods of pregnancy, the umbilical veſſels branching out very minutely, conſtitute the flocculi of the chorion.

Placenta.—This, together with the membranes, makes a complete bag lining the uterus, and containing the child. As Dr. Hunter has done much in elucidating its ſtructure, and has given a very good account of the ſubject, we ſhall avail ourſelves chiefly of his labours.

Its figure is commonly round and flat; it is about an inch in thickneſs and a ſpan in breadth. It grows gradually thinner towards the edge, ſo as to render the change from the placenta to the membranes more imperceptible. When the cellular part is well filled with wax, or any fluid, it is at leaſt two inches thick. Its ſhape is often oblong or triangular, or irregular; and ſometimes there is a ſmall lobe or two entirely diſtinct from the reſt. The outer ſurface, which adheres to the womb, and is therefore naturally convex, is rough, tender in its ſubſtance, commonly covered with blood, lightly ſubdivided into ſmaller conſtituent lobes, and, to a common obſerver, apparently poſſeſſing no blood-veſſels, or at leaſt none of any conſiderable ſize. The internal ſurface, naturally more or leſs concave, is gloſſy, hard or compact in its texture, and beautifully marked with the ramifications of the umbilical veſſels. The navel-ſtring, which produces theſe branching veſſels, is inſerted ſometimes into the very centre, but more commonly a little nearer the edge, and often into the very edge of the placenta. In four different inſtances, Dr. Hunter ſaw the navel-ſtring terminate on the inſide of the membranes, at the diſtance of five or ſix inches from the placenta. In all theſe caſes the umbilical veſſels parted from one another even to conſiderable diſtances in their courſe upon the membranes, and came to the edge and inner ſurface of the placenta at different places, even at the oppoſite parts. The termination or inſertion of the navel-ſtring, wherever it happens to be, makes the centre of ramification for the large veſſels on the internal ſurface of the placenta.

The human placenta, like that of quadrupeds, is a compoſition of two parts intimately blended, *viz.* an umbilical or infantile, and an uterine portion. The former is made up by the ramification of the umbilical veſſels of the fœtus; the other is a certain portion of the decidua, produced, as we have already deſcribed, from the ſurface of the uterus. The umbilical portion of the placenta is made by a regular ramification of the arteries and veins of the navel-ſtring into ſmaller and ſmaller branches, without any lateral anaſtomoſis, ſo that when unravelled by gentle putrefaction, motion, and waſhing, this part takes on the appearance of a tree whoſe branches divide to almoſt infinite minuteneſs, not only towards its outer ſurface, but every where through its ſubſtance.

The two umbilical arteries anaſtomoſe freely by a canal of communication juſt where they are going to branch out upon the placenta, ſo that by injecting one of them, the other is readily filled alſo. Every branch of an artery is attended with a branch of a vein; theſe cling to one another, and frequently, in the ſubſtance of the placenta, entwine round one another as in the navel-ſtring.

Injections prove, both in the human ſubjects and in quadrupeds, that the umbilical arteries terminate in the veins of the ſame name, and not in the veſſels of the uterus; and that the blood paſſes from the arteries into the veins, as in other parts, and ſo back to the child again. If the placenta be whole in all its ſubſtance, which is ſeldom the caſe, and its blood-veſſels be pretty well emptied of their blood, any ſubtile injection thrown into an artery will fill the arterial ſyſtem through the whole ſubſtance of the part to an amazing degree of minuteneſs, and return ſo freely by the veins as to fill them very generally and equally. In the ſame manner the whole umbilical ſyſtem may be filled by injecting the vein, the fluid returning from the veins into the arteries. In both theſe experiments the injected fluid is confined to the umbilical vaſcular ſyſtem, none eſcaping at the external ſurface of the placenta, neither by large nor ſmall orifices, whether of veins or arteries.

When a placenta is finely injected, and then ſteeped, and frequently waſhed in clear water, it is evident that the umbilical veſſels do not reach even the outer ſurface of the placenta, but are only ſeen through a membrane (decidua,) which covers all that ſurface. It is rough or ragged, like the inner ſurface of the uterus, to which it adheres, and by its whiteneſs becomes very diſtinct from the vaſcular injected part of the placenta, over which it is ſpread. It becomes ſtill more diſtinguiſhable when the part is put into ſpirits, which render it more opaque and whiter. This membrane is an effloreſcence or production of the inner membrane of the uterus, and is analogous to the uterine fungi of quadrupeds. It receives no veſſels, demonſtrable by the fineſt injections, from thoſe of the navel-ſtring, yet it is full of both large and ſmall arteries and veins. Theſe are all branches of the uterine veſſels, and are readily filled by injecting the arteries and veins of the uterus; and they all break through in ſeparating the placenta from the uterus, leaving correſponding orifices on the two parted ſurfaces.

This decidua, or uterine portion of the placenta, is not a ſimple thin membrane expanded over the ſurface of the part, it produces a thouſand irregular proceſſes which pervade the ſubſtance of the placenta, as deep as the chorion or inner ſurface; and are every where ſo blended and entangled with the ramifications of the umbilical ſyſtem, that no anatomiſt will perhaps be able to diſcover the nature of their union. While theſe two parts are combined, the placenta makes a pretty firm maſs; no part of it is looſe or floating. But when they are carefully ſeparated, the umbilical ſyſtem is evidently nothing but looſe floating ramifications of the umbilical veſſels, like that vaſcular portion of the chorion which makes part of the placenta in a calf; and the uterine part is ſeen ſhooting out into innumerable floating proceſſes and rugæ, with the moſt irregular and moſt minutely ſubdivided cavities between them that can be conceived. This part anſwers to the uterine fungus of the quadrupeds. In a placenta at nine months the two conſtituent parts can only be ſeparated by ſome degree of putrefaction, and gentle rubbing and waſhing; but this operation always deſtroys the uterine portion, which is more tender, and yields to putrefaction ſooner than the other. In the placenta of an earlier age, the union of the two conſtituent portions is leſs intimate, and they may both be preſerved very entire, like the vaſcular chorion and fungus of the quadruped. Dr. Hunter ſeparated them in a conception of four months, and left the uterine portion attached to the inſide of the uterus.

The two portions of the placenta are ſo interwoven with each other as to leave innumerable ſmall vacuities, with free communications, through the whole ſubſtance. If this cellular ſtructure be inflated or injected, the placenta, like the corpora cavernoſa penis, acquires a very conſiderable increaſe of thickneſs, and ſubſides again when the fluid eſcapes. This cellular receptacle in the placenta cannot be completely filled after it has been parted from the uterus, becauſe then the fluid, which we may by any contrivance throw in, will be diſcharged at innumerable orifices on the outer ſurface of the placenta; but while it remains attached to the uterus, all the cells may be eaſily and completely filled by injecting any fluid into the arteries or veins of the uterus. Theſe veſſels, and theſe only, have a demonſtrable communication with the ſpongy cells of the placenta, which receive the maternal blood from the arteries of the uterus, and give it back into the veins of that part. Both theſe veſſels paſs in the decidua, and the larger branches of both, with little or no ramification, terminate abruptly in the cells. The arteries are all much convoluted and ſerpentine; the larger, when injected, are almoſt of the ſize of crow-quills. The veins have frequent anaſtomoſes, paſs in a very ſlanting direction, and generally appear flattened; ſome of them are at leaſt as big as a gooſe-quill, and many of them are very ſmall. They are very numerous round the edge of the placenta, and many run for a little way, in the direction of tangents to the circle, in the very angle between the membranes and the placenta.

In ſeparating the latter part from the uterus, which can be effected with very ſlight force, all theſe veſſels are neceſſarily torn through; and then each broken veſſel has an open mouth on the inner ſurface of the uterus, and a correſponding orifice on the outer ſurface of the placenta. They may be readily obſerved on a freſh placenta, as ſoon as it has come away in a common labour. Air blown into the cellular part by thruſting in the end of a blow-pipe, ruſhes out readily by the open mouths both of the arteries and veins.

While the placenta remains adhering to the uterus, injection will paſs either from the uterine arteries or veins into the cells of that organ; and, after filling theſe cells, it returns by the oppoſite order of veſſels to that by which it was thrown in. Hence, if we wiſh to inject both ſyſtems in the gravid uterus, we ſhould fill the firſt only moderately, and then the other.

The venous ſyſtem of the decidua and uterus may be filled with air from the cells of the placenta. Introduce a blunt probe through a ſlit in the coat of the navel-ſtring, and force it into the cells of the adjacent part of the placenta; then, withdrawing the probe, inſinuate an injecting pipe, and tie it firmly with a broad thread round the navel-ſtring. By that pipe you may fill the whole placenta uniformly in its cellular part, and likewiſe all the venous ſyſtem of the uterus and decidua, as readily and fully as if you had fixed the pipe in the ſpermatic or hypogaſtric vein; ſo ready a paſſage is there reciprocally between the cells of the placenta, and the uterine veſſels. It is as much reciprocal, and more largely open, than between the corpus ſpongioſum and the veins of the penis.

From all his experiments, repeatedly and diligently made, Dr. Hunter concludes, that the human placenta, like that of the quadruped, is compoſed of two diſtinct parts, though blended together, *viz.* an umbilical, which may be conſidered as a part of the fœtus, and an uterine, which belongs to the mother; that each of thoſe parts has its peculiar ſyſtem of arteries and veins, and its peculiar circulation, receiving blood by its arteries, and returning it by its veins; that the circulation through theſe two parts of the placenta differs in the following manner; in the umbilical portion the arteries terminate in the veins by a continuity of canal, whereas in the uterine portion there are intermediate cells, into which the arteries terminate, and from which the veins begin. Though the placenta be completely filled with any injection thrown into the uterine veſſels, none of the wax finds its way into any of the umbilical veſſels; and in the ſame manner fluids injected into the umbilical veſſels can never be puſhed into the uterine, except by rupture or tranſudation.

Several views of the arteries and veins, which paſs from the uterus to the placenta, are exhibited in Dr. Hunter's plates; ſee Tab. 15. fig. 1. Tab. 19. Tab. 29. fig. 1. and Tab. 30. and the ſame veſſels on the ſurface of the uterus in fig. 3. Tab. 10. and fig. 2. Tab. 28.

It has been ſtated already, that the human placenta is made of a ſingle maſs; but ſome varieties have been obſerved in this reſpect. It poſſeſſes ſometimes a ſmall appendix; or it may be made up of three or more ſmall pieces, united by means of the chorion. Wriſberg ſaw a placenta compoſed of ſeven pieces. Where there are twins, or three children, the placenta is uſually ſingle; but there may be two or three ſeparate ones united by the amnios, which forms the partition of the bags containing the children.

The Fœtus.—The proportions of parts, and conſequently the whole figure of the fœtus, differ very much before birth, from that which they poſſeſs afterwards; and they differ alſo very conſiderably at different periods of utero-geſtation. Influenced by their opinions of the beauty and due proportions belonging to the human frame in later ſtages of exiſtence, many have called the fœtus, in its early periods, ſhapeleſs and deſtitute of ſymmetry; not reflecting that a different figure and relation of parts belongs, in the order of nature, to the age we are ſpeaking of, and that this may ſtill be beautiful and ſymmetrical according to the ſtandard of that age. While the roſe is ſtill incloſed in the calyx, its appearance is very different from that which it exhibits when the petals burſt forth from their confinement, and the whole flower is diſplayed in its mature and perfect ſtate: yet we do not deem the roſe bud inelegant or imperfect in its form. We may affirm, on the ſame principles, that every age in the human ſubject is diſtinguiſhed by its peculiar kind of beauty; that the embryo, the fœtus, the infant, the youth, &c. poſſeſs their reſpective proportions, thoſe of each differing from the others; and conſequently, that an embryo may, with propriety, be termed beautiful, if its formation correſpond to the ſtandard of its age. It is true, indeed, that the fœtus in abortions is often ill-formed, being ſmaller than it ſhould be, deviating from the uſual proportions, or monſtrous; and, very probably, this mal-formation may be one of the cauſes why ſuch embryos die, and are ſeparated with the ovum from the uterus; juſt as we ſee that miſ-ſhapen or worm-eaten fruits ſeldom arrive at maturity, but have their further growth impeded by that very cauſe. To the ſame purport it is obſerved by Autenrieth, § 8, "that he found three monſtrous fœtuſes, out of nineteen, whoſe parts could be diſtinguiſhed; that Wriſberg met with two among five, which he examined; and Ruyſch two in twelve; the proportion of the whole being ſeven in twenty-nine. This large number, (if we conſider, at the ſame time, that all the collections of anatomical preparations abound with monſtrous fœtuſes, which have died immediately after birth, while adult monſters are extremely rare,) renders it very probable that nature employs the ſhort, but effectual means of extirpation, in order to preſerve the genuine figure of the human frame, and that one model only, of all thoſe into which the human frame may paſs, is endued with permanent vital powers." This author obſerves alſo, that a greater number of abortive embryos are of the male than of the female ſex; and this obſervation is confirmed by Soemmering, who extends it likewiſe to monſters.

It is extremely difficult to aſcertain at what exact time the fœtus of an ovum becomes viſible; becauſe it is almoſt always impoſſible, in the human ſubject, to aſcertain the date of the impregnation. Dr. Baillie ſtates, that he ſaw a preparation in the poſſeſſion of Dr. Combe, where, from peculiar circumſtances, it had been aſcertained that the conception was twenty-two days old, and where the fœtus was viſible, although extremely ſmall. In an abortion, which came away after the firſt ceſſation of the catamenia, diſſected by Blumenbach, and exhibited in the 4th table of his "Inſtitutiones Phyſiologicæ," the amnios was about the ſize of a large pea, but no veſtige of the fœtus could be diſcerned.

The following account of the ſucceſſive developement of the embryo is derived chiefly from Soemmering's work, "Icones Embryonum Humanorum," which is chiefly devoted to this ſubject, and exhibits a moſt beautiful ſeries of embryos from the earlieſt period to the fifth month.

Generally ſpeaking, the embryo grows the moſt rapidly in the firſt weeks after conception; the rate of its progreſs afterwards diminiſhes to the ninth month: this growth, however, does not proceed uniformly at all times. It is gradually retarded in the ſecond month, accelerated in the third; ſtopped again in the beginning of the fourth, and continued more rapidly from the middle of that month to the ſixth; from which time it is again retarded till the period of maturity. A ſimilar obſervation has been made concerning the chief viſcus of the embryo, by Walter, the ſon. (Annot. Acad. de hepate, § 8.) He found that the rapid and prodigious growth of the liver did not continue beyond the end of the fourth month. It appears, moreover, that different parts of the body of the embryo grow very differently; and that ſome arrive at a certain degree of perfection ſooner than others.

The younger the embryo, the larger is the containing ovum. That part, therefore, in proportion to the fœtus, is the largeſt, moſt capacious, thickeſt, and firmeſt, in the earlieſt periods after conception; and the ſmalleſt, thinneſt, and moſt tender, at the complete term of utero-geſtation. At the middle of pregnancy it exhibits an intermediate ſtate between theſe extremes.

In the firſt and ſecond months the embryo is completely bent; a little ſtraightened in the following month, and afterwards, as the limbs increaſe, convoluted into a kind of oval-ſhape. The head is brought forwards on the cheſt during the whole period of utero-geſtation. The younger the embryo, the greater is the bulk of the head, compared to that of the trunk; or, what is equivalent, the trunk is ſmalleſt at that time. The head muſt conſequently be the largeſt when it can be firſt diſtinguiſhed. In the firſt month the head conſiderably exceeds the ſize of the reſt of the body. Its growth goes on leſs rapidly after this time, and does not exceed that of the trunk; ſo that at the age of five months, it bears a moderate proportion to the body. The younger the embryo, the ſmaller is the face, in compariſon to the cranium. The pyramidal proportions of the temporal bones are particularly large in the firſt month.

The neck, correſponding in ſome degree to the ſize of the head, is large and ſhort; ſo ſhort, indeed, that it can hardly be recognized at all in the firſt and ſecond months, being marked by the ſlighteſt conſtriction. It is ſcarcely diſtinguiſhable before the third month, on account of the head being bent forwards.

The extremities are ſmalleſt, in proportion to the trunk, in the youngeſt embryo. They firſt ſhoot out from the trunk in the form of hemiſpherical tubercles, like buds from a tree; are protruded a little further, and elongated in the ſecond month; at which time, the upper limbs may be diſtinguiſhed into arms and hands, and the lower into legs and feet. Then the fingers ariſe, like little papillæ from the hands; the arms and fore-arms being more developed; at the ſame time thighs, legs, and feet, may be diſtinguiſhed in the lower limbs, but the latter are ſtill without toes. Theſe, however, ſhoot out at the end of the ſecond month, the fingers being at the ſame time elongated. In the three firſt months the upper limbs exceed the ſize of the lower ones; they become nearly equal in the fourth; and in the fifth the lower ones have acquired that ſuperiority which they afterwards retain.

The lower part of the ſpine is at firſt curved round towards the belly, ſo as to reſemble ſomewhat the tail of a quadruped, when thrown between the hind legs. This prominence, ſometimes called *tuber coccygeum*, is largeſt in the two firſt months, projecting beyond the lower limb, ſo as to give the ſpine a keel-like form. It gradually diſappears in the third month, as the lower limbs are elongated.

The eyes are firſt obſerved, of the organs of ſenſe, and are larger and more prominent as the embryo is younger. They are ſeen very diſtinctly in a beautiful and, as it ſhould ſeem, perfectly formed fœtus of the firſt month, not larger than a middle ſized pea, repreſented by Soemmerring. They may always be recognized, in the very youngeſt embryos, by a deep black circle. Before the ſecond month either the eye-lids are open, or ſo thin, that the black pigment of the bulb is diſcerned through them. Soemmerring thinks that the eye-lids are really open until about the tenth week, when they are cloſed. After that time he has always found them firmly ſhut, and the ſlit between them ſhorter than the diameter of the globe. The circle of the iris, which is of the deepeſt black, is completed ſooner on the outer than the inner ſide.

Very ſmall pores are ſeen in the ſituation of the external ears about the ſeventh or eighth week; the middle of the helix then riſes from the head, and is followed ſucceſſively by the tragus, antihelix, antitragus, lobulus, and upper part of the helix. The ears are completed by the formation of the concha and ſcapha in the fifth month. Their proportions are ſtill very different from thoſe of the adult. Two ſmall holes at firſt occupy the ſituation of the noſe, which itſelf gradually ſhoots out about the ſeventh week; the dorſum, alæ and ſeptum are diſtinguiſhable in the eleventh week. The mouth is largeſt in the firſt months; and is open, without any lips. The latter parts are diſtinctly formed about the eleventh week, and are firmly approximated, ſo as to cloſe the mouth, from the third month.

The genital organs, ſcarcely diſtinguiſhable in the firſt weeks, have acquired a conſiderable ſize at the commencement of the third month. The penis is large and prominent about the twelfth week, and the glans uncovered; the ſcrotum is ſmall and empty until the 9th month. Sometimes it is looſe, and diſtended with water; ſometimes corrugated. A ſmall ſlit is ſometimes diſcerned in the female in the ſecond month. The clitoris is large and prominent in the third month, like the correſponding organ of the male; ſo that a female embryo, viewed laterally, might be miſtaken for one of the other ſex. About the fourth month the clitoris hangs more downwards, but is ſtill large even in the fifth.

The umbilical chord at firſt is ſhort, but large; it ſometimes equals the trunk in very ſmall embryos. Afterwards its length increaſes, but the relative breadth diminiſhes. Its ſurface is always unequal and knotted.

Soemmerring has remarked that the ſex of the youngeſt embryos can be diſtinguiſhed, independently of the genital organs, if they are well proportioned. The moſt ſtriking difference is found in the ſtructure of the thorax. That of the male is longer, more conical, formed of thicker ribs, and more prominent, with reſpect to the abdomen and pelvis, than that of the female. In the latter, not only is the whole thorax ſhorter, but alſo rather larger above, as far as the fourth rib, and therefore leſs conical. It is more diſtant from the pelvis, on account of the greater interval between the laſt rib and os innominatum, and leſs prominent, ſo that where the body is either erect or ſupine, the ſymphyſis pubis is the moſt prominent part in the female, and the thorax in the male ſubject.

The abdomen begins higher in the female, and is large and prominent, expanding towards the genitals: we might ſay that the female thorax is compreſſed, and the abdomen tumid.

The diſtinction is ſo obvious, in reſpect to the points now mentioned, that it will not only be readily obſerved in the well formed embryos carefully compared; but it may even be thought ſtrange that it ſhould have hitherto eſcaped obſervation. It will often be noticed, according to Soemmerring, in very ſmall embryos; and if we can aſcertain the ſex by the organs of generation, we ſhall readily perceive the diſtinction in the form of the cheſt.

The form of the head exhibits another ſexual diſtinction. It is on the whole larger in proportion to the body, but leſs rounded in the male than in the female: the occiput too is convex, ſo that the neck is hollowed in appearance, and the vortex is flattened. In the female the form is more globular, the occiput not prominent, and the neck conſequently not hollowed, and the vortex ſpherical.

Some points of diſtinction may be ſeen alſo in the extremities; of which males have the ſuperior rather larger, the ſcapulæ ſtronger and more prominent, and therefore ſuitable to the ſtronger thorax of this ſex, the arms rather conical, the fore-arms more muſcular, the carpi broader, and the ends of the fingers more obtuſe. The lower limbs, adapted to the narrow male pelvis, are contracted above; the thighs are more ſlender, but the feet very ſtrong, with prominent malleoli and heels. The great toe exceeds the others in ſize very remarkably. The characters of the female are juſt the reverſe of theſe. The upper limbs are ſhorter, with the ſcapulæ more ſloping, the arms cylindrical, fore-arms ſlender, wriſts narrow, and ends of the fingers acuminated. The lower limbs, from the ſuperior breadth of the pelvis, are largeſt above, and diminiſh conically towards the knees; the heels and ancles are not prominent, and the great toe exceeds the others but ſlightly.

The ſpinous proceſſes of the inferior dorſal, and ſuperior lumbar vertebræ form a kind of projecting ridge in the back of the male, where the female preſents a depreſſion. The ſame difference is ſeen not only in the mature fœtus, but alſo in infants, and in the beſt proportioned boys and girls.

After deſcribing the progreſs of the embryo, and the differences of the male and female at this early period, Soemmering alludes to the much diſputed queſtion, whether the ſame powers of body and mind are beſtowed on all men, or whether there be not natural diverſity in theſe in different individuals, ariſing from original differences in the ſtructure of the frame. Attentive examination will ſhew that the bodies of embryos are marked by native traits of diſtinction, clearly recogniſable at a time, when neither food, education, habits, clothing, nor the operations of diſeaſe can have exerted any influence on them. Not to mention that fœtuſes are born, who, from too delicate an organization of the eyes, ſhun as the greateſt evil, that light, which is our firſt bleſſing; that imperfection in the ſtructure of the ears incapacitates ſome from the ordinary buſineſs of life; that others are almoſt cut off from human ſociety by deficient formation of the organs of voice; that mal-formation of the heart devotes ſome to an exiſtence of conſtant ſuffering, incapable of all exertion of body and mind, while deformity of the limbs circumſcribes the powers of others; that many are born without brain, and therefore utterly deſtitute of all mental faculties; putting all theſe circumſtances out of the queſtion, we notice great differences in the form and proportions of well made embryos. Wide differences exiſt in the ſhape, capacity, and firmneſs of that part of the head which lodges the brain; the countenance varies infinitely in the diſtance, ſize, and form of the organs of the external ſenſes; and there are marked diverſities in the volume of the cheſt, and in the ſtrength and form of the limbs.

To our account of the progreſſive developement of the different parts of the body, we ſhall ſubjoin a ſhort deſcription of the fœtus in its different periods. In the firſt month it conſiſts of a mere jelly; which is eaſily deſtroyed by very little touching, and evaporates almoſt entirely by heat. Authors have delineated embryos at the end of the firſt month of the ſize of a barley corn; or a pea. Soemmering gives a repreſentation of one very elegantly formed, no larger than a very ſmall pea. At this time the head is fully developed, and much exceeds the reſt of the body. The cranium is particularly large. The eyes and mouth are diſcernible. The figure of the whole is globular, the head and ſpine being ſtrongly bent towards each other. The poſition of the bodies of the vertebræ is diſcernible. The arms are two very ſmall tubercles; the lower extremities are the ſame; and the coccygeal tubercle is a larger prominence between the right and left of the latter limbs.

In the ſecond months the body becomes more firm and opaque, and its parts are more developed. The mouth and noſe are diſcernible; the eyes diſtinguiſhed by their blackneſs; and the ears can hardly be ſeen without the aid of the microſcope. The whole figure is ſtrongly incurvated, ſo that the coccygeal tubercle, which is larger than the rudiments of the lower limbs, nearly touches the head. At the end of this month the fingers and toes are diſcernible. Oſſification alſo commences; firſt in the clavicles, the large cylindrical bones, the lower jaw, frontal and occipital bone, &c. The body may now be half an inch long. The umbilical chord, very ſhort and thick, connects the child cloſely to the ovum. In the end of the third month the features are well formed. The forehead is very prominent. The general figure ſtill incurvated. The coccygeal tubercle diminiſhes and diſappears. The extremities are fully developed, and the fingers and toes perfectly diſtinct. The organs of generation are clearly ſeen; the penis and clitoris being very large, the nymphæ prominent, and the labia thick. The abdomen projects towards the umbilicus. Soemmerring has given a moſt exquiſite figure of a male embryo of about 12 weeks. The eye-balls are clearly diſtinguiſhable, larger than the opening of the lids. The noſe is well formed; and even the philtrum is clearly diſcerned in the upper lip. There is ſcarcely a veſtige of the coccygeal arch. The ſize and form of the ſcapula is evident, and the parts of the extremities in general diſtinctly ſeen; even the prominence of ſeveral muſcles, as the deltoid and biceps, gluteus major, vaſtus externus, &c.

In the fourth and fifth months the form and proportions approach conſtantly more nearly to thoſe which the body poſſeſſes in future. All the external parts are clearly diſtinguiſhable in the 14th and 15th weeks; except the hair and nails. Hitherto the fœtus was ſurrounded on all ſides by a large quantity of the water of the amnios; but as it grows now more rapidly than the ovum, it occupies the cavity of that part more completely. The head, in the fourth month, on account of its conſiderable ſize when compared to the body, ſinks conſtantly lower in the uterus. The fœtus comes completely in contact with its coverings in the fifth and beginning of the ſixth months, and conſequently the mother uſually begins now to feel its motions. On a very rare occaſion, Wriſberg ſaw clearly, for a few minutes, a ſlight motion of the arms and feet in a fœtus of 130 days. He could not diſcern any beating of the heart or arteries; neither did the muſcles of reſpiration act, when he inflated the lungs. In the ſixth month the membrana pupillaris of the eye is very viſible. The ſcrotum is ſtill empty and corrugated. Hair and nails are formed. The integuments ſtill hang rather looſely on the body, ſo that it has a lean and wrinkled appearance. In a fœtus of between 5 and 6 months, the length of the body was 10½ inches; and that of the head, from the vertex to the lower jaw, 3¼ inches.

The length of three fœtuſes, whoſe ages were 158, 162, and 170 days, varied from 16 to 19 inches; and their weight from 1lb. 10 oz. to 1 lb. 13 oz. All three came into the world alive: the pulſation of the arteries could be clearly felt, they reſpired, but cried feebly. They moved their limbs freely, could not ſuck, but ſwallowed milk which was poured into their mouths; and they lived ſeveral hours.

The ſize of the fœtus is conſiderably increaſed in the laſt three months. The greater comparative growth of the limbs makes it appear as if the head became ſmaller; the latter part is about one-third of the body in a newly born child. More fat is accumulated under the ſkin, ſo as to make the outline of parts more rounded.

The increaſe at this time is rather in breadth and thickneſs than in length. The hair grows longer, and the nails more firm. The membrana pupillaris diſappears, and the teſtes deſcend into the ſcrotum. A child of ſeven months can live a few hours only out of the uterus, and thoſe of eight months ſeldom live a fortnight.

The fœtus is fully developed and mature, ſo that it can live out of the uterus at the end of the ninth calendar month. Experience has ſhewn that children may live, when born a fortnight or three weeks before this time, if well taken care of; and it ſeems probable that a longer interval may elapſe before birth: but the neceſſary uncertainty of the mode of reckoning renders the point dubious. The proportions of parts are very different in the fully grown fœtus from thoſe of the adult. The head is extremely large; and the upper part of the trunk, and upper extremities, are very conſiderable when compared with the lower parts.

"The ſize and weight of a child's body at birth, ſays Dr. Hunter, are generally over-rated in this country; inſomuch that we are often told, even by thoſe who ought to know, of children weighing from 15 to 20 pounds. So far is this from being true, that I never knew an inſtance of a child which weighed 12 pounds, and the greateſt number a little above half that weight. Dr. Macaulay was at pains, at our hoſpital, to aſcertain the ordinary bulk of new-born children, by firſt weighing a great number indiſcriminately as they were born; and then by giving an order to our matron to weigh occaſionally all ſuch as were of a remarkable ſize in either extreme. Of ſeveral thouſands born in the Britiſh hoſpital at their full time, while the doctor's order was attended to, the ſmalleſt weighed about four pounds, the largeſt 11 pounds two ounces, and by far the greater number weighed from five to eight pounds, avoirdupois. In caſes of twins, it ſeldom happens that each attains the weight of a ſingle child. It has been remarked that the firſt is uſually the ſtrongeſt."

The meaſure and weight of the fœtus cannot be much depended on as criteria of its being mature or otherwiſe: yet if a child is much under between ſix and five pounds, and ſhorter than eighteen inches, it may be deemed immature. The following are alſo characters from which we draw the ſame concluſion. Thinneſs of the body, and mobility of the ſkin; a reddiſh livid colour of the ſurface, particularly in the palms and ſoles, probably from the blood ſhining through the thin integuments: and a fine woolly covering of the body. Mobility of the parietal bones, and great ſize of the fontanell. Thinneſs and ſhortneſs of the nails. The eyes being much cloſed, and the child not looking about at ſurrounding objects. Coldneſs of the hands and feet.

The growth of the child, during its reſidence in the uterus, is very conſiderable compared to its ſubſequent increaſe. According to Haller, (Element. Phyſiol. lib. 29. ſect. 4. § 17.) it increaſes in the firſt month to a bulk 300,000 times greater than its original ſize. In the ſecond month its increaſe is to 48 times the ſize it poſſeſſed at the end of the firſt. From this time to the full period it will only average an increaſe of 15 times for each month. At the end of the three firſt years, the proportion to the mature fœtus is as 14 to 5: and at the end of the 22 following years, the proportion to an infant of three years, as 8 to 1. The increaſe in the firſt month of exiſtence is to that of the laſt month of growth as 4,885,717 to 1, and the whole increaſe is from 1 to 108,000,000,000.

The number of twin-caſes to ſingle births, according to Süſſmilch, is as 1 to 65 or 70: by the ſame calculator, one inſtance of three children occurs in 6500 births; but probably it does not happen ſo often. Four children are extremely rare, and the caſes of five are ſtill more extraordinary. Twins live often enough; three children but ſeldom; and four, perhaps, never.

As a general obſervation, it may be ſtated that male children are larger than females. Dr. Clarke of Dublin has given us ſome intereſting facts on this ſubject from a regiſter of 20,000 births, in a paper contained in the 76th vol. of the Philoſophical Tranſactions. The weights of ſixty males and ſixty females were as follows, leaving out fractions:

Males.

℔s. - - -	4.	5.	6.	7.	8.	9.	10.
Number of children	0.	3.	6.	32.	16.	2.	1.

Females.

℔s. - - -	4.	5.	6.	7.	8.	9.	10.
Number of children	2.	9.	14.	25.	8.	2.	0.

He found the dimenſions of the head in the male to exceed thoſe of the female: thus, of 120 children, ſix only meaſured more than 14½ inches round the head; and all theſe were males. This greater ſize of males expoſes them to greater difficulty in the birth, and conſequently a greater number dies in that proceſs; one half more than of females. The proportion of males born to females was nine to eight: but, in conſequence of the greater mortality of the former in parturition, and the firſt days of exiſtence, the balance in favour of the male ſex, out of 20,177 children, was only 483 at the end of a fortnight, although originally 1177. In countries where polygamy is allowed, more females are ſaid to be born than males.

Poſition of the Child.—"The fœtus in utero," ſays Dr. Hunter, "is naturally contracted into an oval form, adapted to the figure and circumſtances of its habitation. The vertex of the head makes one end of the oval, and the nates the other; one ſide or edge of the oval is formed by the occiput, the back part of the neck, and the incurvated trunk; the other is made by the forehead, and the maſs of contracted and conglomerated limbs. The chin is cloſe to the breaſt, the trunk is bended forwards, the knees are cloſe to the fore parts of the hypochondria, the legs drawn to the back parts of the thighs, the feet or lower parts of the legs decuſſating each other; and the upper extremities contracted into the vacant ſpace betwixt the forehead and knees. The moſt common ſituation of the extremities is not to be determined, as they are found to be a little different in different diſſections; and in the living body they vary almoſt every moment: thence the hands are ſeen indiſcriminately on the head or face, or acroſs one another, or round the knees, or legs; and the legs are ſometimes extended, and the feet are placed by the face; or one is in that poſition, and the other contracted, and the foot downwards.

"The navel-ſtring, in paſſing from the child to the placenta, is often variouſly entangled with the extremities, and frequently winds once or oftener round the neck.

"When there is a conſiderable quantity of liquor amnii, the child takes the advantage of room, and the compoſition of its parts is not ſo cloſe or globular. In proportion as there is leſs room, its figure is more compacted and moulded to the ſhape of the cavity of the uterus. In two different caſes which I examined, there was ſo little fluid ſurrounding the child, though the waters had not been diſcharged, that the uterus had preſſed and moulded all parts of the child into a very ugly form, as if it had been made of dough: and in ſuch caſes the hands and more particularly the feet are liable to be compreſſed and twiſted into deformity, on account of their being projecting or pliant parts.

"With regard to the mother, the moſt common ſituation of the child, by far is, with its head downwards, and its nates at the upper part of the uterus. Once, perhaps, in twenty or thirty caſes, it is the contrary, and preſents, as they term it in midwifery, with its poſteriors. All the obſervations that I have been able to make in diſſections, and in the practice of midwifery, would perſuade me that the child's head is naturally downwards through all the later months of utero-geſtation."

By the poſition of the fœtus, as we have now deſcribed it, rolled up and compacted into an oval figure, it takes up the ſmalleſt poſſible room in proportion to its ſize. It diſtends the uterus too equably: and, in order to fulfil this object more completely, the intervals left by the inequalities of the child's body are filled with a fluid (the liquor amnii), and the whole is contained in membranes, ſo as to form a perfectly oval maſs, diſtending the uterus in all directions. Hence the fluid is more copious in younger embryos, becauſe they cannot be compacted into an oval maſs, and are too tender to diſtend the uterus.

The peculiarities of ſtructure, in various parts of the body, which diſtinguiſh the fœtus, will come under conſideration, moſt properly, when we deſcribe the different parts in which they are found. We ſhall, therefore, merely enumerate them on the preſent occaſion.

The ſurface of the body is covered every where with a firm ſebaceous and white ſubſtance, called by ſome vernix caſeoſa. This covering, which renders the whole body greaſy, cannot be waſhed off with plain water. It is inſoluble in alcohol, oils, or pure water: but ſome alkalies diſſolve part of it, and form a kind of ſoap. It has often been ſuppoſed that this is a ſediment from the liquor amnii; but that is very improbable, as the liquor amnii contains nothing unctuous, and there is none of it on the amnios or navel-ſtring. It muſt, no doubt, be a ſecretion from the ſkin.

The cutis, at firſt thin and gelatinous, is covered by a cuticle in the earlieſt ſtages. Proper fat is not formed under the ſkin before the fourth month; its place is occupied by a kind of jelly-like ſubſtance. Afterwards a pretty thick layer of fat is formed over the whole body, next to the ſkin; but there is very little about the viſcera or internal parts: little among the muſcles, or in the bony ſtructure. The ſkin has a very red and vaſcular appearance; and is ſaid to have this appearance, even in negroes, who are affirmed to change to the black colour a few days after birth. A ſoft woolly covering, ſeen particularly about the ſides of the face, the back, ſhoulders and ilia, in young embryos, diſappears in the mature fœtus.

The ſtate of the bones in the fœtus has been already alluded to in the article Bones. The jelly, of which the embryo is firſt compoſed, becomes more firm and conſiſtent in the fourth and fifth weeks. The materials of the parts which will afterwards be bones, are firſt changed from the gelatinous conſiſtence, common to all the organs, into cartilage, at firſt ſoft and tender, and aſſuming gradually firmneſs and elaſticity. Its figure repreſents that of the future bone. It loſes its tranſparency, and white opaque ſpots are diſcerned in it (*puncta oſſificationis*) about the ſeventh or eighth week after conception. Theſe are firſt obſerved in the clavicles, ribs, vertebræ, large cylindrical bones, lower jaw and other bones of the face, os frontis, and occipitis. Large veſſels are ſeen ramifying through the cartilage, and diſtributed on the oſſifying points; theſe ſecrete the oſſeous matter, which is there depoſited. In ſimple flat and ſmall bones there is a ſingle point, from which the oſſeous depoſit extends into the reſt of the bone. In moſt others, particularly ſuch as have an irregular figure, there are two, three, or more points, beginning at the ſame time, and extending in their circumference until they meet. Such bones conſiſt of certain pieces in the fœtus and young child, united by plates of cartilage. In other bones, particularly of the long kind, a principal point is obſerved at firſt, forming the body of the bone, or diaphyſis. Afterwards, ſmaller points ariſe, eſpecially at the ends, which had hitherto remained cartilaginous. Theſe are called epiphyſes, and, after their oſſification has proceeded conſiderably, they are ſtill connected to the body of the bone by a plate of cartilage. The oſſific points generally commence in the very middle of the cartilage, and extend thence into the cirumference. They differ in appearance in the different bones. In the flat ones, particularly of the head, they are thin reticulated ſcales, perforated with innumerable ſmall holes. The bony fibres, as they are called, extend, in theſe ſcales, in a radiated manner, from the centre to their circumference: in the long bones they are ſhort cylinders, with a ſmall depreſſion at each end, and poſſeſſing, apparently, parallel fibres: in the round bones they are globular granules; and in thoſe of irregular figure, irregular in their outline, and generally poſſeſſing ſeveral points.

At the time of birth the oſſicula auditus, labyrinth, and tympanum, are completely formed; all the other bones of the body are in a more or leſs incomplete ſtate.

Phyſiologiſts in all ages have attempted to explain how oſſification is effected, in what manner the cartilage is removed, and bony ſubſtance put in its place: which points we ſhall probably underſtand, when the hitherto unveiled myſteries of ſecretion and nutrition are completely laid open to our inſpection. In the mean time, inſtead of bringing forwards a ſeries of old hypotheſes, we ſhall juſt quote a paſſage from Albinus, (Annot. Acad. lib. 7. p. 76). "We may conjecture that there exiſts, from the firſt origin of the embryo, rudiments of the cartilages, however ſmall, ſoft, tender, and approaching to the nature of fluid: or at leaſt that ſomething is generated at that time, which is afterwards cartilage. But of the eſſential nature of cartilage or bone; of the manner in which cartilage is ſubſtituted in the place of bone; how either cartilage or bone is formed from our aliments; and what particular part of the fluids furniſhes the materials of this growth; we muſt confeſs ourſelves ignorant, and ſhall probably remain ſo."

The bones of the fœtus contain much more animal matter, and leſs earth than thoſe of the adult; they are conſequently of a greyiſh colour, and acquire more of a white or yellow hue, as they advance towards their perfect conſiſtence. The extremities of the long bones, on account of their numerous blood-veſſels, are dark coloured. The perioſteum is ſtrong and thick, and ſeparates eaſily. The place of marrow is ſupplied, in the embryo, by a mere gelatine, which acquires ſomewhat of a fatty or oily nature towards birth.

The younger the embryo, ſo much larger is the head in proportion to the trunk and extremities; ſo much ſmaller are the bones of the face compared to the cranium; ſo much larger the organs of hearing; and ſo much lower and flatter is the lower part of the face. The internal ſurface of the ſkull has no marks ariſing from the convolution of the brain, nor any grooves for the blood-veſſels. The cranium is at firſt merely membranous; the mode in which it is oſſified has been already conſidered under the article CRANIUM. We may juſt enumerate here, as peculiarities of the fœtal cranium, the want of the frontal, ſphenoidal, and maxillary ſinuſes, of the maſtoid proceſſes, and of the meatus auditorii externi, and the imperfect ſtate of the ethmoid ſinuſes. The condition of the jaws, with their contained teeth, has been conſidered at large in the article CRANIUM.

The os hyoides has ſcarcely began to oſſify at the time of birth.

The cavity of the thorax is proportionally larger than in the adult, and more conical. Blumenbach attempts to account for this ſize by the peculiarities in the circulation, and the conſequently greater bulk of the liver. The pelvis is very ſmall, ſo that there is no room in it for the urinary bladder. The individual bones of the cheſt and pelvis, as indeed of the reſt of the body, will be more particularly deſcribed in other articles.

In the upper extremities, the clavicles begin to be formed very early, and attain to a very large ſize, when the reſt of theſe limbs is extremely ſmall. Thus in the tenth week they are three times the ſize of the femora. The ſcapula is alſo conſiderable at an early period, and has a piece of oſſification double the ſize of that in the os innominatum. The carpus is completely cartilaginous, as is the tarſus in the lower limbs, excepting the aſtragalus and os calcis, each of which poſſeſſes a ſmall oſſific point. The oſſification proceeds afterwards more rapidly in the tarſus than in the carpus, probably on account of the erect ſtature of the human ſubject, and the ſhare which the tarſus has in ſupporting the body in that poſition.

All the bones of the embryo are uniform on their ſurfaces, where, in the adult, elevations and impreſſions are found.

The muſcles can hardly be diſtinguiſhed in the three firſt months, like the reſt of the ſoft parts they ſeem compoſed of a mere jelly. The fibrous texture becomes diſcernible in the following months; when we are able to diſtinguiſh tendons alſo. Such, at leaſt, is the obſervation of Wriſberg, in an embryo of $5\frac{1}{2}$ months. The tendons, which are fixed to the bones of the adult, terminate in the perioſteum and perichondrium of the fœtus, and come away entirely with theſe membranes.

It is obſerved, by Soemmerring, that the tendons of the recti abdominis are proportionally broader and ſtronger than in the adult. The pyramidales are conſiderably larger. There is a round opening in the linea alba for the paſſage of the umbilical veſſels. The muſcles of the internal ear are nearly complete at the time of birth; the intercoſtals and diaphragm are conſiderably developed at the ſame period, and the muſcles of the upper more than thoſe of the lower extremities.

The eyes are developed at a very early period, being diſtinctly viſible in the youngeſt embryos hitherto obſerved. They appear as black points at the end of the firſt month. The pigmentum is viſible from the firſt, and is particularly thick and black. It has been correctly obſerved by Hogarth, that no part of the body grows ſo quickly, and is ſo perfect in the fœtus, requiring no additional growth after birth, as the iris. The cornea, cryſtalline lens, and vitreus humor, have a reddiſh tint. The lens is ſpherical in its figure. That great peculiarity of the fœtal eye, the membrana pupillaris, will be deſcribed in the article EYE.

The external ears are developed rather late, as there is not the ſlighteſt trace of them at the end of the firſt month. The meatus externus is often filled up with the vernix caſeoſa. The membranous texture of the whole meatus; the covering of the membrana tympani by the membrana mucoſa; the attachment of that membrane to the annulus auditorius; the want of maſtoid cells are all further explained in the article EAR.

The formation of the noſe commences late; and the cavity is ſmall and very incomplete in the fœtus, as a neceſſary conſequence of the ſtate of the bones of the head at that time.

The thyroid gland is large and vaſcular in the fœtus.

The thymus, which is of very conſiderable ſize before birth, and gradually diſappears afterwards, will be conſidered under that article.

The lungs are ſmall, collapſed, of a red colour, and ſink in water.

The mammæ are large in proportion to the ſize of the body. The papilla is ſmall, and not yet ſurrounded by an areola. The breaſts of the male and female fœtus do not differ: they contain a whitiſh fluid, which can be forced out by gentle preſſure, and ſometimes flows ſpontaneouſly in children.

The abdomen is very large in the fœtus, and is drawn into a conical form towards the navel in young embryos. The great ſize of the abdomen may be accounted for by conſidering, that this cavity holds the bladder, and that the liver and renal capſules are very large. The diſtance from the end of the ſternum to the pelvis, in a newly born child, is one-third of the length of the body; in the adult it is not one-fifth.

In the alimentary canal of the fœtus, we obſerve an almoſt entire want of valvulæ conniventes in the ſmall inteſtine; and of appendices epiploicæ in the large. The appendix vermiformis is a gradual conical contraction of the cæcum. The inteſtines are more or leſs filled with a ſoft matter, of a yellowiſh green colour in the ſmall, and of a dark green, approaching to black, in the large, called meconium. There is very little of this near the ſtomach; it increaſes in quantity lower down, and is the moſt abundant in the large inteſtines. But in the early months, the latter part of the canal contains no meconium. It is not diſtinguiſhed by any peculiar taſte or ſmell.

The pancreas is large, and the liver of immenſe ſize in the embryo. The kidneys are alſo conſiderable, and lobulated on the ſurface. The renal capſules equal the ſize of the kidneys. The urinary bladder is very large, equalling the dimenſions of the ſtomach

The ſituation of the teſtis in the abdomen, and its paſſage from that cavity into the ſcrotum, will be conſidered when the teſtis itſelf is deſcribed.

The heart is proportionally large in the fœtus, and occupies a conſiderable part of the thorax. Hence, on expoſing that cavity, this viſcus comes immediately into view, and ſeems in a manner to cover the lungs. The foramen ovale, by which the two auricles communicate; and the equal ſtrength of the two ventricles, will be conſidered when the heart itſelf is deſcribed. The pulmonary artery of the fœtus divides into three branches, of which the middle is the largeſt. This is termed the *ductus arterioſus*, and it runs directly to join the aorta, immediately below the arch of that veſſel. It is often named after Botal, although Galen and others knew it. Its length is about equal to a finger's breadth. It conveys into the aorta a large part of that blood which paſſed from the right auricle into the right ventricle; more than half of it, according to Haller. This canal is cloſed very ſoon after birth, often within a few days. The umbilical veſſels have been already deſcribed in a former part of this article. The arteries are found obliterated from the navel to the bladder, very ſoon after birth, often within a very few days; near the bladder they are very much contracted, but not cloſed, and give origin to the arteries of the bladder. The umbilical vein, and ductus venoſus are cloſed in the ſame way. The mode in which the circulation is carried on through the parts now deſcribed, is repreſented in the article CIRCULATION.

The coverings of the brain are at firſt ſo thin and tranſparent, that this organ can be ſeen through them. It is almoſt fluid until the 5th or 6th month, and remains very ſoft even to the time of birth, ſo that its diſſection is difficult. It is always larger in proportion to the body, the younger the fœtus. The nerves are larger in proportion to the body.

Phyſiology of fœtal exiſtence.—Some remarks on this ſubject will be found in the article CIRCULATION. We have only to obſerve, further, on the ſubject of the connection between the mother and child, that the *mode* by which this is effected, notwithſtanding it has been a favourite ſubject of reſearch with the greateſt phyſiologiſts of all ages, remains ſtill a problem. The account which we have given of the ſtructure of the placenta, ſhews that the arteries and veins of the uterus have communications with the ſubſtance of the former organ; we are, however, entirely unable to ſtate *how* the blood of the mother, or any nutritive fluid, is admitted into the umbilical veſſels; although the obvious impoſſibility of the fœtus deriving the materials of its growth from any other ſource, leads us to conclude, without heſitation, that ſuch admiſſion muſt take place. The reader will probably think that the following quotation, containing Mr. Hunter's opinion, does not tend to elucidate materially this obſcure queſtion.

“ The blood, detached from the common circulation of the mother, moves through the placenta of the fœtus, and is then returned back into the courſe of the circulation of the mother, to paſs on to the heart.

“ This ſtructure of the placenta, and its communication with the uterus, leads us a ſtep further in our knowledge of the connection between the mother and fœtus; the blood of the mother muſt paſs freely into the ſubſtance of the placenta, and the placenta moſt probably will be conſtantly filled; the turgidity of which will aſſiſt to ſqueeze the blood into the mouths of the veins of the uterus, that it may again paſs into the common circulation of the mother; and as the interſtices of the placenta are of much greater extent than the arteries, which convey the blood, the motion of the blood in that part muſt be ſo much diminiſhed, as almoſt to approach ſtagnation.” (Obſ. on certain parts of the Animal Economy, p. 135.)

The exiſtence of the fœtus is purely vegetative. Conſtantly receiving the materials of its nouriſhment and growth from the juices brought to the placenta by the veſſels of the mother, it may be regarded as a new organ produced by conception, participating in the general life, but having its own peculiar life, which is, to a certain degree, independent of that of the mother.

The animal life, or that claſs of functions by which the animal is connected to the external world, has not yet commenced in the fœtus. Its ſtate therefore cannot, with any juſtice, be compared to that of a perſon aſleep, in whom theſe functions are only ſuſpended: but in the fœtus they have not begun.

The fœtus can have no ſenſations from the ſurrounding medium: its temperature being invariable, it can have no object of compariſon, which is eſſential to ſenſation. The ſenſes cannot act, becauſe none of the cauſes, which excite them, have hitherto operated. That of touch, being dependent on the others, and ſerving to rectify the concluſions which they tend to, muſt of courſe be inactive. This inaction of the ſenſes ſuppoſes a ſimilar ſtate of their nerves, and of the brain. Tranſmiſſion of impreſſions is the function of the former; perception of the latter: but neither of thoſe acts can take place when there are no objects to be tranſmitted or perceived. Memory and imagination flow immediately from perception: judgment ariſes from one of theſe three, and gives origin to the will. This connected ſeries of faculties has not begun in the fœtus, becauſe of the want of ſenſations. The brain is capable of acting, and poſſeſſes all the requiſites for action; it is not *excitability* but *excitation* that is wanted. The fœtus moves while contained as the uterus; and theſe motions are conſidered as ſymptoms of pregnancy. As all motion ariſes from ſome foregoing impreſſion, and as the ſenſes of the fœtus are completely inactive, it is difficult to aſſign a ſatisfactory cauſe for theſe movements of the child.

The functions of organic life, or thoſe by which the nutrition and growth of the body are effected, muſt commence almoſt as ſoon as the fœtus is conceived. The matter of nutrition ariſes in its body in an aſſimilated ſtate, having been prepared by the mother: it enters immediately into the circulating ſyſtem, without traverſing the digeſtive organs, then nearly inactive. The organs of excretion, which decompoſe the body, as the lungs, ſkin and kidnies, are alſo almoſt inert. The ſecretions have hardly commenced.

To the great ſimplicity of the aſſimilative proceſs in the fœtus, let us add the remarkable activity of the organs employed in it; an activity which depends on the greater proportion of their vital powers. The whole force of the animal economy ſeems to be concentrated on the two ſyſtems of circulation and nutrition; the proceſſes of digeſtion, reſpiration, ſecretion, and exhalation being exerciſed, at moſt, but feebly: the diminiſhed energy of the latter being made up by the increaſed power of the former. If we conſider, moreover, that the organs of the animal life, condemned to a neceſſary inaction, are gifted with a very ſmall ſhare of vital powers; we ſhall ſee that nearly the whole of that living energy, which is deſtined, in the ſequel, to animate all the ſyſtems of the body, is, in the fœtal ſtate, concentrated upon thoſe which are concerned in building up the various parts; and conſequently that the functions of nutrition and growth poſſeſs, at this age, an energy vaſtly ſuperior to that of any others.

We may refer the reader to a great number of works on the ſubjects of the preceding article. In the eighth volume of the Elementa Phyſiologiæ, Haller has diſplayed his uſual erudition and judgment in a complete collection of all the facts aſcertained previouſly to his time. Dr. Hunter's Anatomia uteri humani gravidi, folio, and Soemmerring's Icones embryonum humanorum, folio, 1799, contain a perfect ſeries of repreſentations of the human ovum, and its contents from the earlieſt time to its maturity. Dr. Hunter's Anatomical deſcription of the human gravid uterus and its contents, publiſhed after his death by Dr. Baillie, 4to. 1794, is a clear and plain deſcription of the ſubject. We may mention further, Wriſberg deſcript. anat. embryonis, obſervationibus illuſtr. 4to. Gött. 1764, or, in the third volume of Sandifort's Theſaurus; alſo, his remarks on the ſtructure of the ovum in the Göttingen Commentaries for 1773 and 1783. Roderer De pondere & longitudine infantum recens natorum in the Göttingen Commentaries for 1753; and Wriſberg de vita fœtuum humanorum dijudicanda,

canda, in the ſame work for 1773. Autenrieth ſupplementa ad hiſtoriam embryonis humani, Tubingen, 1797, 4to.

On the compariſon of the ſtructure of the fœtus and adult, ſee C. I. Trew de differentiis hominis nati et non nati, Altdorf, 1736. I. G. Roderer de fœtu perfecto, Straſburg, 1750. Portal in the Mem. de l'Acad. des Sciences de Paris 1770. A. and F. Roeſslein de differentiis inter fœtum et adultum, 4to. Straſburg, 1783. On the nutrition of the fœtus, ſee Leveillé ſur la nutrition du fœtus conſideré dans les mammiferes & les oiſeaux. Paris an. 7. & Lobſtein diſſertation ſur la nutrition du fœtus, Straſburg, 4to. 1802. The moſt complete book on the whole of the ſubject, that is, the ſtructure and developement of the ovum, and the anatomical peculiarities of the fœtus, is F. G. Danz Grundriſs der Zergliederungs kunde des ungebohrnen kindes in den verſchiedenen Zeiten der Schwangerſchaft. 2 vols. 8vo. 1793, which contains moſt abundant references to all the ſources of information on every part of the ſubject.

Embryo, in *Vegetable Phyſiology*, εμβρυον, a *fœtus*, or *infant*, the Corculum of Linnæus, under which term we have already mentioned it, is the moſt eſſential part of a perfect ſeed. When ſexual impregnation has not taken place, this organ is defective, however perfect all the other parts of a ſeed may be, as in the *Cycas revoluta* which bore fruit at the biſhop of Wincheſter's, and is deſcribed and figured in the Tranſactions of the Linnæan Society, v. 6. 312. t. 29, 30. Here every part of the fruit and ſeed was apparently in the higheſt perfection, except that a ſmall cavity was only found in the place of the embryo, a defect doubtleſs to be attributed to the abſence of a male plant of the ſame ſpecies. The ſame has been obſerved in cucumbers and melons, whoſe fruits are not the worſe in flavour on account of ſuch a deficiency, though dates, when unimpregnated, are known to be much inferior in quality. The embryo or corculum is very conſpicuous in the walnut, the garden bean, pea, lupine, &c. In a very poiſonous plant, the *Jatropha Curcas*, figured in Gærtner, t. 108. f. 1. this author mentions as a remark of Mr. Boyle, that the nucleus or albuminous part of the ſeed may be eaten with impunity, if the embryo and cotyledons, or rather perhaps *plumula*, be taken away. This ſame circumſtance was pointed out by the natives of Sierra Leone to Dr. Afzelius and his companion Borone. The internal ſtructure of the embryo, before it begins to vegetate, is obſerved by Gærtner to be remarkably ſimple, conſiſting of an uniform medullary ſubſtance, encloſed in its appropriate bark or ſkin. When the vital principle is excited to action, veſſels are formed, and parts developed, which ſeemed not previouſly to exiſt, as in the egg of a bird. The embryo is generally ſituated within the ſubſtance of the ſeed, but not always, being entirely external to the body of the ſeed, though within the ſkin, in the natural family of graſſes or corn. In umbelliferous plants it occupies the very centre of the ſeed, and in that family its poſition is reverſed; whereas in compound or ſyngeneſious flowers, though equally central, it is erect with regard to the baſe or inſertion of the ſeed. In the date and ſome other palms the embryo is lateral and horizontal; while in the cocoa-nut and others it is erect, in the centre of the baſe of a large *albumen*. Its direction is either ſtraight, curved, or even ſpiral. Its form is moſt ſimple in plants that have only one cotyledon, or rather no proper cotyledon at all. S.

Embryo-*worms*. It is a matter of no ſmall curioſity, to obſerve the arrangement of the multitudes of the embryo-worms, as they are lodged in the bodies of the viviparous two-winged flies.

An accurate diſſection of one theſe little animals, ſhews very plainly the parts where the embryo-worms are incloſed. This diſſection is eaſily made with a pair of fine pointed ſciſſars, taking off the whole upper ſhell of the body from the lower; and that part which covers the belly may be turned back upon the corcelet, without diſturbing the internal parts by the operation; and the form and arrangement of the parts which contain the embryo-worms in theſe, will be found very different from that of thoſe which contain the eggs in the common flies. Baker on the Microſcope, p. 115. 416. 417. 428. 430.

EMBRYOPTERIS, in *Botany*, from εμβρυον, an *embryo*, and πτερον, a *wing*, as appears from an examination of Gærtner's figure; though, from the conſtruction of the word, it ſeems to be derived from πτερις, a *fern*, or *brake*. Hence this name, as it at preſent ſtands, is liable to a double objection, as being compounded of one previouſly eſtabliſhed, *Pteris*, and ſtill more as conveying a falſe idea of its own application. *Embryopterum* would have been correct and unexceptionable, and we ſhould without ſcruple have adopted ſuch an alteration; but the name is altogether ſuperfluous, the plant in queſtion being a *Dioſpyros*, under which head its generic character may be ſeen. We have, therefore, here only to add to that liſt of ſpecies the following.

Dioſpyros glutinifera, Roxb. MSS, (Embryopteris peregrina; Gærtn. v. 1. 145. t. 29. f. 2. E. glutinifera; Roxb. Coromand. v. 1. 50. t. 70.) Stamens numerous. Leaves oblong, paliſh beneath. Seeds eight or ten. This is a middle-ſized evergreen tree, growing in the moiſt cool valleys among the mountains of the northern Circars, flowering in March and April. The natives call it Tumika, and eat the fruit, which Dr. Roxburgh deſcribes as ſtrongly aſtringent, and not palatable. The Malays name it Mangoſtan-utan, and the Dutch Lym-appel. The wood is of an indifferent quality, and not much uſed. The *branches* are ſmooth. *Leaves* alternate, ſtalked, oblong, ſometimes inclining to elliptic, and occaſionally a little heart-ſhaped at the baſe; entire, ſmooth, paliſh beneath. *Flowers* white; the males in ſmall axillary cluſters; females on a ſeparate tree, ſolitary and larger. *Berry* globular, about two inches in diameter, of a ruſty yellow, and covered with a ruſty farina when ripe. Gærtner miſtook the top of the fruit for the baſe, and hence erroneouſly deſcribes the calyx as ſuperior. He alſo miſtook the radicle of the embryo for a ſimple cotyledon, but his profound knowledge led him to ſuſpect that a cavity in the other extremity might be the real ſeat of the embryo, and that the circumambient ſubſtance was conſequently a vitellus. We preſume this cavity to have ariſen in the plumula, from a ſhrinking of the parts, after the vital principle was extinct, his ſpecimen being an old one, and therefore his ſuſpicion was, ſo far, well founded. He deſcribes the *albumen* as gelatinous in its centre, and diſſolving in water, to which Dr. Roxburgh's ſpecific name, and the Dutch appellation, both ſeem to allude. S.

EMBRYOTHLASTES, Εμβρυοθλαστης, in *Surgery*, an inſtrument wherewith to cruſh the bones of an embryo, or dead child; ſo as to make it eaſier of extraction, and prepare it for the embryulcus, to draw it out of the womb.

EMBRYOTO'MIA, from εμβρυον, *a fœtus*, and τεμνω, *to cut*, the operation of cutting into the womb, in order to extract the fœtus. See Cæsarian *Section*.

EMBRYULCUS, from εμβρυον, and ελχω, *to draw*, an inſtrument uſed in extracting dead children. See Crotchet.

EMBS, or Ems, in *Geography*, a ſmall town of Germany, which, till the peace of Luneville, belonged in part to the landgrave of Heſſe Darmſtadt, and in part to the prince of Naſſau Dietz, to whom it has been ceded; is chiefly remarkable for five ſulphureous baths in its neighbourhood.

Embs, or *Hohenembs*, a ſmall diſtrict of Germany, in the circle of Swabia, ſouth of the county of Bregentz and the lake of Conſtance, about 10 miles long and 5 broad, erected into a county by Charles V.

EMDEN, or Embden, a town of the kingdom of Holland, capital of the department or province of Eaſt Frieſland, which, till the year 1807, belonged to Pruſſia, to the ſovereign of which it had been ſold by the United Provinces of the Netherlands, in 1744. It is ſituated on the Ems, not far from the ſea, and near the lake Dollart; 30 miles N.E. of Groningen. N. lat. 53° 20'. The harbour is commodious; it holds 400 veſſels.

Emden had gained conſiderable commercial importance, from having been declared a free-port by the king of Pruſſia, in 1751. Its ſituation was extremely convenient for the Dutch, to carry on their commerce with the greateſt ſecurity in time of war; particularly during the late wars between England and France, when the Texel was blockaded by the Engliſh. Goods uſed to be forwarded, on the river Ems, to within a ſhort diſtance of Munſter in Weſtphalia; from which city they were conveyed by land-carriage to the interior of the continent, to Switzerland, and Italy. In the year 1781, the number of ſhips cleared outwards was 1025, inwards 1004; but in 1799, there entered at Emden inwards 3402 veſſels, and 2151 ſailed outwards. In 1784, Emden had 273 veſſels of the tonnage of 38,578 tons, beſides 43 veſſels for the herring fiſhery; in 1804, the number of ſhips employed in the carrying trade only, belonging to Emden, exceeded 500.

The population of Emden, in the year 1785, amounted to 7968 individuals, without the garriſon; in 1802, Emden counted 10,400 inhabitants. The herring fiſhery produced annually near 1000 tons of herrings. It employed 60 boats, and a great many hands among the lower orders of the people.

EMEGIAGEN, a town and fortreſs of Africa, in the empire of Morocco.

EMENDALS, an old term ſtill uſed in the accounts of the Inner Temple; where, ſo much in emendals at the foot of an account, on its balance, ſignifies ſo much in the bank, or ſtock of the houſe, for reparation of loſſes, and other occaſions.

EMENDATIO *Panis & Cerevisiæ*, the aſſize of bread and beer; or the power of ſuperviſing and correcting the weights and meaſures belonging to them. See Assize.

EMERALD. Of this mineral there are two diſtinct varieties: the true emerald, and the beryl or aquamarine, both of which we ſhall proceed to deſcribe.

True Emerald.—Emeraude Verte, *Fr.* Schmaragd, *Germ.*

The colour of emerald is pure priſmatic green, of various degrees of intenſity; but the deep-coloured varieties paſs occaſionally into graſs and verdegris-green, and the lighter ones into greeniſh-white. The only natural ſtate in which it has been hitherto met with is cryſtallized. Its primitive form is a regular hexahedral priſm; ſometimes the lateral edges are replaced by ſecondary planes, forming a dodecahedral priſm; or, the ſolid angles are replaced by ſmall triangular facets; or, the terminal edges are bevelled, ſometimes very ſlightly, and ſometimes ſo deeply as to preſent the appearance of terminal truncated pyramids. The length of the priſms ſeldom greatly exceeds their diameter. The cryſtals are middle-ſized and ſmall, rarely large: they are generally implanted, and ſometimes imbedded, and always occur in cluſters. The internal luſtre is vitreous and ſhining; the fracture is ſmall and imperfectly conchoidal, paſſing into obſcurely foliated. It is tranſparent or tranſlucent, and exhibits a double refraction. Its hardneſs is ſomewhat ſuperior to that of quartz. Sp. gr. 2.72 to 2.77.

It is fuſible *per ſe* before the blow-pipe, but with difficulty, into a ſemi-opake whitiſh glaſs. With borax it melts eaſily, and without efferveſcence. Its conſtituent parts, according to Vauquelin and Klaproth, are as follows:

	Vauq.		Klapr.
Silex -	64.50	—	69.
Alumine -	16.	—	15.
Glucine -	13.	—	12.5
Lime -	1.6	—	0.25
Oxyd of chrome	3.25	—	0.25
Oxyd of iron	0.	—	1.
Water -	2.	—	0.
	100.35		98.

It is at preſent found only in Peru, in the valley of Tunia or Tomana, between the mountains of New Granada and Popayan; and near Puerto Viejo, in the diſtrict of Manta, in the ſame province. It is ſaid to occur in veins, paſſing through argillaceous ſchiſtus, and other primitive rocks, and is accompanied by quartz, felſpar, black ſchorl, mica, calcareous ſpar, and iron pyrites.

Emerald is reckoned among the gems, and when of a fine colour, and without flaws, is highly eſteemed. The moſt magnificent ſpecimen known of this mineral was preſented to the church of Loretto, by one of the Spaniſh kings: it conſiſted of a maſs of white quartz, thickly implanted with emeralds, more than an inch in diameter.

The emerald is ſuppoſed by Dutens and others to have been unknown to the ancients; and it is certain, that ſeveral of their deſcriptions of the ſmaragdus are not at all correſpondent, except in colour, to the modern emerald. But among the twelve kinds of ſmaragdus, or rather pſeudoſmaragdus, enumerated by Pliny, one of them, and that the moſt valued, appears to be the real emerald. With regard to its colour, this naturaliſt ſays, "Nihil omnino viridius comparatum illis viret." He ranks it, in eſtimation, immediately after the diamond and pearl; and adds, that ſo pleaſing was its tone of colour, that by common conſent the engraver was ordered to ſpare it: "Quapropter decreto hominum iis parcitur, ſcalpi vetitis." The emeralds of the ancients were procured from Ethiopia; but theſe mines have now been for many ages forgotten and neglected; nor is it certain that any except the Peruvian emeralds are now extant. The only one that may with any probability be referred to an African origin, is that with which pope Julius II. adorned the papal tiara: for as this ſovereign died in 1513, and the enterprize of Pizarro againſt Peru did not take place till 1545, it is not unreaſonable to conclude that the emerald in queſtion is not an American one. There are two ſpecimens, which formerly obtained great eſtimation as invaluable Ethiopian emeralds, which the ſuperior accuracy of modern knowledge has ſtripped of their value, both in the eyes of the naturaliſt and of the jeweller. The one is a tabular maſs, of the weight of 28 *lbs.* now in the abbey of Reichenau, and which formerly belonged to Charlemagne: this Mr. Coxe has aſcertained to be green fluor. The other is the "Sacro cattino de Smeraldo orientale," which was depoſited in the treaſury of Genoa, and was not allowed to be ſeen except in conſequence of an order from the ſenate: in this the acute eye of M. Condamine

mine detected ſome air-bubbles, which induced him to conſider it as only green glaſs; and ſubſequent examination has fully confirmed his ſuſpicion.

Beryl, or *Aquamarine*—Emeraude verte bleuatre, Hauy. Edler beril, Wern. Its colour is mountain-green, paſſing into whitiſh-green, yellowiſh-green, wine-yellow, and honey-yellow, or blueiſh-green, paſſing into ſmall and ſky-blue. Its colours are almoſt always pale; and when two exiſt in the ſame cryſtal, they are generally arranged in alternate layers. The primitive form and varieties of cryſtallization are the ſame as thoſe belonging to the true emerald; but the actual and proportional length of the priſms is much greater. The lateral planes of the cryſtal are ſtriated longitudinally, ſo as ſometimes to give the priſm a cylindrical appearance. The joints perpendicular to the axis are generally very diſtinct, and moſt commonly are plane ſurfaces; but ſometimes, like thoſe of articulated baſalt, they are formed by a convex protuberance let into a cup-ſhaped concavity. Another ſingular accident to which this mineral is ſubject is, that a priſm, which at its lower end is ſolid, terminates occaſionally in a bruſh-like extremity, compoſed of numerous ſmall priſms. Sometimes a joint is ſo diſpoſed, that it is no longer perpendicular to the axis of the priſm; in conſequence of which, an elbow is produced, as if the priſm had been broken acroſs, and the pieces ill cemented together again. Sometimes, again, the axis of the priſm is perforated. The ſize of the cryſtals varies from capillary to 18 inches long by 2 or 3 in diameter. Its external luſtre is ſhining and gliſtening; internally, it is brilliant and vitreous. The croſs fracture is ſmall, and imperfectly conchoidal; the longitudinal fracture is foliated. It is commonly tranſparent, paſſing into tranſlucent; its hardneſs is nearly the ſame as that of the emerald. It is electric by friction, and often phoſphoreſcent. Sp. gr. 2.68 to 2.72.

According to the analyſes of Vauquelin and Roſe, it is compoſed of,

	Vauq.		Roſe.
Silex -	68.	—	69.
Alumine -	15.	—	14.
Glycine -	14.	—	14.
Lime -	2.	—	0.
Oxyd of iron	1.	—	1.
	100.		98.

Beryl occurs imbedded in primitive rocks, alſo in veins accompanied by quartz, felſpar, fluor ſpar, garnet, mica, and topaz. It is found in Brazil, in Saxony, in the ſouth of France, near the village of Barat, whence very large but ill-coloured cryſtals have been procured, and occaſionally in the higheſt mountains of Aberdeenſhire. But the fineſt ſpecimens of all come from Siberia, and are found chiefly in three places of this vaſt country.

Firſt, in the Uralian mountains, about 25 leagues to the north of Ekaterinbourg. The ſpecimens that come from this mine are of a ſmall ſize, but a very good colour.

Secondly, in the Altaic mountains, between the Ob and the Irtiſch. The cryſtals from this mine are large, and of a greeniſh-blue colour, but coarſe, and mixed with quartz.

Thirdly, in the granitic mountain of Odon Tchelon, in Daouria. This is by far the moſt intereſting and the richeſt mine. There are in fact three different mines at different heights on this mountain, from which beryls are procured: that ſituated the loweſt is in a maſs of ſemi-decompoſed granite, mixed with ferruginous clay and nodules of Wolfram; in this there are irregularly diſſeminated minute priſms of beryl, rarely exceeding an inch in length, and of a greeniſh-yellow colour. About 800 yards above this mine is an irregular vein of micaceous clay, from which are procured the moſt valuable cryſtals; their colour is a pure pale green, and their dimenſions not very unfrequently amount to ſeven or eight inches in length by two in diameter. At the very ſummit of the mountain is ſituated the third mine, in a vein of white indurated clay, mixed with arſenical pyrites: the beryls that it yields are generally of a greeniſh-blue colour, but ſometimes of a pure but pale ſky-blue, and very tranſparent.

Beryl is ranked by courteſy among the gems, but its value is greatly inferior to that of the emerald.

Emerald, *Oriental*, is a greeniſh variety of ſapphire.

Emerald, *Counterfeit*. The manner of making counterfeit emeralds in paſte is this: take cryſtal prepared, two ounces; common minium, or red lead, four ounces; mix theſe well together, then add of good verdegris two penny-weights, and crocus martis made with vinegar, eight grains. Mix all theſe well together, and ſet the whole in the hotteſt part of a potter's furnace, as long as the fire laſts. It muſt be put in a ſtrong crucible, and covered with a lute. When it is cold take off the lute, and, if it is baked enough, it will be clear to the bottom; otherwiſe relute the pot, and put it into the furnace again. Twenty-four hours commonly are ſufficient for making this; ſometimes it requires a little more. The paſte, thus made, is harder than ordinary, and is of a fine colour, and capable of a good poliſh. Neri's Art of Glaſs, p. 128.

If the paſte be deſired of a very deep emerald colour, take prepared cryſtal one ounce; red-lead, ſix ounces and a half; of verdegris, three penny-weights and thirteen grains; and of crocus martis, made with vinegar, ten grains. This requires a longer baking than the other, and is leſs hard, though of a deeper colour.

The proportions of theſe ingredients may be varied at pleaſure, and the colour be made of all degrees of deepneſs; but the more lead is added, the more baking is required, and, after all, the paſte will be ſo much the ſofter.

Emerald *Colour*, in the *Glaſs Trade*. The way of giving this beautiful dye to glaſs is this: in the pots of melted metal, made of polverine, and without manganeſe, when the matter is well purified, put a little crocus martis calcined with vinegar. About three ounces of this crocus is enough for a hundred weight of glaſs; let it ſtand till thoroughly mixed, then put into every hundred weight of metal two pounds of calcined braſs; this muſt be added at ſix different times, letting the metal ſtand two hours every time. When this is all in, make a proof of the metal; and if it has any blueiſhneſs, add more crocus martis, a ſmall quantity at a time. When the whole is of a fine leek-green, let it ſtand twenty-four hours to mix thoroughly, and then work it. Neri's Art of Glaſs, p. 51.

Emerald, or *Emeraud*, in *Heraldry*, is uſed in lieu of vert, or green, in blazoning the arms of dukes, earls, &c.

EMERGENT Year, in *Chronology*, is the epocha, or date, whence we begin to account our time.

Our emergent year is ſometimes the year of the creation; the Jews uſe that of the deluge, or the Exodus, &c. The emergent year of the Greeks was the eſtabliſhment, or at leaſt reſtoration, of the Olympic games by Iphitus. The Romans accounted their years from the building of the city, ab u. c. that is, ab urbe condita. See Epocha.

EMERITA Augusta, in *Ancient Geography*. See Augusta, and Merida.

EMERSA, Folia, in *Botany*, applies to ſuch leaves of aquatic plants as are raiſed above the ſurface of the water, and which are uſually of a different figure from thoſe that are *immerſa*, or ſunk under water. See Leaf.

EMERSION, in *Phyſics*, the riſing of any ſolid above the ſurface of a fluid ſpecifically heavier than itſelf, into which it had been violently immerged, or thruſt.

It is one of the known laws of hydroſtatics, that a lighter ſolid, being forced down into a heavier fluid, immediately endeavours to emerge; and that with a force, or moment, equal to the exceſs of a weight of a quantity of the fluid above that of an equal bulk of the ſolid.

Thus, if a ſolid be immerged in a fluid of double its ſpecific gravity, it will emerge again, till half its bulk, or body, be above the ſurface of the fluid.

Emersion, in *Aſtronomy*, is when the ſun, moon, or other planet, begins to re-appear, after its having been eclipſed, or hid by the interpoſition of the moon, earth, or other body.

The difference of longitude is ſometimes found by obſerving the immerſions and emerſions of the firſt of Jupiter's ſatellites.

The immerſions are obſerved from the time of Jupiter's being in conjunction with the ſun, to his oppoſition; and the emerſions, from the oppoſition to the conjunction; which two intervals are uſually ſix months a-piece, and divide the year between them.

But when Jupiter is in conjunction with the ſun, and fifteen days before and afterwards, there is nothing to be obſerved; the planet, with his ſatellites, being then loſt in the light of the ſun.

Emersion is alſo uſed when a ſtar, before hid by the ſun, as being too near him, begins to re-appear, and to get out of his rays.

Emersion, *Scruples*, or *Minutes of*, an arch of the moon's orbit, which the moon's centre paſſes over, from the time ſhe begins to emerge out of the ſhadow of the earth to the end of the eclipſe. See Eclipse.

EMERSON, William, in *Biography*, an eminent Engliſh mathematician, was born in 1701, at Hurworth, a village near Darlington, in the county of Durham. His father kept a ſchool, and was a good mathematical ſcholar: to him, and to a young clergyman, the ſubject of this article was chiefly indebted for his early inſtruction in the different branches of the mathematics. He attempted to keep a ſchool himſelf, but ſoon found his temper unfitted for the taſk; and, on the death of his parents, having come into the poſſeſſion of a moderate competence, he devoted himſelf to a life of ſtudious retirement, where he compoſed a great number of treatiſes, by which his name has been long known to all lovers of ſcience; and from the profits of which he redeemed his little patrimony from ſome incumbrances which he found on it. He enjoyed a good ſtate of health till nearly the cloſe of his life, when he had frequent and very ſevere attacks of the ſtone; a diſeaſe to which, in the year 1782, he fell a victim, when he had attained to the 81ſt year of his age. Mr. Emerſon was ſingular in his behaviour, dreſs, and converſation. His manners were rough, coarſe, and often very diſagreeable. In converſation, he was poſitive, dogmatical, and impatient of contradiction. His relaxation from ſtudy was ſometimes working in the fields, and ſometimes the amuſement of fiſhing, to which he was much attached. When he had any treatiſe for publication, he always went to London, to attend to the printing himſelf. He was an able mathematician; but his ſtyle as a writer is not adapted to ſmooth the path of ſcience for beginners. His works, which are very numerous, are now chiefly ſuperſeded by other and more popular writers, who have had the better art of facilitating the ſtudies of young perſons, by a more agreeable ſtyle, and an eaſier method of demonſtration. His "Treatiſe on Mechanics" is that which is now beſt known, and to which reference is more frequently made than to any of his other works.

EMERSTORFF, in *Geography*, a town of Germany, in the archduchy of Auſtria, ſeated on the Danube; 6 miles above Crems.

EMERUS, in *Botany*. See Coronilla, ſpecies 1.

EMERY, *Schmiergel*, Wern. in *Mineralogy*. Its colour is greyiſh-black or blueiſh-grey. It occurs maſſive and diſſeminated: when in maſs, it is generally encruſted with magnetic iron ore, pyrites, and mica; the latter ſubſtance frequently penetrates the whole maſs, giving it, when broken, a ſilvery appearance. It poſſeſſes a gliſtening or glimmering luſtre. Its fracture is fine-grained uneven, paſſing into ſplintery. In hardneſs it is about equal to Adamantine ſpar, cutting flint and rock-cryſtal with great eaſe. It is heavy, and not very eaſily frangible. When moſt free from iron, it conſiſts, according to Tennant, of

Silex	3.4
Alumine	92.
Iron	4.6
	100.

When highly impregnated with iron, this ingredient amounts to about 36 *per cent.*

Emery is procured from the iſlands of the Archipelago, eſpecially from Naxos; alſo from the neighbourhood of Alocer, in Eſtremadura, in Spain. Much of the emery uſed in France is imported from the iſlands of Guernſey and Jerſey, in the Britiſh channel. It is alſo found at Ochſenkopf, in Saxony, in beds of talc and ſteatite.

This mineral is largely uſed for cutting and poliſhing, by lapidaries and workers in glaſs and metal. The mode of its preparation is very ſimple. Being pulverized in an iron mortar, it is carefully waſhed over, and thus ſeparated into five or ſix different degrees of fineneſs, according to the work in which it is to be employed.

EMER-YAPAR, in *Geography*, a town of Aſia, in Thibet; 17 miles from Cha-tcheou.

EMESA, Emisa, *Emiſſa*, or *Emeſus*, in *Ancient Geography*, an ancient city of Syria, ſituated on the eaſtern bank of the Orontes, between Apamea and Laodicea Cabioſa. During the troubles which agitated Syria, this city was ſeized by an Arabian, named Sampſiceramus, who, aſſuming the title of king, held Emeſa and its ſmall territory, undiſturbed by the Seleucidæ, engaged in more important concerns. He left two ſons, Jamblichus and Alexander; the former of whom ſucceeded his father, and was much attached to the Romans. In the civil wars of Rome, he took part firſt with Cæſar againſt Pompey, and afterwards with Antony againſt Octavianus. After the victory gained by the latter at Actium, Antony, dreading his concurrence with other princes in favour of the conqueror, and upon this ſuſpicion, having got him into his power, cauſed him to be put to a moſt cruel death. Upon his death, Antony beſtowed the kingdom on his brother Alexander, who, continuing faithful to his benefactor in his greateſt diſtreſs, was taken priſoner by Octavianus, and not only deprived of his kingdom, but carried in triumph to Rome, and afterwards put to death. His ſon, Jamblichus II., was favoured by Octavianus, and reſtored by him to his father's kingdom, after he had remained for ſome time in a ſtate of exile. He had ſome ſucceſſors, who ſupported the dignity of this ſmall kingdom; but the laſt of its kings, whoſe name is recorded in hiſtory, was Azizus, who, falling in love with Druſilla, the ſiſter of Agrippa Minor, embraced the Jewiſh religion, in order to marry that princeſs. This ſmall kingdom was afterwards, as we may preſume, ſeized by the Arabians; for we find that, ſome years after, it was poſſeſſed by the Ituræans. Emeſa was the birth-place of the emperor Heliogabalus; and it was one of the cities in which the Romans planted colonies. It is now called *Homs;* and though formerly a ſtrong and populous city, it is at preſent only a large ruinous town in the pachalic of Damaſcus, containing not more than 2000 inhabitants, partly Greeks and partly Mahometans. An aga reſides here, who holds, as a ſub-renter of the pacha of Damaſcus, the whole country as far as Palmyra. The pacha himſelf holds this farm, as an appanage deriving immediately from the ſultan. Hama and Marra are held in the ſame manner; and theſe three farms pay 400 purſes, or 500,000 livres (about 20,000*l.*), but they produce nearly four times that ſum. Volney's Travels in Egypt and Syria, vol. ii.

EMETICS, in *Medicine*, from ἐμέω, *I vomit*, thoſe ſubſtances which excite vomiting, or cauſe the ſtomach to reject its contents upwards.

Medicines of this claſs have been employed, for the purpoſe of clearing the ſtomach, from the earlieſt ages to which any authentic records of practice extend. In the time of Hippocrates, indeed, the uſe of emetics ſeems to have been very general, not only as a remedy in diſeaſes of ſome ſeverity; but as a popular expedient for relieving ſlight indiſpoſition, eſpecially the occaſional derangements of the organs of digeſtion, brought on by indulgence in eating and drinking. Hippocrates even recommends them to the healthy as a preſervative; and he has ſtated many precepts with reſpect to the proper times for adminiſtering them, in conjunction or alternation with faſting, bathing, exerciſe, &c. under various circumſtances of health and diſeaſe. See his treatiſe on Diet, book iii. and elſewhere. Yet it muſt be remarked, that the catalogue of emetic ſubſtances in the poſſeſſion of the ancients was very imperfect, in compariſon with our own; and conſiſted either of uncertain and almoſt inert articles, on the one hand, or of ſevere and rather unmanageable ſubſtances on the other. Hippocrates preſcribed powdered hyſſop in about a gallon of water, as a vomit for corpulent men, with the addition of a little vinegar and ſalt; it was to be drank at firſt gradually, and afterwards more quickly.

Celſus has likewiſe detailed a ſet of rules, relative to the uſe of emetics, among the means of reducing the habit, if too plethoric. He ſays, "emetics are more uſeful in the winter than in the ſummer, becauſe in that ſeaſon there is more phlegm, and a greater heavineſs in the head. They are of no advantage to thoſe who are ſlender, or who have a weak ſtomach; but are uſeful to plethoric, and bilious people, whether they have ſuffered from repletion, or have their digeſtion impaired. For if they have taken more than the digeſtive power is able to concoct, they ought not to riſk the danger of its corrupting; and if it is already corrupted, it is proper to expel it in the moſt expeditious way poſſible. Hence, when any perſon is attacked with bitter eructations, together with pain and weight in the region of the ſtomach, let him immediately reſort to a vomit. It is alſo proper for thoſe, who have a ſenſe of heat in the breaſt, a frequent ſpitting or nauſea, or a noiſe in the ears, or humour in the eyes, or a bitterneſs in the mouth," &c. "I grant," he obſerves farther, "that emetics ſhould not be taken for the ſake of indulging a luxurious appetite; but that they are advantageous in ſome forms of diſeaſe, I know from experience: I admoniſh thoſe, however, who wiſh to enjoy good health and attain old age, not to make a daily uſe of them. If any one wiſhes to vomit after taking food, he ſhould firſt drink warm water only, if he vomits eaſily; if with ſome difficulty, he ſhould add a little ſalt or honey to the water: but he that intends to vomit in the morning, ſhould drink *mulſe* (a mixture of wine and honey,) or eat hyſſop, or radiſh, and then drink warm water, as has been already directed. All the other ſubſtances, which the ancient phyſicians preſcribed, are injurious to the ſtomach. If that organ is weak after the vomit, a little food ſhould be taken, of a proper kind; and if the fauces have been much irritated, three cups of cold water may be drunk. He who has uſed a vomit, if it were in the morning, ought to take a walk, then anoint, and afterwards ſup; but if after ſupper, he ſhould bathe on the following day, and ſweat in the bagnio: he will do well to make the next meal ſlight, and that of roaſted meat, with auſtere and unmixed wine, ſtale bread, and food of the drieſt kind." He concludes with this obſervation: "he that chuſes to vomit twice in the month, will find it more advantageous to do it for two days ſucceſſively, than if he were to repeat it on the fifteenth day; unleſs this intermiſſion ſhould occaſion a weight at his breaſt." De Medicinâ, lib. i. cap. 3.

Theſe ſtatements ſhew, that the uſe of emetics conſtituted a part of that regimen, among the ancients, in which more of their time was occupied, and more attention beſtowed, than the moderns in this country are accuſtomed to give to the ſubject. They alſo reſorted to vomiting, as a remedy in fevers, and other diſeaſes. See Celſus, lib. iii. cap. 7. And emetics, as well as purgatives, were employed after the termination of fevers, upon theoretical principles, to evacuate the remainder of the morbid matter, after its virulence was ſuppoſed to be ſubdued by concoction. In the uſe of purgatives, we find ſome remains of this theory among the people, as well as among the ignorant part of the profeſſion, even at the preſent day. Hippocrates ſeems to have believed, that this remnant of the morbid matter, like a piece of leaven, if retained after the criſis, was the occaſion of the return of the diſeaſe. "Quæ per morbos poſt judicationem intus relinquuntur, morborum reverſiones faciunt." Aphor. 12. ſect. ii.

The direct effect of an emetic is the evacuation of the contents of the ſtomach. Hence the principal purpoſe, for which it may be uſed, would ſeem to be the removal of morbid or noxious matters from that organ; whether conſiſting of its own ſecreted juices, in a diſeaſed condition of indigeſtible food, either from quantity or quality, of poiſons, or of other noxious ſubſtances, which may have been ſwallowed. Hence the vulgar reſort to emetics on every occaſion of what is popularly called a "foul ſtomach," or of "bile on the ſtomach." Theſe conditions are preſumed to exiſt, when ſuch ſymptoms as the following are preſent: when there is a want of the uſual appetite, or, in addition to that, a loathing of food; or, when, after food, or during the time of its digeſtion, an uneaſy ſenſation of fullneſs, weight, and diſtenſion is felt in the ſtomach, eſpecially if accompanied with heartburn, flatulency, and acid or bitter eructations; and to theſe may be added frequent head-achs, particularly in the morning.

Now, although it cannot be queſtioned, that the removal of the preſent contents of the ſtomach, in ſuch caſes, generally affords more or leſs relief; it is not the leſs certain, that this relief is ſeldom very durable; for the noxious matters are more frequently to be conſidered as the effects, than as the cauſes of the morbid condition of the ſtomach: they depend moſt commonly on the weakneſs and loſs of tone in the muſcular fibres of the ſtomach, and the imperfect ſecretion of the gaſtric juice; and theſe, it is obvious, are not to be cured by vomiting, though their conſequences may be relieved by this for a longer or ſhorter time. On the contrary, there can be no doubt, that frequent vomiting renders the ſtomach leſs able to retain, what is thrown into it, and to weaken its powers of digeſtion. "They are unhappy," ſays Dr. Cullen, "who truſt to this mode of relief, and have therefore frequent recourſe to it; for I am certain, from much experience, that frequent vomiting hurts the tone of the ſtomach, and often makes the ſymptoms of indigeſtion recur more frequently and ſooner than they otherwiſe would have done." Treatiſe on the Materia Medica, vol. ii. p. 465.

The ſame author remarks, that the effects of vomiting, and the degree of diſeaſe that required it, are commonly judged of by the vulgar, and often by phyſicians, though not always fairly, by the appearance of the matter thrown up. For example, there is commonly thrown up a conſiderable quantity of viſcid mucus; and to this the ſymptoms of the diſeaſe are frequently imputed. "It is, indeed, poſſible," he adds, "that an unuſual accumulation of mucus in the ſtomach may be the cauſe of want of appetite, and other ſymptoms of indigeſtion, but not always ſo juſtly as might be imagined. The mucous follicles of the ſtomach conſtantly pour out a conſiderable quantity of this matter; a conſiderable quantity is to be found in the ſtomachs of the moſt healthy perſons: and the experiments of M. Senac ſhew, that there is always a conſiderable quantity of it in the mucous follicles, which may very readily be ſqueezed out very copiouſly in vomiting. It is not, therefore, to be judged that the quantity, and even a large quantity, thrown up by vomiting, had either previouſly exiſted in the cavity of the ſtomach, or that ſuch a mucus had been the cauſe of the morbid ſymptoms, indicating therefore the repetition of vomiting. It has been upon occaſions of this practice, that I have known repeated vomiting, not only to give no durable relief, but rather to increaſe the ſuppoſed cauſe."

The evacuation, however, occaſioned by an emetic, is not confined excluſively to the ſtomach; the upper part of the inteſtines, namely, the *duodenum*, and even part of the *ilium*, is commonly evacuated at the ſame time. The periſtaltic motion of the alimentary canal may proceed either downwards or upwards; and when the action of any part of it is directed in one way, the next adjoining portion follows in ſome degree the ſame direction. Whence, in vomiting, as the periſtaltic motion of the ſtomach is directed upwards, ſo the motion of the duodenum, is directed in the ſame way, and it pours its contents into the ſtomach; from which it will appear that a conſiderable portion of the upper part of the inteſtines may be evacuated. The moſt clear proof of this inverted motion of the duodenum, in vomiting, is, that, eſpecially after repeated vomiting, a quantity of bile is poured into the ſtomach, and is in conſequence thrown out by the mouth. This frequent appearance may depend entirely upon the quantity of bile for the time preſent in the duodenum; but it probably extends farther. In the action of vomiting, as the contraction of the diaphragm and of the abdominal muſcles concurs at the ſame time, the whole viſcera of the abdomen are ſtrongly preſſed: this preſſure muſt affect the gall-bladder and the biliary ducts, and occaſion them to pour out their contents very largely, which, being thrown into the ſtomach from the *duodenum*, may be ejected by vomiting. It is commonly ſuppoſed, indeed, by the vulgar, that the bile thus thrown up exiſted previouſly in the ſtomach, and in ſome inſtances it may have been ſo: but it is more probable that it had been brought from the *duodenum*, and even from the gall-bladder and biliary ducts in the way juſt explained. For had the bile been previouſly lodged in the ſtomach itſelf, it might have appeared in the firſt vomitings, as well as in the laſt; but it happens, in almoſt all inſtances, that the bile is thrown out by the mouth only after repeated vomitings, and often after repeated ſtrainings in the organs employed in that act.

Dr. Cullen attributes ſome good effect to the preſſure on the liver and abdominal viſcera, juſt alluded to, in obviating the ſtagnations which are liable to occur in the ſyſtem of the *vena portarum*, and which lay the foundation of obſtinate diſeaſes. He affirms, that he knows no means of expediting the circulation in the liver ſo powerful as that of vomiting. Other writers have expreſſed an opinion of the advantages derived from this mechanical preſſure and conquaſſation of the viſcera of the abdomen, in exciting the meſenteric circulation, as well as that of all the glands, and conſequently in favouring and aiding all their ſecretions. (See Dr. Fothergill, De emeticorum uſu, &c. Cullen, loc. cit. p. 468.) Dr. Cullen, however, conſiders the effects of this mechanical compreſſion and motion as moſt evident in the viſcera of the thorax, eſpecially in promoting expectoration: hence the utility of vomiting in catarrhal affections, more particularly the chronic catarrh of old people. He alſo allows that it may be uſeful in many caſes of pulmonary conſumption; but juſtly adds, that we cannot, either from theory or experience, find any reaſon to believe that frequent vomiting is adequate to cure that diſeaſe.

There is alſo another indirect action of vomiting, which is beneficial to the ſyſtem, ariſing from the ſympathy between the ſtomach and the ſkin. This ſympathetic conſent between the veſſels of the ſkin and of the ſtomach is very great, inſomuch that the ſeveral ſtates of each may be communicated to thoſe of the other. Thus, wetting the ſkin relieves thirſt, as was proved by Capt. Bligh and his party; and in the ſame way the action of an emetic excites particularly the action of the veſſels on the ſurface of the body; and this action is excited by doſes of theſe medicines, which are not ſufficient to excite vomiting. Hence moſt of the ſubſtances employed as emetics are capable of exciting perſpiration. We are diſpoſed to believe that a ſimilar ſympathy, between the ſtomach and the veſſels in the cells of the lungs, is the cauſe of the utility of vomiting in producing expectoration, rather than the mere mechanical preſſure of the lungs.

The action of vomiting, when excited rather briſkly, by the general ſhock or conquaſſation of the whole frame, affects the nervous ſyſtem at large as a ſtimulant. In this way the utility of an emetic, in the commencement of a continued fever, is partly to be accounted for. Dr. Cullen, indeed, attributes the advantages of vomiting in that caſe to the relaxation of the ſpaſm of the extreme veſſels in the ſkin, according to his theory of fever; and partly, perhaps, the operation may be accounted for in this way: but it is to be remarked, that other expedients, which have nothing in common but the general ſhock which they occaſion to the nervous ſyſtem, alſo contribute to cut ſhort or to alleviate fever, under the ſame circumſtances; a briſk purgative, for example, cold affuſion, or the ſhower-bath, &c.

It is alſo obſerved by Dr. Fothergill, who aſcribes conſiderable effects to the *ſtimulant* operation of emetics, that, in ſpaſmodic diſorders, and ſeveral others of the nervous kind, which ſeem to ariſe principally from the torpor and languor of the digeſtive organs, emetics are often of eſſential benefit. He mentions CHOREA, or St. Vitus's Dance, certainly not the leaſt obſtinate of nervous complaints, as often relieved by emetics.

The ſame celebrated phyſician cautions us particularly reſpecting the adminiſtration of emetics to thoſe who are of plethoric habit, or who labour under diſeaſes, in which general or local plethora is preſent. If the ſymptoms, in ſuch caſes, indicate the propriety of employing emetics, blood-letting ought, in his opinion, to precede their uſe; for there is danger, leſt in the temporary convulſion of ſtraining to vomit, the diſtended veſſels ſhould be ruptured, or the blood be carried with too great force, or in too great quantity, to parts where the reſiſtance of the veſſels is too weak to withſtand it. Thus, if the veſſels of the head ſhould give way, a ſudden and fatal apoplexy may be brought on; if thoſe of the lungs ſhould be ruptured, a ſpitting of blood, followed by a ſlow, but not leſs fatal conſumption, may be induced, or ſimilar miſchief may be occaſioned in other viſcera. (Loc. citat.) In caſes, however, in which theſe plethoric diſeaſes are to be ſuſpected, the prudent practitioner will, even after blood letting, conſider emetics as inadmiſſible, unleſs the neceſſity of immediately emptying the ſtomach of its contents be great and preſſing.

The occaſion, on which ſuch a neceſſity is the moſt obviouſly paramount to all other conſiderations, is when poiſon has been recently ſwallowed. In this caſe, the greateſt riſk is from the operation of this ſubſtance on the ſtomach, and therefore the moſt expeditious means of inducing vomiting are to be adopted. If the poiſon be of the vegetable narcotic ſpecies, ſuch as opium, it often ſo completely paralyzes the muſcular fibres of the ſtomach, as that ordinary emetics have no power to excite its action. The white vitriol, or ſulphate of zinc, operates in general almoſt inſtantaneouſly, eſpecially if ſwallowed with a large quantity of water. When this has failed, we have known a few grains of the blue vitriol, or ſulphat of copper, diſſolved in warm water, given with ſucceſs, where opium had been ſwallowed. A ſtrong infuſion of ipecacuanha, drank copiouſly, has ſometimes effectually emptied the ſtomach under ſimilar circumſtances.

In a fit of inebriety, when vinous or fermented liquors have been drunk to the extent of inducing a ſtate approximating to apoplexy, the ſafeſt, perhaps, and beſt mode of emptying the poiſon from the ſtomach, conſiſts in pouring in warm water as copiouſly as it can be ſwallowed; ſince it at once dilutes the inebriating liquor in the ſtomach, and therefore diminiſhes its effects, and urges the ſtomach to expel it. See DRUNKENNESS.

Although emetics have been found to be beneficial in the early ſtages of all fevers, as already mentioned, yet we muſt not here omit to notice their peculiar good effects in the ſcarlet fever, as obſerved by Dr. Withering. (See his Treatiſe on the Scarlet Fever.) This fact, indeed, had been pointed out by Tournefort (in his voyage to the Levant, tom. i.), and other writers; but Dr. Withering recommends vomiting, repeated according to circumſtances, as the moſt eſſential remedy for this diſeaſe. "In the very firſt attack," he ſays, "a vomit ſeldom fails to remove the diſeaſe at once. If the poiſon has begun to exert its effects upon the nervous ſyſtem, emetics ſtop its further progreſs, and the patients quickly recover. If it has proceeded ſtill further, and occaſioned that amazing action in the capillaries, which exiſts when the ſcarlet colour of the ſkin takes place, vomiting never fails to procure a reſpite to the anxiety, the faintneſs, and delirium." Dr. Willan alſo ſpeaks highly of the utility of emetics in ſcarlet fever, with ſore throat, but has not found it neceſſary to repeat them ſo often as Dr. Withering adviſed. Treatiſe on Cutaneous Diſeaſes, ord. 3.

Emetics are ſometimes uſeful in aſthma, and in hooping-cough, probably upon the ſame principle as in chronic catarrh, before noticed. They have been ſaid alſo to aſſiſt in forwarding a gall-ſtone through the ducts into the inteſtines as well as an urinary calculus from the kidney to the bladder, through the ureter, by the mechanical agitation of the body, which they occaſion. But their operation in this way muſt be very feeble and uncertain, and may do injury, when the calculi are large or angular. Sydenham employed ſtrong emetics as remedies for dropſy; but they generally purged alſo, to which operation their good effects, when they did prove beneficial, muſt be the rather attributed.

The catalogue of medicines poſſeſſing an emetic power, which were in uſe among the ancients, although ſufficiently ample, contained, as we have already ſaid, ſubſtances either of feeble and uncertain action, or of acrid and violent qualities. The hellebore was ſometimes fatal. Even Sydenham complained in his time, that an emetic ſubſtance, which was "ſafe, and at the ſame time effectual," was a deſideratum in the Materia Medica. His active emetic conſiſted of the *crocus metallorum*, as it was then termed, or *crocus antimonii*, (a preparation made by deflagrating the ſulphurated antimony with an equal weight of nitre,) which being ſoluble in any acid, was moſt uncertain in its operation, as it depended upon the quantity of acid with which it met in the ſtomach. The ipecacuanha root appears to afford that ſubſtance to us, which was a deſideratum in the time of Sydenham.

We may, with Dr. Fothergill, conſider emetics under three heads, the very mild, the moderate, and the ſtrong or draſtic; not to mention the irritation of the throat with a feather; the exerciſe of ſwinging, ſailing, or whirling round certain objects of ſight, &c. which are not reſorted to as remedies. Among the mildeſt means of exciting vomiting, is filling the ſtomach ſuddenly with a large quantity of liquid; ſimple warm water is generally ſufficient for the purpoſe; but its operation is aided, when other ſubſtances of little power are combined with it: thus, infuſions of green tea, of chamomile flowers, the carduus benedictus, broths, &c. may be employed for this purpoſe. Again, when it might not be proper to give an emetic ſubſtance, in ſuch a doſe as might of itſelf excite vomiting, by the aſſiſtance of copious draughts of warm water, ſmall doſes may ſerve the purpoſe of evacuating the ſtomach, and even of obtaining the other effects to be derived from vomiting.

The moderately active emetic ſubſtances are thoſe which are at preſent in general uſe; namely, the ipecacuanha, and the tartar emetic, or tartrite of antimony, in ſmall doſes; and alſo ſome other ſubſtances, when much diluted with warm water, which might be of too inflammatory a nature if given alone, in ſuch quantity as to produce vomiting; ſuch are, an infuſion of the root of horſe-radiſh, or a tea-ſpoonful of muſtard as prepared for the table, ſome preparations of the ſquill, the aſarum, &c. The ipecacuanha was firſt introduced as a remedy for dyſentery; but it is now aſcertained that its utility in that diſeaſe depends upon its purgative quality.

The metallic ſalts formed with ſulphuric acid are active emetics, and may be arranged in the ſtrongeſt or draſtic claſs. The leaſt violent of theſe is the white vitriol, or ſulphate of zinc, which has been chiefly employed on account of the ſuddenneſs of its operation, when poiſonous matters have been taken into the ſtomach: but, in order to render its effects certain, the doſe muſt generally be large, and if it is not thrown out again immediately, it is apt to continue a diſagreeable nauſea, or even a vomiting, longer than is neceſſary. Dr. Cullen ſays, "I find that the purpoſe of this medicine (that is, a ſudden vomiting,) may commonly be obtained by employing a large doſe of ipecacuanha, either in powder or in the wine; and by following this ſoon after with a large draught of warm water impregnated with chamomile, or rather with what is more at hand, a tea-ſpoonful of table-muſtard; the buſineſs may be commonly very effectually executed."

The preparations of mercury are ſeldom employed as emetics. The ſulphat, or turpeth mineral, has been chiefly uſed, but its operation is violent.

Dr. Darwin obſerves, that "the quantity of the doſe of an emetic is not of ſo great conſequence as of other medicines, as the greateſt part of it is rejected with the firſt effort. All emetics are ſaid to act with greater certainty when given in a morning, if an opiate had been given the night before. For the ſenſorial power of irritation of the ſtomach had thus been in ſome meaſure previouſly exhauſted by the ſtimulus of the opium, which thus facilitates the action of the emetic; and which, when the doſe of opium has been large, is frequently followed on the next day by ſpontaneous ſickneſs and vomitings, as after violent intoxication." Zoonomia, part 3. art. v. 2. 1.

EMETIC *Powder,* called alſo *powder of Algaroth,* from the name of its author, is a precipitate of antimony; or butter of antimony ſweetened and ſoftened by repeated lotions. See ANTIMONY.

EMETIC *Tartar,* is now called *Antimonium Tartariſatum.* See ANTIMONY.

EMETIC *Wine, vinum antimonii,* is only white wine, wherein is infuſed ſome glaſs of antimony. See ANTIMONY.

Small doſes of emetic wine have been recommended as deobſtruent and ſudorific in ſlow fevers, in many chronical diſeaſes, and eſpecially in an obſtinate rheumatiſm. See Medic. Eſſ. Edinb. abr. vol. i. p. 170. and Huxham, Obſ. de Aere & Morb. epidem.

EMETZ, in *Geography,* a town of Ruſſian Siberia, in the government of Tobolſk; 28 miles W. of Iſchim.

EMEU, in *Ornithology,* the common name of the Caſſowary, a large bird of the oſtrich kind.

EMILE, in *Geography,* a ſmall town of France, in the department of the Seine and Oiſe, chief place of a canton in the diſtrict of Pontoiſe, with a population of 1800 individuals. The canton contains 20 communes and 13,843 inhabitants, on a territorial extent of $127\frac{1}{2}$ kiliometres.

EMILI, PAUL, in *Biography,* a modern hiſtorian, was born at Verona. In Italy he obtained a great character, and was brought into France by the cardinal de Bourbon, in 1487, who patronized him till his death. After this he was obliged to teach the languages for a ſubſiſtence. He undertook to write the hiſtory of France, for which he was rewarded with a canonry in the cathedral of Notre Dame. This hiſtory he brought down, in ten books, from Pharamond to the 5th year of Charles VIII.; it was publiſhed at different times; and likewiſe altogether at Paris in the year 1539, and has been ſeveral times re-printed and tranſlated into foreign languages. His ſtyle is pure, but ſometimes too conciſe, and even bordering on the obſcure; he is nevertheleſs to be regarded as the firſt writer who gave to French hiſtory a juſt form and method. He died at Paris in the year 1529, leaving behind him a very excellent character: his morals were as pure, as the language adopted in his works was chaſte and elegant. Bayle.

EMILION, SAINT, in *Geography,* a ſmall town of France, in the department of the Gironde, near the river Dordogne; ſix miles E. of Libourne, remarkable for the excellent wine which grows in its neighbourhood.

EMILIUS, ANTHONY, in *Biography,* profeſſor of hiſtory in the univerſity of Utrecht; was born Dec. 20th, 1589, at Aix la Chapelle, where his father had retired for the ſake of his religion. He received the early parts of his education in his native country, and finiſhed his claſſical ſtudies at Dort, under the famous Gerard John Voſſius: he then went to Leyden and other univerſities, and ſpent ſome years in foreign travel. On his return to his native country he ſucceeded Voſſius as rector of the college of Dort, and ſome time after he went to Utrecht to exerciſe the ſame office, where he was afterwards elected to the profeſſorſhip of hiſtory, an office in which he continued till his death, November 10th, 1660. His lectures, for more than twenty-ſix years, were taken from the annals of Tacitus. He publiſhed, about the year 1651, a collection of Latin ſpeeches and poems. Bayle.

EMILLAGUE, in *Geography,* one of the Pelew iſlands.

EMINENCE, a little hillock, or aſcent, above the level of the adjoining champain.

EMINENCE is alſo a title of honour given to cardinals.

The decree of the pope, whereby it is appointed, that the cardinals ſhould be addreſſed under the quality of eminence, bears date the 10th of January, 1630. They then laid aſide the titles of *illuſtriſſimi,* and *reverendiſſimi,* which they had before.

The grand maſter of Malta is likewiſe addreſſed under the quality of eminence.

The popes John VIII. and Gregory VII. gave the ſame title to the kings of France. The emperors have likewiſe borne it.

Eminentiſſimus, the ſuperlative of eminent, hath of late been attributed to the cardinals.

EMINENTIAL EQUATION is uſed by ſome algebraiſts in the inveſtigation of the areas of curvilinear figures; for a ſort of artificial equation, containing another equation eminently. Hayes Flux. p. 97.

EMINENTLY, EMINENTER, in the *Schools,* is uſed in contradiſtinction to *formally,* and in the ſame ſenſe with *virtually, viz.* to denote that a thing poſſeſſes, or contains, any other in a more perfect or higher manner than is required to a formal poſſeſſion thereof.

Thus an angel is ſaid to have prudence eminently; as he has it in a higher and more perfect degree than it is in man, in whom it is formally.

For one thing to contain another eminently, there are uſually required two conditions. 1. That the containing be of a more excellent nature than the contained. 2. That the leſs excellent be ſome way contained in the more excellent; *viz.* either as in its productive cauſe, or by ſome ſimilitude, or as to the manner and order of acting, &c.

EMIR, a title of dignity, or quality, among the Turks, and Saracens, attributed to ſuch as are relations or deſcendants of their great prophet Mahomet.

The word is Arabic, and literally ſignifies *prince.* It is formed of the verb אמר, *amar,* which is originally Hebrew; and in both theſe languages ſignifies *to ſay,* and *to command.* This is a title given to all the nobility of the firſt rank in the empire of the Mogul and in Tartary. The plural of this term is "Omra."

The emirs are held in high veneration, and have alone the privilege of wearing a green turban. On the borders of the Holy Land there are ſeveral emirs ſovereign princes; as the emir of Gaza, and the emir of Terabea, over whom the grand ſignior has but little authority. The title emir, at firſt, was only given to the caliphs: in Perſia they were alſo called *emir zadeh, q. d.* prince's ſon; whence by abbreviation of emir, they formed *mir;* and of *emir zadeh, mirza.* In after times, when the caliphs had aſſumed the title of ſultans, that of emir remained to their children, as that of Cæſar did among the Romans.

At length, the ſame title of emir came to be attributed to all who were judged to deſcend from Mahomet by his daughter Fatimah, and who wear the green turban.

Emir is alſo a title, which being joined to ſome other word, frequently denotes an office or employ; as the *emir al omera*, commander of commanders, who, in the time of the caliphs, was chief of the councils and armies.

The appellation emir is alſo applied by the Turks to all viziers and baſhaws, or governors of provinces. (See Bashaw, &c.) Add, that *emir akhor*, vulgarly *imrahor*, is maſter of the horſe to the grand ſeignior.

Emir alem, vulgarly *miralem*, ſtandard-bearer and director of all the ſtandards of the empire.

Emir bazar, the provoſt, or ſuperintendant of the markets, who regulates the prices of proviſions.

The *emir hagge*, or *hadj*, denoting pilgrimage, or prince conductor of the pilgrims of Egypt to Mecca, is baſhaw, or pacha of Damaſcus. See Caravan and Damascus.

Emir al moſleim, or *emir al moumenin*, *i. e.* commander of the faithful, or the believers, was a title aſſumed by the Almoravides and Almohades, who reigned in Africa and Spain.

Emir-*Bacha*, in *Geography*, a town of Aſiatic Turkey, in the province of Natolia; 80 miles W. of Tocat.

EMISSARIA, in *Anatomy*, are the veins which paſs into the ſkull from the external parts of the head, and terminate in the ſinuſes of the dura mater. Theſe openings are deſcribed in the article Cranium. The veins are ſometimes called after Santorini, an Italian anatomiſt. See Veins.

EMISSARIUM, in *Antiquity*, a ſluice, or drain, to draw off the water uſed in watering gardens, fields, &c.

EMISSARY, formed of *e* and *mitto*, *q. d.* I ſend out, a truſty, dextrous, able perſon, ſent ſecretly, to ſound the ſentiments and views of another, to make him ſome propoſal or overture; or to ſpread reports, watch the actions, motions, and countenance of a contrary party or perſon, in order to make advantage of them all. See Spy.

The leaders of parties have abundance of emiſſaries employed in their ſervice, who inform them of what paſſes every where, that they may take their meaſures accordingly.

EMISSION, the act of throwing, or driving a thing, particularly a fluid, from within, outwards. The ancients took viſion to be performed by the emiſſion of viſual rays from the eye.

But the term emiſſion is chiefly applied among us to the expulſion or ejaculation of the ſeed.

Emission *of Heat*.—All the heat we experience in the world is derived from three ſources; *viz.* from the ſun; from compreſſion, which comprehends colliſion and friction; and laſtly, from the decompoſition and compoſition of bodies.

It is hardly to be doubted, that the emanation of heat from the ſun, like the emanation of light from the ſame ſource, is not conſtantly the ſame; and it is recorded in hiſtory, that at certain times the light of the ſun has been obſerved to be pale, or leſs bright than uſual; and had the thermometer been in uſe amongſt the ancients, it would probably have been obſerved that the dimneſs of light was accompanied with a proportionate diminution of the uſual heat; for theſe alterations, as far as we can conjecture, ſeem to depend upon the ſize of the ſpots which cover the ſurface of the ſun at different and uncertain times.

The direct rays of the ſun on the ſame part of the ſurface of the earth, are more or leſs hot according to the time of the year, the clearneſs of the atmoſphere, the ſtate of the wind, and the colour or other quality of the ſpot upon which they fall. On this iſland, in the ſummer ſeaſon, the direct rays of the ſun ſeldom raiſe the thermometer to 110° But in other climates, eſpecially within the tropics, they raiſe it much higher; ſometimes as high as 150°. We muſt not, however, believe the ſtrange accounts of their melting lead or firing gun-powder; for thoſe rays cannot produce any ſuch effect, provided they are not concentrated, or aſſiſted, by artificial means.

It is not on account of the ſun's being nearer or farther from us, that we receive much more heat at one time of the year than at another; for the difference of its diſtance is too ſmall to produce any ſenſible effect; nor is it owing to the ſun's emitting more calorific rays at one time of the year than at another. But we receive more heat in ſummer than in winter, 1ſt, becauſe the ſun being nearer to our vertex, or to the zenith, in the former, than in the latter ſeaſon, its rays have a ſhorter way to paſs through the atmoſphere, and are of courſe leſs obſtructed by it. And the ſame cauſe renders the ſun's rays hotter about the middle, than at the commencement or the cloſe of the ſame day: 2dly, we receive more heat when the ſun is higher, becauſe in that caſe a greater quantity of its rays fall upon any given portion of the ſurface of the earth; than when it is lower, and its rays come in a direction more oblique; and, 3dly, becauſe in the ſummer ſeaſon the ſun remains longer above the horizon than in winter.

With reſpect to the cauſe of the emiſſion of heat from the body of the ſun, we cannot pretend to have the leaſt knowledge. It is generally ſuppoſed that the ſun is a body of fire; but it is impoſſible to ſay, whether it is an aggregate of caloric, independent of other matter, or a compound body undergoing a gradual decompoſition. It was, ſome time ago, alſo ſuppoſed, that the ſun emitted only rays of light, and that the action of thoſe rays upon terreſtrial bodies, extricated the heat from the latter. But the recent diſcovery (made by Dr. Herſchell,) of the calorific rays of the ſun ſuffering a different refraction from that of its luminous rays, beſides other conſiderations, renders this ſuppoſition vain. Excepting from the ſun, no ſenſible degree of heat is derived from the moon or from any other celeſtial object.

The immediate production of heat by the other means that have been mentioned above, *viz.* by compreſſion, colliſion, friction, compoſition and decompoſition of bodies, ariſes either from the caloric being ſqueezed out of a body, like water out of a ſpunge; or from an alteration of the capacities of bodies for containing heat. We ſhall endeavour to illuſtrate theſe proceſſes.

I. Experiments ſhew, that when a certain ſubſtance is compreſſed into a narrower ſpace, a quantity of heat comes out of it, and is communicated to the ſurrounding bodies. On the contrary, when a certain ſubſtance is expanded into a larger ſpace, it abſorbs a quantity of heat from the ſurrounding bodies; for theſe bodies are cooled in conſequence of it. Thus, if you wet your hand, and then expoſe it to the ambient air, the water, in the act of expanding itſelf into the form of vapour, abſorbs a quantity of heat from the hand, which is thereby ſenſibly cooled. If, by means of a condenſing engine, air is compreſſed in a proper veſſel, heat is extricated from it; and if the operation be performed quickly, a quantity of heat will be emitted, which is ſufficient to ſet fire to tinder, and other light combuſtible bodies. When the ſteam of water is condenſed, heat is depoſited by it upon thoſe bodies which are in contact with it.

Wood rubbed againſt wood, or againſt any hard body; metal rubbed againſt metal, or againſt any other hard body; in ſhort, ſolid bodies rubbed or knocked againſt each other, are thereby heated, often ſo far as to become red-hot.

By this means, heat may be produced where there is no oxygen, ſo that in thoſe caſes it cannot be derived from the decompoſition of that air. This has made ſome perſons ſuſpect that heat is not the effect of a peculiar ſubſtance called *caloric*; but that it is only a peculiar movement of the particles of bodies. The moſt ſtriking experiments relative to this ſubject were made by count Rumford (Phil. Tranſ. for 1798. p. 1.) He took a cannon, not yet bored, having a projection of two feet beyond its muzzle, a part which is uſually caſt with the piece, in order to inſure the ſolidity of the metal throughout, by the preſſure which its weight occaſions. This piece was reduced to the form of a cylinder, joined to the cannon by a ſmaller neck, and a large hole was bored in it: the whole cannon was then made to revolve on its axis by means of the force of horſes, while a blunt ſteel borer was preſſed againſt the bottom of the hollow cylinder, by a force equal to about 10,000lb. avoirdupoiſe; the ſurface of contact of the borer with the bottom of the cylinder being about two ſquare inches. This apparatus was wrapped up in flannel, when its temperature was about 60°. In half an hour, when the cylinder had made 960 turns, the horſes being ſtopped, a mercurial thermometer was introduced into a perforation in the bottom of the cylinder, extending from the ſide to the axis, and it ſtood at 130°, which count Rumford conſiders as expreſſing very nearly the mean temperature of the cylinder. The duſt or ſcales, abraded by the borer, weighed only 837 grains, or about $\frac{1}{950}$th of the whole weight of the cylinder. In another experiment, the cylinder was ſurrounded by a tight deal box, fitted with collars of leather, ſo as to allow it to revolve freely, and the interval between the cylinder and the box was filled with 19 pounds of cold water, which was excluded from the bore of the cylinder, by oiled leathers fixed on the borer; and after two hours and a half the water was made to boil. Hence count Rumford calculates that the heat produced in this manner, by the operation of friction, was equal to that of nine wax candles, each three quarters of an inch in diameter, continuing to burn for the ſame time.

Reaſoning upon theſe reſults, count Rumford thinks, that the heat, thus produced, cannot be extricated from the bodies concerned; and he is led to aſk "What is heat?—Is there any ſuch thing as an *igneous fluid?*—Is there any thing that can with propriety be called *caloric?*"

He then ſays, "We muſt not forget to conſider that moſt remarkable circumſtance, that the ſource of the heat generated by friction, in theſe experiments, appeared evidently to be *inexhauſtible.*

"It is hardly neceſſary to add, that any thing which any *inſulated* body, or ſyſtem of bodies, can continue to furniſh *without limitation*, cannot poſſibly be a *material ſubſtance:* and it appears to me to be extremely difficult, if not quite impoſſible, to form any diſtinct idea of any thing, capable of being excited, and communicated in theſe experiments, except it be *motion.*

"I am very far from pretending to know how, or by what means, or mechanical contrivance, that particular kind of motion in bodies, which has been ſuppoſed to conſtitute heat, is excited, continued, and propagated, and I ſhall not preſume to trouble the Royal Society with mere conjectures."

It muſt, however, be conſidered, that there is no friction which does not produce compreſſion; *viz.* a contraction of the bulk of the bodies concerned, at leaſt for a time; and therefore that the caloric is forced out of the bodies themſelves; and, being communicated to the ſurrounding bodies, produces the uſual ſigns of heat. It is a ſtrong corroboration of this aſſertion, that ſubſtances, which are not compreſſible, are not heated by mechanical force; thus, a flint will only be broken, but a piece of ſoft metal will be heated, by the ſtrokes of a hammer. Thus, alſo, you may place any weight upon a quantity of water, without altering its temperature, becauſe the compreſſibility of water is next to nothing; but if you place an additional weight upon a quantity of air; the bulk of the air will be contracted, and its temperature will be raiſed.

By about 15 or 20 ſmart and quick ſtrokes of a hammer on the end of a ſoft iron rod of about a quarter of an inch in diameter, placed upon an anvil, an expert blackſmith will render that end of the rod viſibly red-hot; and the ſofter the iron is, the quicker the effect will take place. But the production of vivid red ſparks from a piece of ſteel, when ſtruck againſt the edge of a flint, is a phenomenon not leſs curious. Theſe particles are ſcraped off by the flint, and are of courſe compreſſed ſo as to become red-hot.

"One of the moſt remarkable circumſtances, attending the production of heat by friction," ſays Dr. Young, "is the diſcovery of profeſſor Pictet, that it is often much more powerfully excited by ſoft ſubſtances than by harder ones. In making ſome experiments in a vacuum, in order to examine how far the preſence of air might be concerned in the effects of friction, he accidentally interpoſed ſome cotton between the bulb of his thermometer and the cup, which was ſubjected to the friction of various ſubſtances as it revolved; and he found that the ſoft filaments of the cotton excited much more heat, than any other of the ſubſtances employed."

II. When a body heated above the actual temperature of the atmoſphere, is placed amongſt other bodies, the ſuperfluous heat of the former is communicated to the latter; for there is no known body that can effectually intercept the tranſition of heat from one ſubſtance to another. But there is a remarkable phenomenon attending the communication of heat, which is neither very obvious, nor eaſily obſerved. This is, that in the diſtribution of heat amongſt a variety of ſubſtances, ſome bodies abſorb more of it than others, though they be all placed exactly in the ſame ſituation; hence different bodies are ſaid to have different *capacities* for abſorbing heat. (See HEAT, SPECIFIC HEAT, or SPECIFIC CALORIC.) So that if a certain quantity of heat is communicated to a mixture of equal weights of water and of mercury; the water will imbibe a much greater ſhare of that heat than the mercury, and yet both will appear of the ſame temperature.

Now it has been found that by mixing certain bodies together, their capacities for abſorbing heat is diminiſhed; therefore they part with a portion of their heat, which is of courſe communicated to the ſurrounding bodies. Thus, when a pint of ſpirit of wine is mixed with a pint of water, the mixture grows ſenſibly hot, becauſe their capacities for containing heat are diminiſhed in conſequence of their action upon each other. And it is to be remarked that whenever heat is emitted in the act of mixing fluids, as in the above-mentioned example of water and ſpirit, or of water and ſulphuric acid, &c. a concentration of bulk takes place; thus the above mixture of a pint of water with a pint of ſpirit will be found to meaſure leſs than two pints.

In combuſtions, the heat which is firſt communicated by the contact of an ignited body, or otherwiſe, decompoſes part of the combuſtible body, and of the ſurrounding oxygen air, which produces more heat, and this decompoſes more of thoſe bodies, and ſo the combuſtion proceeds and continues as long as there are combuſtibles and oxygen air ready for the proceſs. See EXCITATION *of heat.*

EMISSION *of Light.* The perception of objects, which we receive through our ſight, is obtained by the intermediation of ſomething, which we call *light*. Hence the blind muſt judge of the preſence of particular objects, by means of the ſound, or the ſmell, or the touch, &c. but not by the means of light. In ſhort, light does not ſenſibly affect any other part of our bodies, beſides the eyes. It follows then, that ſomething muſt paſs between any object we ſee and our eyes, but concerning this ſomething we have no certain knowledge. A variety of conjectures and hypotheſes have been offered; but of theſe hypotheſes two only may deſerve our attention. Deſcartes, Huyghens, and others, thought that a ſubtile fluid was diſperſed throughout the univerſe; that the luminous bodies, ſuch as the ſun, the ſtars, a lighted candle, &c. put that fluid, not in a progreſſive, but in a certain vibratory motion; (ſomewhat like the motion which is communicated to the air by ſonorous bodies;) and that this motion, being communicated to the nerves of our eyes, rendered the luminous objects perceptible to us. Newton and his followers ſuppoſe that light is a real emanation from luminous objects; *viz.* that a ſubtile fluid, conſiſting of certain peculiar particles of matter, proceeds from the luminous bodies; and by entering our eyes, excites in us the ſenſation of light, or the perception of luminous objects. A variety of facts and conſiderations ſeems to render this Newtonian hypotheſis of light by far the moſt probable of the two. See the article Light.

Admitting then Newton's hypotheſis, ſeveral conſequences, which naturally depend upon it, demand a particular illuſtration; *viz.* this emiſſion of light muſt conſiſt of particles; thoſe particles muſt have a very minute, but determinate, ſize;—they muſt be at certain diſtances from each other; muſt move with a certain velocity, and muſt have a certain momentum. Several remarkable diſcoveries that have been made in aſtronomy, and in other branches of natural philoſophy, enable us to determine the above-mentioned particulars, not with abſolute preciſion, but within certain limits of probabilty. The facts upon which this probability reſts, are as follows.

If a ſmall hole be made in a ſcreen, and the ſcreen be placed before our eyes, as about the diſtance of five or ſix feet; and if a luminous body, as a red-hot coal, be repeatedly paſſed before that hole, on the other ſide of the ſcreen, we muſt naturally perceive the hole luminous at intervals of time. But if the interval of time, during which the coal is not before the hole, be leſs than the tenth part of a ſecond, then the hole will appear conſtantly luminous, exactly as if the red-hot coal were held ſteadily before it. This ſhews that the impreſſion of light upon our eyes continues a certain time after the removal of the luminous objects. This is alſo the reaſon why, when a ſtick with a lighted extremity is quickly turned round in a circle before our eyes, we perceive an uninterrupted luminous circle.

The duration of the impreſſion of light upon our eyes is longer or ſhorter, according as the object is more or leſs luminous; ſo that the impreſſion is proportionally ſtrong. See the article Viſion.

Aſtronomers have obſerved, that the eclipſes of the ſatellites of Jupiter appear to take place ſooner than the time which is determined by the tables of their motions, when the planet is nearer to us; and later when that planet is farther from us. Hence it is naturally conjectured, that light moves progreſſively, and equally; *viz.* that it employs a certain time in going through a certain ſpace; and this conjecture is corroborated by other aſtronomical obſervations. The calculations, which have been made upon theſe appearances, ſhew that light moves at the aſtoniſhing rate of, at leaſt, 170,000 miles per ſecond; ſo that in its motion from the ſun to us, light employs about 8¼ minutes.

If a ſmall hole be made in a ſcreen, and ſeveral perſons are ſituated on one ſide of the ſcreen; every one of them looking through that hole at a different object placed on the other ſide of the ſcreen; it is evident that the various ſtreams of light from thoſe objects to the eyes of the obſervers, muſt paſs through the ſame ſmall hole in different directions, and without diſturbing each other, at leaſt in an obſervable degree. This ſhews, that the particles of light muſt be ſo very ſmall, and ſo diſtant from each other, as not ſenſibly to obſtruct each other's paſſage through a very narrow aperture.

In ſome experiments (rather imperfect) which were made by throwing the focus of a concave mirror upon the extremity of a very delicate beam, which was nicely ſuſpended, a ſlight motion was thereby communicated to the beam; whence it was deduced, that the light thus collected had a ſenſible momentum. From the weight of the beam, and from the motion which it had received from the impulſe of the light (upon the ſuppoſition that its motion was occaſioned by it); alſo from the above-mentioned velocity of light; it was calculated, that the quantity of matter, which was contained in the light which was thrown upon the end of that beam, during one ſecond of time, and which was collected from a reflecting ſurface of about four ſquare feet; amounted to no more than one twelve hundred millionth part of a grain. (Prieſtley's Hiſt. of Light, Viſion, &c. per. vi. ſect. i. chap. 3.) Theſe facts, joined to our daily experience, ſeem to authorize the following concluſions.

1. Since every phyſical point of a luminous object may be ſeen from every point of an immenſe ſpherical ſpace which ſurrounds it, when no opaque body is interpoſed, it follows, that the ſtreams of light, which proceed from all the points of viſible objects, and move in all manner of directions, are paſt all conception. If this be alleged as an objection to Newton's theory, the leaſt reflection will ſhew, that it offers an objection equally great, if not greater, to the other hypotheſis that has been mentioned above; but the following reaſoning will, in great meaſure, clear the difficulty with reſpect to Newton's hypotheſis.

2. It has been mentioned above, that the impreſſion of light remains a certain time upon our eyes, and (in the experiment with the red-hot charcoal) it has been ſhewn to remain about one-tenth part of a ſecond; but ſuppoſe it to remain only during the 100dth part of a ſecond. Then it is evident, that if 150 particles of light be emitted in a ſecond from a ſingle point of a luminous object, as from a point on the ſurface of the ſun; theſe particles will be more than ſufficient to give our eyes an uninterrupted viſion of that point; yet ſtill theſe particles, on account of their immenſe velocity, may be more than 1000 miles diſtant from one another, and, of courſe, may leave room enough for millions of other particles to paſs in all directions. Canton's Calcul. Ph. Tr. vol. 58.

3. The waſte of the ſubſtance of a luminous body, ariſing from the emiſſion of light, conſidering the minute nature of its particles, is very trifling, even with reſpect to the ſun, which has been the great fountain of light during ſo many centuries. Dr. Prieſtley, alluding to the above-mentioned experiment, where an impulſe was communicated to a beam by concentrated light, ſays, "Now the light in that experiment was collected from a ſurface of about four ſquare feet, which reflecting only about half what falls upon it, the quantity of matter contained in the rays of the ſun, incident upon a ſquare foot and half of ſurface, in one ſecond of time, ought to be no more than the twelve hundred millionth part of a grain. But the denſity of light at the

ſurface of the ſun is greater than at the earth in the proportion of 45,000 to 1; there ought, therefore, to iſſue from one ſquare foot of the ſun's ſurface in one ſecond of time, in order to ſupply the waſte by light, one-forty thouſandth part of a grain of matter; that is, a little more than two grains in a day, or about 4,752,000 grains, which is about 670 pounds avoirdupois, in 6000 years." Hiſt. of Light, &c. p. 390.

4. In conſequence of the motion of light, it is evident, that if a luminous body were ſuddenly placed in the heavens, at the ſame diſtance that the ſun is from us, we could not poſſibly ſee it before the lapſe of 8¼ minutes. Alſo, when we behold a celeſtial object, we do not ſee it exactly in the place where it actually ſtands; but we ſee it in the place where it ſtood ſome time before.

5. Light moves in ſtraight lines, as long as it goes through the ſame uniform medium, or through a vacuum.

6. When we direct our eyes towards certain poliſhed ſurfaces, we frequently ſee in them the appearances of objects, which are ſituated in places quite different from thoſe in which we ſee them. In this caſe the rays of light coming from thoſe objects fall upon the poliſhed ſurfaces, and from them they are *reflected* (that is, *ſent back*) to our eyes. Thoſe objects then are ſaid to be ſeen by reflected light, and the ſurfaces in which their appearances are ſeen are called the *reflecting ſurfaces*. Indeed, every body which does not itſelf emit any light, (as is the caſe with all thoſe which cannot be diſcerned in a dark room,) are ſeen by reflected light; for the light which is emitted from the ſun, from a candle, from a fire, &c. falls upon thoſe bodies, and is from them reflected to our eyes; but that light is reflected irregularly on account of the inequalities on the ſurfaces of moſt bodies; ſo that though all bodies which do not ſhine of themſelves, are ſeen by reflected light; yet they are called reflectors, or are ſaid to have reflecting ſurfaces, only when thoſe ſurfaces are ſmooth and poliſhed, in which caſe they reflect the light regularly, ſo as to repreſent the images of other objects, that are placed before them. See REFLECTION *of* LIGHT.

7. In its paſſage from one body into another, or from a vacuum into any ſubſtance, and *vice verſâ*, light is often bent in its direction; and that bending is called the *refraction of light*. See REFRACTION *of* LIGHT.

8. Light is likewiſe bent in its direction, when it paſſes cloſe by the ſurfaces of bodies; and this bending is called the *inflection of light*, which ſee.

The ſources of light are various, but they may be compriſed under the following enumeration.

1. The celeſtial bodies, which ſhine either by their own light, as the ſun and the ſtars; or by reflected light, like the moon and the ſatellites.

2. The *aurora borealis*, and other meteors, whoſe nature is not as yet diſtinctly known.

3. Bodies that are in a ſtate of *combuſtion*, and emit heat as well as light.

4. The *electrical light*; and,

5. The *phoſphoreſcent bodies*, of which there are ſeveral ſpecies, *viz.* 1. The *phoſphorus* properly ſo called, which is conſidered as an elementary ſubſtance. 2. The living animals which have the property of ſhining in the dark, ſuch as glow-worms, lantern-flies, &c. 3. Thoſe bodies which abſorb light when expoſed to it, and then emit it in the dark; ſuch are ſeveral precious ſtones, calcareous bodies, Canton's phoſphorus, the Bolonian ſtone after due preparation, &c. 4. The bodies which emit light when they are heated to a certain degree; fluoric ſtones, ſeveral marbles, calcareous earth, &c. have this property. 5. The ſubſtances which emit a light either quite white, or tinged with different ſhades of red or blue, by attrition; *viz.* by being rubbed or ſtruck againſt each other. Moſt ſtones of the ſilicious kind poſſeſs this property. 6. And laſtly; thoſe bodies which emit light without any ſenſible heat, whilſt they actually are under a ſtate of decompoſition; and of this ſort are moſt animal matters, and ſome vegetable ſubſtances, eſpecially rotten wood.

The doubtful nature of the *ignis fatuus*, or *jack-a-lantern*, may perhaps alſo be reckoned amongſt the phoſphori. See AURORA BOREALIS, ELECTRIC *light*, METEORS, PHOSPHORUS, PHOSPHORESCENT BODIES, and IGNIS FATUUS.

EMITES, in *Natural Hiſtory*, a name uſed by ſome authors for the chermites, a beautiful ſpecies of white marble, of which the tomb of Darius, and many other of the great works of antiquity, were made. It was valued for its fine poliſh.

EMLY, in *Geography*, a village of the county of Tipperary, province of Munſter, Ireland, the ſee of a biſhop; which was united to Caſhel in 1568. It is 15 miles W. from Caſhel.

EMLYN, THOMAS, in *Biography*, an eminent nonconformiſt divine, was born at Stamford, in the county of Lincoln, in the year 1663. His parents, though accuſtomed to attend the religious ſervice of the eſtabliſhed church, thought ſo favourably of the principles of the Proteſtant diſſenters, that they determined to educate their ſon for the miniſtry among perſons of this deſcription. Accordingly, he was placed for academical inſtruction in the year 1678, under the care of Mr. Shuttleworth, who reſided at Sulby, near Welford, in Northamptonſhire. In the following year he was admitted at Emanuel college, in the univerſity of Cambridge; but afterwards returned to Mr. Shuttleworth, under whoſe tuition he remained for four years. With a view to the enjoyment of ſuperior advantages, he removed, in 1682, to the academy of Mr. Doolittle in the vicinity of London, and in this ſituation he diligently availed himſelf of the collateral means and opportunities of improvement, afforded him by an acceſs to books, and intercourſe with literary perſons; and made ſuch improvement in the knowledge, connected with his profeſſion, that he was encouraged to commence the exerciſe of his profeſſion in December, 1682. His mind, at this early period, diſdained the ſhackles of eſtabliſhed ſyſtems of theology; and he determined to inquire freely, and to exerciſe, independently of the controul of authority, the right of private judgment. It was favourable to his future improvement, that he was not under a neceſſity of immediately connecting himſelf with a congregation, and of devoting his whole time to neceſſary preparation for the public ſervices of his profeſſion. In the year 1683, he became chaplain to the counteſs of Donegal, and accompanied her to Belfaſt in Ireland, where he had a liberal appointment, and was treated with reſpect and kindneſs. The counteſs married ſir William Franklin, a gentleman of conſiderable property in the weſt of England, who offered our young divine a valuable living in that country; but not approving the terms of miniſterial conformity, he declined the acceptance of it. His ſentiments, however, were ſo liberal, that he regularly attended the public ſervices of the eſtabliſhed church, and was himſelf attended in the evening, when he officiated in the counteſs's hall, by the miniſter of the pariſh, with whom he cultivated an intimate acquaintance. He likewiſe occaſionally officiated in the pariſh church, having obtained, without ſubſcription, a licence to preach from the biſhop of the dioceſe. At this time he viſited Dublin, and his ſervices were ſo acceptable to the congregation, of which Mr. Daniel Williams and Mr. Joſeph Boyce were paſtors, that he was afterwards induced to ſettle among them. In the mean while a variety of circumſtances occurred in the agitated ſtate of the north of Ireland, and the domeſtic diſunion of the family of his patroneſs, which rendered it expedient for Mr. Emlyn to remove to England. Accordingly in the year 1688, he came to London, where he renewed his acquaintance with Mr. (afterwards Dr.) Daniel Williams, who had relinquiſhed his paſtoral connection with the congregation at Dublin. As he paſſed to and fro from Ireland to London, he was accuſtomed to preach in ſeveral pariſh churches; and at Liverpool in particular, where he had accidentally officiated, his preaching was ſo much approved, that upon the deceaſe of the pariſh miniſter, whoſe place he had ſupplied, ſeveral of the inhabitants expreſſed their wiſhes, that they might be allowed to procure for him the living. But this offer, however reſpectful on their part, his principles would not permit him to accept. In 1689, Mr. Emlyn, being altogether unemployed, was invited by ſir Robert Rich, one of the lords of the admiralty, to his reſidence near Beccles in Suffolk; and he was induced to officiate to a diſſenting congregation at Loweſtoff, where he continued about a year and a half; though he declined complying with their invitation to undertake the paſtoral office. The liberality of his ſentiments and conduct, during his abode in this place, ſerved to promote a perfect harmony between the members of the eſtabliſhed church and the diſſenters. Here he became acquainted with Mr. William Manning, a reſpectable non-conformiſt miniſter in the neighbourhood; and their mutual intercourſe led them both to adopt ſentiments, with regard to the doctrine of the Trinity, in vindication of which Dr. Sherlock's treatiſe had juſt appeared, very different from thoſe which they had hitherto entertained. Mr. Manning became a Socinian; but Mr. Emlyn adopted what has been generally called the Arian opinion, believing the pre-exiſtence of our Saviour, as the Logos, and that by him God had created the material world. To this opinion he adhered through life. Upon the abdication of king James II., the turbulence of Ireland in ſome degree ſubſided; and Mr. Boyce urged Mr. Emlyn, to join him in the paſtoral care of the diſſenting congregation in Wood ſtreet, Dublin. After much previous deliberation, he accepted the propoſal, and, in 1691, removed to Dublin. Here he ſoon acquired diſtinguiſhed reputation as a preacher. His diſcourſes were rational, perſuaſive, and pathetic; his voice was clear and ſtrong, and his delivery dignified and graceful; the devotional ſervices were conducted with great propriety; controverſial ſubjects were avoided; and all the private duties of a Chriſtian paſtor were diſcharged in an exemplary manner. In 1694, Mr. Emlyn married Mrs. Eſther Bury, a widow lady, with a handſome jointure; and he was thus enabled to maintain a reſpectable appearance. After conſiderable heſitation and ſuſpence, he determined, when a proper occaſion offered, to avow his opinion concerning the doctrine of the Trinity. But before the formal execution of his purpoſe, he met with various domeſtic troubles. In 1701, he loſt both his ſon and his wife; the latter affliction deeply wounded his feeling, and led him to that admirable train of meditation, which is purſued in the funeral ſermon preached on the occaſion, and which was printed under the title of "Funeral Conſolations." Soon after he was bereaved of his wife, and whilſt his mind was in an unfit ſtate to encounter new conflicts, his opinion concerning the Trinity became the ſubject of inveſtigation. Dr. Cummins, a phyſician of Dublin, and a member of his congregation, communicated his ſuſpicions to Mr. Boyce; and they determined to apply to Mr. Emlyn for a declaration of his real ſentiments. Having explicitly avowed his opinion, that the God and father of Jeſus Chriſt is alone the Supreme Being, and that the ſon derives his excellence and authority from him, he offered to withdraw quietly from the congregation, and thus to prevent the diſturbance that was likely to enſue. But this pacific meaſure was unſatisfactory. Mr. Boyce, in a manner that reflects diſgrace on his memory, brought the matter before the Dublin miniſters, who, after a candid declaration of his ſentiments on the part of Mr. Emlyn, immediately forbade him to preach any more. His congregation, during this precipitate courſe of proceedings, was never conſulted on the occaſion. Mr. Emlyn avowed his ſentiments to the deacons and principal managers of the church; and after reſpectfully acknowledging their kindneſs to him, requeſted his diſmiſſion. The conduct of his accuſers was the cauſe of much ſurpriſe and concern to the congregation, and Dr. Cummins himſelf regretted the part which he had acted. However, it was at length determined that Mr. Emlyn ſhould retire for an interval to England; and ſuch was the violence of the Dublin miniſters, that, notwithſtanding the great inconvenience and expence, to which he was conſtrained to ſubmit, two of their number were deputed to "charge him not to preach any where when he went thither." Theſe perſecutors followed him with their letters of accuſation to London, and endeavoured to deprive him of the benefits of that candour and charity which he experienced on his arrival. Whilſt he remained in London, he publiſhed a ſhort account of his caſe; and after an abſence of 10 weeks, he reſolved to return to his family in Dublin. In order to obviate the prejudices that were entertained againſt his perſon and doctrine, he wrote his "Humble Inquiry into the Scripture account of Jeſus Chriſt, or a ſhort Argument concerning his Deity and Glory, according to the Goſpel." He then determined to return to England; but his purpoſe was prevented by the perſecuting ſpirit of his enemies, who obtained a ſpecial warrant from the lord chief juſtice to ſeize our author and his books. At firſt the chief juſtice refuſed bail; but afterwards allowed it, when two ſufficient perſons became bound in a recognizance of 800*l.* for Mr. Emlyn's perſonal appearance. In the next term the grand jury found a bill againſt him, in which he was indicted of blaſphemy. The trial came on in June 1703; and it was conducted in a manner no leſs diſgraceful and tyrannical than the proceedings of a board of popiſh inquiſitors. The jury were intimidated to deliver their verdict, and to bring in the defendant guilty, for which ſome of them afterwards expreſſed their concern. After the verdict was pronounced, the attorney-general moved, that the author might have the honour of the pillory; but ſentence was deferred till the laſt day of the term. In the mean time Mr. Emlyn was committed to the common gaol. Mr. Boyce now began to relent, and uſed all his intereſt to prevent the paſſing of the cruel ſentence threatened by the attorney-general. Mr. Emlyn alſo, in deference to the advice of his friends, wrote a letter to the lord chief juſtice, which was indited with a ſpirit, and in a ſtyle which ought to have influenced his mind. When he appeared to receive judgment, one of the queen's council moved that he ſhould retract; but Mr. Emlyn would not conſent. The lord chief juſtice, therefore, ſentenced him to ſuffer a year's impriſonment; to pay a fine of 1000*l.* to the queen, and to lie in priſon till it ſhould be paid; and to find ſecurity for his good behaviour during life. He was given to underſtand, that though the pillory was due to his crime, this puniſhment was not inflicted, as he was a man of letters. After ſentence was pronounced, he was led round the four courts with a paper on his breaſt, to be expoſed. For more than a quarter of a year, he was kept a cloſe priſoner in the under-ſheriff's houſe; and after the expiration of this term he was hurried away to the common gaol, where he lay among the priſoners in a cloſe room, filled with ſix beds, for about five or ſix weeks; and then he was removed upon his petition, by *habeas corpus*, to the Marſhalſea, on account of his health. In this priſon he wrote, in 1704, a treatiſe, entitled "General Remarks on Mr. Boyce's Vindication of the true Deity of our Bleſſed Saviour." In this ſtate of impriſonment, he remained until the month of July 1705, viſited by few of his former friends, and altogether neglected by his ſavage brethren, the Dublin miniſters. Mr. Boyce, indeed, ſhould be excepted; and to his zealous and repeated ſolicitations, to the generous interference of Thomas Medlicote, eſq., the humane interpoſition of the duke of Ormond, and the favourable report of the lord chancellor, that the exorbitant fine paſſed upon him was illegal, his releaſe from confinement was owing. By their exertions the fine was reduced to 70*l*., which was actually paid into her majeſty's exchequer; but the archbiſhop of Armagh, the queen's almoner, who had a claim of 1*s*. in the pound upon the whole fine, inſiſted on the whole ſum, nor would he extend his charity to a conſcientious ſufferer till he received 20*l*. by way of compoſition for the 50*l*. to which the ſentence entitled him. During Mr. Emlyn's confinement in the Marſhalſea, he conſtantly preached on ſundays to ſome of the impriſoned debtors, and ſeveral of the lower claſs of his former hearers. Soon after his releaſe Mr. Emlyn removed to London, where he preached once every ſunday to a ſmall congregation of perſons of ſentiments ſimilar to his own, but without receiving any ſalary. Attempts were made to reſtrain him by Charles Leſlie, the famous non-juror, and alſo by the lower houſe of convocation, but by the moderation of archbiſhop Teniſon, and the interference of government, they were unſucceſsful. Mr. Emlyn's congregation gradually declined by the death of his hearers, and was at length diſſolved; upon which he retired to obſcurity, and employed himſelf in vindicating, by various publications, the principles he had adopted, and the cauſe to which he was devoted. One of his moſt elaborate productions was entitled, "A Vindication of the Worſhip of the Lord Jeſus Chriſt, on Unitarian principles," and publiſhed in the year 1706. One of his moſt curious works was publiſhed in 1710, and was entitled "The Previous Queſtion to the ſeveral Queſtions about valid and invalid Baptiſm, lay Baptiſm, &c. conſidered, *viz*. whether there be any neceſſity, (upon the principles of Mr. Wall's Hiſtory of Infant Baptiſm) for the continual uſe of Baptiſm among the poſterity of baptiſed Chriſtians." In 1715, he publiſhed his "Full Enquiry into the original Authority of the Text, 1 John, v. 7, &c. containing an account of Dr. Mill's evidence from antiquity, for and againſt its being genuine, &c." In this controverſy there appeared, pro & con, ſeveral tracts, the titles of which we cannot recite in this place, nor can we mention the various publications of Mr. Emlyn on the ſubject of the Trinity. In 1719, he publiſhed "A true Narrative of the proceedings of the Diſſenting Miniſters of Dublin, againſt Mr. Thomas Emlyn, and of his Proſecution, (at ſome of the Diſſenters' Inſtigation,) in the ſecular court, &c." Mr. Emlyn, though himſelf unpopular, had the ſatisfaction to obſerve, that the opinion for which he ſuffered excited attention, and gained advocates, both in England and Ireland. Although none of the diſſenting miniſters in London could dare to aſk him to preach for them, except Mr. Burroughs, and Dr. James Foſter, he was honoured with the eſteem and friendſhip of many perſons, diſtinguiſhed by their ſtation and learning; and particularly by Dr. Samuel Clarke, and Mr. Whiſton. Upon the death of Mr. James Pierce of Exeter, about the year 1726, it was propoſed to invite Mr. Emlyn to be his ſucceſſor; but he wiſhed them to decline all thoughts of him, as his advanced age, and increaſing infirmities would not permit him to accept the office. The gout had much impaired Mr. Emlyn's conſtitution, and he at length fell a martyr to it, on the 30th of July, 1743, in the 79th year of his age. A complete collection of his works was made in 1746, and is compriſed in two vols. 8vo.; to which are added memoirs of his life, written by his ſon Sollom Emlyn. His ſermons are ſeparately publiſhed in one volume.

EMMA, in *Biography*, daughter of Richard II. duke of Normandy, wife of Ethelred king of England, and mother of Edward the Confeſſor, had a conſiderable ſhare of power during her ſon's reign. The duke of Kent, who was jealous of her great aſcendancy, and deſirous of getting rid of her as a rival, cauſed her to be accuſed of ſeveral high crimes, to which the king her ſon too readily liſtened, and not only deprived her of all thoſe immenſe treaſures which ſhe had amaſſed, but confined her for life in the monaſtery of Wincheſter. Some hiſtorians go much farther, and contend that ſhe was accuſed of murder, and of incontinence with the biſhop of Wincheſter, but Mr. Hume conſiders ſuch reports, and the ſtory of her being obliged to juſtify herſelf by walking over the nine red-hot plough-ſhares, as the inventions of Monks, and propagated for the ſake of exciting the ſilly wonder of poſterity. Bayle, however, gives full credit to the facts, and adds that the king, now ſenſible of the complete innocence of his mother, and penitent for the ſufferings he had inflicted on her, ſubmitted his back to the ſcourge. Hume. Bayle.

EMMAUS, in *Ancient Geography*, a village of Paleſtine, 60 furlongs N. of Jeruſalem; mentioned, Luke xxiv. 13, as the place whither two of our Lord's diſciples retired on the day of his reſurrection, and where he joined them in the form of a traveller, and demonſtrated to them, that the Meſſiah was to ſuffer death and to riſe again; and where he diſcovered himſelf to them at ſupper, while he was breaking bread. At this place were hot baths; and a church was erected on the ſpot where Cleopas, one of the fore-mentioned diſciples, ſtood. Joſephus informs us, that Veſpaſian left 800 ſoldiers in Judea, to whom he gave this village.

EMMAUS, a city of Judea, 22 miles from Lydda, afterwards called *Nicopolis*, and different from the village of Emmaus, though often confounded with it. Mr. Reland proves theſe to be different places from the teſtimonies of Joſephus, St. Jerom, the Maccabees, and the Talmudiſts. In this Emmaus, or Nicopolis, there were hot baths, in which, as the tradition of the inhabitants reports, our Lord waſhed his feet, and communicated a healing virtue to them. Julian, the apoſtate, from enmity to Chriſt, gave orders for ſtopping up this fountain.—Alſo, a town near Tiberias, in which were hot waters. Joſeph. de Bell. l. iv. c. 1.

EMME, in *Geography*. See EMMENTHAL.

EMMELIA, Εμμελεια, in *Antiquity*, a dance peculiar to tragedy, which had all the gravity and dignity that were ſuitable to the action then repreſenting, and was deſigned to inſpire the audience with ſentiments of compaſſion and benevolence for the unfortunate and oppreſſed, with indignation againſt the guilty, and with the love of virtue, and abhorrence of vice. The happy mixture of noble and elegant concords, together with an exquiſite modulation in the action of the perſonages, denoted by emmelia, is ſtrikingly exemplified in that piece of Æſchylus, in which king Priam offers a ranſom for the body of his ſon. The chorus of Trojans, proſtrate with him at the feet of the conqueror of Hector, and like him uttering, amid their dignified emotions, expreſſions of grief, fear, and hope, communicate to the ſoul of Achilles, and thoſe of the ſpectators, the ſentiments with which they are penetrated.

The movements of ſuch a dance as this muſt have been very ſolemn and majeſtic, and have bore a great affinity to the action of an orator; it was the only one, excepting the military dances, that had the approbation of Plato. Mem. Acad. Inſcript. vol. ii. p. 160. See Dance.

Emmelia, in *Muſic*, tuneful ſounds among the Greeks, ſuch as were fit for melody.

EMMELOORT, in *Geography*, a town in the north part of the iſland of Schockland, in the Zuyder ſea; 10 miles E. of Vollenhove.

EMMENAGOGUES, Menagoga, in *Medicine*, are ſuch ſubſtances as are underſtood to poſſeſs the power of exciting the menſtrual diſcharge in the female ſex.

Both the ancient and modern writers on the Materia Medica, but eſpecially the former, mention a great number of medicines, to which they attribute this power, and ſpeak of it with conſiderable confidence. But the articles, to which an emmenagogue quality has been thus aſcribed, have not ſucceeded in the hands of the phyſicians of cautious obſervation in our own times; ſo that it is now generally admitted, that we are not in poſſeſſion of a medicine, which has any ſpecific power in ſtimulating the veſſels of the uterus. Dr. Gregory aſks, in his Lectures, "What effect a medicine, poſſeſſed of ſuch a power, could have upon men?" which he ſeems to conſider as an unanſwerable refutation of the notion of emmenagogues. But may we not equally diſprove the exiſtence of a diuretic medicine, by inquiring what effect ſuch a medicine would produce in animals which have no kidney? Experience, however, amply corroborates the opinion; and the operation of thoſe ſubſtances, which have occaſioned the catamenia to flow, is explicable on other principles than that of a ſpecific ſtimulus to the uterine veſſels. But it is alſo to be remarked, that there is great room for deception with reſpect to the operation of medicines, in reſtoring or exciting the menſtrual diſcharge; and that the fallacious concluſion of "poſt hoc, ergo propter hoc," has given a character of efficacy to many medicines, (in all departments of practice, but in this moſt eminently,) which in truth poſſeſs no ſuch power. The catamenia frequently appear ſpontaneouſly, after long retention or ſuppreſſion; and whatever medicine happens to be under adminiſtration at that time gains the credit of the cure.

There is an error almoſt univerſally prevalent among the women themſelves, and ſanctioned by goſſiping medicaſters, that the ſuppreſſion of the menſes is the *cauſe* of almoſt every diſorder which the female conſtitution can ſuffer; and conſequently, that its reſtoration, in theſe caſes, is the moſt important point to be attended to in their treatment. Now the converſe of this poſition is much nearer the truth. The ſuppreſſion of the catamenia is moſt commonly the *effect* of a previouſly diſordered ſtate of the conſtitution, and will be removed, as a matter of courſe, when the health in general is reſtored. Hence, ſuch a ſuppreſſion is one of the ſymptoms of almoſt all chronic diſeaſes, and debilitated conditions of the body: it is ſometimes the conſequence of the oppoſite ſtate, of a plethoric or inflammatory diatheſis. The remedies, therefore, which poſſeſs an emmenagogue power, operate indirectly upon the uterine ſyſtem, through their effects upon the ſyſtem at large; and are conſequently of oppoſite qualities, as they apply to two oppoſite conditions of the conſtitution: or, they operate locally upon the adjoining parts, and affect the uterus from its contiguity.

The retention of the catamenia in young women, about the age of puberty, is generally connected with extreme debility of the ſyſtem, often with that morbid change of complexion which deſignates the green-ſickneſs, or Chlorosis, which ſee. It is in ſuch caſes, that preparations of iron, bark, and other tonic medicines, may be deemed emmenagogues, by reſtoring the general tone of the habit: the chalybeates have been particularly extolled for their emmenagogue powers. But in full florid habits, when the catamenia are ſuddenly ſuppreſſed, laxatives, diaphoretics, and even blood-letting, moſt effectually contribute to reſtore the diſcharge. Many other reputed emmenagogues operate as local ſtimuli to the contiguous parts: hence aloes, and other warm purgatives, which irritate the lower portion of the inteſtines, have been celebrated for their emmenagogue powers. Electricity, applied through the pelvis to the hips and back, has ſometimes been an efficacious emmenagogue. Savine, caſtor, the fœtid gums, the warm-bath, and pediluvium, may be deemed ſtimulants to the uterus, as a part of the general ſyſtem: the efficacy of the warm-bath, or ſlipper-bath, when employed about the expected period of menſtruation, is often very great. Dr. Mead highly extolled the tincture of black hellebore, which, he ſays, ſeldom failed in his practice; and he attributed to it ſuch a ſtimulative power over the blood-veſſels, that when it did not produce the menſes, he affirms, the blood was driven through other outlets, as from the noſe, bowels, &c. But Dr. Home, and many other phyſicians, have uſed it largely in vain. Dr. Home attributes ſome powers to the ſavine, and much to madder (rubia tinctorum); which, however, has appeared to others to be altogether inert. Cullen Mater. Medica, vol. ii. Home Clinical Exper. p. 377. See Amenorrhoea.

EMMENDINGEN, in *Geography*, a ſmall town of Germany, in the grand duchy of Baden Durlach, ſituated on the river Eltz, in the diſtrict of Hochberg, the neighbourhood of which produces excellent wine; but it is chiefly remarkable for a fruitleſs conference, which was held here in the year 1590, between the Roman Catholic and Lutheran divines of Germany. Emmendingen is on the high road from Switzerland to Francfort, on the Mayn.

EMMENTHAL, one of the fineſt and richeſt valleys of Switzerland, in the canton of Aarau, deriving its name from the river Emme, by which it is irrigated. The principal towns are Signau, Trachelwald, Soumiſwald, and Brandis. Its cheeſe is known all over Europe under the name of "fromage de Gruyères."

EMMERAN, Saint, formerly a rich imperial abbey of Germany, in the town of Ratiſbon. Its poſſeſſions form now a part of the territory of the prince primate of the Confederation of the Rhine.

EMMERICH, or Emmerick, a ſmall town of Germany, in the grand duchy of Berg, ſituated on the Rhine, in the former duchy of Cleves; 9 miles E. of the town of Cleves, and 24 miles S.E. of Nimeguen. N. lat. 51° 39′. It has a conſiderable trade with Holland, and was anciently one of the Hanſeatic towns. Its origin dates from the year 1247, when it was firſt ſurrounded with walls.

EMMIELLURE, in the *Manege*, a kind of compoſition of honey, and other ingredients, uſed for ſprains and ſhoulder-ſplaits of horſes. See Charge.

The word is French, derived from *miel*, honey, which is a part of the compoſition.

EMMIUS, Urbo, in *Biography*, a learned philologiſt and hiſtorian, was born in 1547, at Gretha, a village in

Eaſt Frieſland, of which his father was the paſtor. In his ſtudies he was diligent and remarkably ſucceſsful. His natural timidity and baſhfulneſs prevented him from undertaking the office of miniſter; and in 1579, he engaged as maſter of the ſchool of Norden, in Eaſt Frieſland, which he conducted with great reputation, till he was haraſſed by bigots for refuſing to ſubſcribe the confeſſion of Augſburg; and at length not only deprived of his ſalary, but prohibited from teaching. From Norden he went to Leer, where he undertook the ſame office, to the great injury of his late ſchool. When Groningen aſſociated itſelf with the United Provinces, and planned the re-eſtabliſhment of its college, Emmius was choſen its director, with the full power of forming ſuch ſtatutes for its government as he ſhould think proper. In this office he continued 20 years, when the college was erected into an univerſity; and Emmius was appointed profeſſor of hiſtory and Greek, in which he gave lectures to a very advanced period of life. He died at Groningen, in 1625, in the 79th year of his age, highly reſpected by all with whom he was connected; and his memory was ſo much honoured, that the magiſtrates, to whom he had been an able counſellor on all important occaſions, placed his portrait in the town-houſe. He publiſhed many valuable works on hiſtory, chronology, and antiquities: among theſe are, "Decades Rerum Friſicarum;" "Vetus Grecia illuſtrata," in three volumes, which is highly eſteemed as a valuable ſummary of the geography, hiſtory, polity, &c. of ancient Greece. It is recorded of him in his life, that he was ſo thoroughly verſed in the hiſtories of all kingdoms and countries, that, at the requeſt of his friends, he could at any time, and without previous conſideration, ſpeak upon the hiſtory of all kingdoms and countries, beginning with any period that might be fixed on, and give a complete detail of all the places, times, and circumſtances of perſons, as if he had come prepared expreſsly to explain thoſe hiſtories. Eulogies were pronounced on his memory by Thuanus, Scaliger, Douza, Heinſius, David Chytræus, and others. By Scaliger his hiſtory of Frieſland is called "divine." Bayle.

EMO, or Emo *Inn*, in *Geography*, in the Queen's county, province of Leinſter, Ireland, has been made a poſt-town, and is much frequented by travellers, as a convenient ſtage. Adjoining it is Emo-park, the ſeat of the earl of Portarlington. Emo is 35 miles S.W. from Dublin, and 5 E. from Maryborough.

EMODI Montes, or *Emodi Mons*, in *Ancient Geography*, part of a chain of mountains in Aſia. Pliny ſays, that the Emodus, the Imaus, the Paropamiſus, and the Caucaſus, were connected together; and that the Serres inhabited the country beyond theſe mountains. Dionyſius Periegetes places the ſprings of the Oxus in the Emodian mountains, and extends this chain as far as the Eaſtern ocean. The mountains Emodus and Imaus, according to major Rennell, are the mountains which extend from the Ganges, above Sirinagur, to Caſhmere: ſeparating the dependencies of Hindooſtan from thoſe of Great Thibet. This ingenious geographer ſuſpects Emodus and Imaus to be different readings of the ſame name; and Emaus or Himaus are, without doubt, derived from the Sanſcrit word *Himmaleh*, ſignifying ſnowy. That vaſt ridge bears the ſame name at preſent; and Pliny (l. vi.) well knew the circumſtance. The mountains of Rimola, ſo called in the Lama's map, to which the territories of Napaul extended, were anciently denominated Emodus; and they are a continuation of the chain between Taſſudon and Paridrong.

EMODIA, Αιμωδια, of αιμα, *blood*, and οδους, *tooth*, in *Medicine*, a word uſed by ſome authors to expreſs a ſtupor of the teeth.

EMOLLIENTS, are medicines which, when externally applied, have the power of relaxing or ſoftening the fibres, when too rigid. They have all been ſuppoſed to act mechanically, but this may be doubted. The commoneſt form of emollient is a cataplaſm or poultice of bread and milk, or other mucilaginous vegetable matter, applied to the ſkin as warm as can be borne without pain. The relaxation and conſequent eaſe which warm cataplaſms produce is very great; but as none of the materials can be readily abſorbed through the cuticle, when unbroken, the emollient effect has with great probability been attributed chiefly, if not entirely, to the relaxing effect of warmth and moiſture upon the extreme veſſels of the living ſurface, unconnected with any ſuppoſed interpoſition of moiſture between the moving fibres.

The other claſs of emollients comprehends unctuous bodies of all kinds, when aſſiſted by friction; and as there is no doubt of a conſiderable abſorption taking place in this method, it is not improbable that the fibres may be actually ſoftened, and rendered more flexible by mechanical operation. No comparative experiments have yet been fairly made to decide whether one unctuous body is more penetrating, that is to ſay, more readily abſorbed by the ſkin, than another; ſo that, as mere emollients, they all have equal claim to uſe.

EMOLUMENT, is properly applied to the profits ariſing daily from an office or employ.

The word is formed of the Latin *emolumentum*; which, according to ſome, primarily ſignifies the profits redounding to the miller from his mill; of *molo*, *molere*, *to grind*.

The patent, or other inſtrument, whereby a perſon is preferred to an office, gives him a right to enjoy all the dues, honours, profits, and emoluments, belonging thereto.

In our law-books, emolument is uſed in a ſomewhat greater latitude, for profit, or advantage, in the general.

EMOTION, in *Elocution*, a mode of utterance applied to appropriate paſſages and on proper occaſions, expreſſive of diſturbance and agitation in the mind of the ſpeaker, reader, or reciter, and calculated to produce the like diſturbance and agitation in the minds of the auditors. Under proper regulation of the judgment, this is one of the higheſt graces of elocutionary expreſſion; nay, ſo eminently is it calculated to produce the effects at which the higheſt ſpecies of elocution principally aim, that it may ſometimes be ſaid moſt completely to attain its end, when the judgment of the ſpeaker becomes for a while ſuſpended, or is at leaſt ſurrendered to its influence and domination. By ſome, however, it is diſputed whether the elocutioniſt (eſpecially the actor) ought really, (for the moſt perfect production of the effect deſired,) to be under the poſitive influence of the emotion exhibited, or ought only to imitate, by the ſtrong operation of judgment and recollection, ſo much of the actual emotion of real life, as appears calculated to excite the general or particular ſympathy deſired; and the writer of this article remembers an inſtance in which a public lecturer was much cenſured by a critical auditor, for having ſuffered himſelf to be overpowered by his own emotions, in deſcribing the tragical fate of Virginia, under the tyranny of the Roman decemviri, that the laſt ſyllable of the ſentence "he ſaved his honour, but he loſt his child," expired in an almoſt inarticulate ſob, and the orator, choaked with tears, was unable to proceed any farther. The effect produced was, however, the beſt anſwer to this hypercriticiſm. The orator had already proceeded far enough; for although one perſon remained cold enough to criticiſe, a ſhriek of horror had run through the audience, one half of whom had burſt into tears of ſympathy, and ſome of whom had actually ſwooned away, overpowered by contagious agitation. So ſuperior is nature and reality, to the boaſted mechaniſm of ſophiſtication and art. Art, however, and the ſevereſt exerciſe of judgment, are neceſſary both to the actor and the orator, (eſpecially to the latter,) in the direction and regulation of theſe emotions; that it may be known when, and how far they are to be indulged; the caſes being very rare in which it can be ſafe and proper to throw the reins on the neck of feeling, and leave it to make its way to the goal, by its own independent energies. Emotion is partly expreſſed by change of time or momentum, in the action of the organs of enunciation, and by different degrees of irregularity in the ſucceſſion and proportions of the cadences; and partly by the modulations of the voice; the intonations of which become modified by the different character of the paſſion to be expreſſed; while, in ſome inſtances, a tremulous expreſſion, and in others frequent interruptions and abrupt tranſitions in the tune, conſiderably heighten the effect. Two things are principally to be avoided in the purſuit or cultivation of this excellence;—the unreſtricted indulgence of ſuch feelings as might hurry into coarſeneſs, indecorous vehemence, or bombaſt; and that frigid affectation which aims at impreſſion by unnatural or unappropriate tones; extremes, which though they may extort *applauſe* from "the unſkilful," always diſguſt "the judicious," and diſappoint completely the legitimate end which genuine emotion muſt have in view,—the excitement of a correſpondent ſympathy.

Phyſiognomical expreſſion, or the play and ſympathy of the features, and the language of geſticulation, muſt not be overlooked: for, as Mr. Sheridan has obſerved, it is a palpable "deluſion," to ſuppoſe, "that by the help of words, alone, we can communicate all that paſſes in the mind of man. The paſſions and the fancy have a language of their own, utterly independent of words, by which only their exertions can be manifeſted and communicated." Lect. on Eloc.

In the recommendation of theſe accompaniments of elocution to any but the profeſſed actor, the profeſſor, however, muſt be aware that he has many and obſtinate prejudices to encounter. The dullneſs and indolence of modern elocutioniſts having conſpired, with other cauſes, to reduce almoſt all public ſpeaking, but that of the ſtage, to one ſympathetic monotony of tone, and look, and attitude, the ſuperſtition of criticiſm (miſtaking ſanction for propriety, and eſtabliſhed uſage for the law of nature) has raiſed a ſort of hue and cry, againſt all expreſſion of attitude and feature; as if theſe were mere theatrical affectations and meritricious artifices.

But this ſubject will be further purſued under the proper heads GESTICULATION and ORATORY; for the preſent it is only neceſſary to obſerve, that as eſſential to the perfection of that particular branch of the art, accompaniments of geſticulative and phyſiognomical emotion are univerſally admitted to be legitimate portions of the art of theatrical recitation, to the judicious application of which the elocution of the ſtage is indebted for a conſiderable part of its effect.

EMOTION, in the *Theory of the Mind*, is applied by Dr. Cogan (Treatiſe on the Paſſions) to the external marks, or viſible changes produced by the impetus of paſſion upon the corporeal ſyſtem. Thus he diſtinguiſhes it from paſſion, which denotes the violent impreſſion made upon our minds by the perception of ſomething very ſtriking and apparently intereſting, and from affections, which are applicable to the leſs violent, more deliberate, and more permanent impreſſions, by cauſes which appear ſufficiently intereſting. The ſtrong impreſſion, ſays this writer, of vivid ſenſation, immediately produces a re-action, correſpondent to its nature; either to appropriate and enjoy, or to avoid and repel the exciting cauſe. This re-action he diſtinguiſhes by the term *emotion*. The ſenſible effect produced at the firſt inſtant by the cauſe of the paſſion greatly agitates the frame; its influence is immediately communicated to the whole nervous ſyſtem, and the commotions excited in that, indicate themſelves both by attitudes and motions of the body, and particular expreſſions of the countenance. It is alone by theſe viſible effects, that the ſubject is diſcovered to be under the influence of any paſſion; and it is merely by the particular changes produced, or kind of emotion, that we are enabled to judge of the nature of the paſſion. Thus, although the paſſion exiſts prior to the emotions, yet as theſe are its external ſigns, they muſt indicate its continued influence as long as they continue to agitate the ſyſtem.

Sheridan, in his "Art of Reading," diſcriminates between ideas and emotions. The former, he ſays, denote all thoughts which riſe and paſs in ſucceſſion in the mind. Emotions ſignify all exertions of the mind in arranging, combining, and ſeparating its ideas, as well as all the effects produced on the mind itſelf by thoſe ideas, from the more violent agitation of the paſſions to the calmer feelings produced by the emotion of the intellect and the fancy. Thought is the object of the one, internal feeling of the other. That which ſerves to expreſs the former Sheridan calls the language of ideas; and the latter the language of emotions. Words are the ſigns of the one, tones of the other. Without the uſe of theſe two ſorts of language, it is impoſſible to communicate through the ear all that paſſes in the mind of man.

EMOY, or HIA-MEN, in *Geography*, an iſland near the S.E. coaſt of China, within the juriſdiction of the province of Fo-ken, about 15 miles in circumference. The port of Emoy is properly an anchoring-place for ſhips, incloſed on one ſide by the iſland from which it takes its name, and on the other by the main land; but it is ſo extenſive, as to be capable of containing ſeveral thouſand veſſels; and its water is ſo deep, that the largeſt ſhips may lie cloſe to the ſhore without danger. About a century ago it was much frequented by European veſſels; but few viſit it at preſent, as all the trade is carried on at Canton. The emperor keeps here a garriſon of ſix or ſeven thouſand men, commanded by a Chineſe general. At the mouth of the road is a large rock, viſible ſeveral feet above the ſurface of the water; and three leagues from it is a ſmall iſland, with a natural arch in the middle which admits light from the oppoſite ſide; and hence it obtained the name of the "Perforated iſland." The iſland of Emoy is particularly celebrated on account of the magnificence of its principal pagoda conſecrated to the deity "Fo." This temple is ſituated on a plain, terminated by the ſea on one ſide, and on the other by a lofty mountain. The front of the edifice is 180 feet in length, and its gate is adorned with figures in relief, the uſual ornaments of the Chineſe architecture. At the entrance is a large portico, with an altar in the middle, on which is placed a gigantic ſtatue of gilt braſs, repreſenting the god "Fo," ſitting croſs-legged. Four other ſtatues, 18 feet high, though repreſenting perſons ſitting, occupy the four corners of the portico. Each of them is formed from a ſingle block of ſtone, and bears in its hands appropriate ſymbols; *e. g.* one bears a ſerpent in its arms, twiſted round its body in ſeveral folds; another has a bent bow and quiver; the two others preſent, one a kind of battle-axe, and the other a guitar, or ſome ſimilar inſtrument. Beyond this portico is an outer court, having at its four ſides four pavilions, terminating in domes, and communicating with one another by a gallery. In one is a bell ten feet in diameter: in another a drum of enormous ſize, uſed by the bonzes for proclaiming the days of new and full moons. The two other pavilions contain the ornaments of the temple, and often ſerve to lodge travellers, whom the bonzes are obliged to receive. In the middle of the court is a large tower, terminating in a dome, with a beautiful ſtone ſtair-caſe winding round it. The dome contains a neat temple, the cieling of which is ornamented with moſaic work, and the walls covered with figures in relief, repreſenting animals and monſters. The pillars that ſupport the roof are framed of wood, varniſhed, and on feſtivals are ornamented with differently coloured flags. The pavement of the temple is formed of ſmall ſhells, preſenting in different compartments birds, butterflies, flowers, &c. The bonzes continually burn incenſe upon the altar, and keep the lamps ſuſpended from the cieling always lighted. At the extremity of the altar is a brazen urn, which, when ſtruck, emits a mournful ſound, and on the oppoſite ſide is a hollow machine of wood, uſed for the ſame purpoſe, which is to accompany with its ſound their voices, when they ſing in praiſe of the tutelary idol of the pagoda. The god "Pouſſa" is placed on the middle of this altar, on a flower of gilt braſs, which ſerves as a baſe, and holds a young child in his arms; ſeveral idols, which are without doubt ſubaltern deities, are ranged around him, and by their attitudes ſhew their reſpect and veneration. Behind the altar is a kind of library, containing books which treat of the worſhip of idols. Acroſs the court is a kind of gallery, containing 24 ſtatues of gilt braſs, repreſenting philoſophers, who were the ancient diſciples of Confucius. At the end of the gallery is a hall, which is the refectory of the bonzes; and beyond a ſpacious apartment is the temple of "Fo," to which there is an aſcent by a large ſtone ſtair-caſe. This temple is ornamented with vaſes, full of artificial flowers, and in it are muſical inſtruments, ſuch as we have already mentioned. The ſtatue of this god is ſeen through a piece of black gauze, which forms a ſort of veil or curtain before the altar. The reſt of the pagoda conſiſts of ſeveral large chambers; the gardens and pleaſure-grounds are on the declivity of the mountain, and a number of delightful grottos are cut out in the rock, and afford an agreeable ſhelter from the exceſſive heat of the ſun. There are ſeveral other pagodas in the iſland of Emoy; one of which is called the "Pagoda of 10,000 ſtones," which is built on the brow of a mountain, in which there is a like number of little rocks, under which the bonzes have formed grottos and pleaſant covered ſeats. Groſier's China, vol. i.

EMPALEMENT, or Impalement, a cruel kind of puniſhment, whereby a ſharp pale or ſtake, is thruſt up the fundament and through the body.

The word comes from the French, *empaler*, or the Italian, *impalare;* or rather, they are all alike derived from the Latin, *palus*, *a ſtake*, and the prepoſition *in*, *in*, *into*.

We find mention of empaling in Juvenal. It was frequently practiſed in the time of Nero, and continues to be ſo in Turkey.

Empalement, or *Calyx*, in *Botany*, denotes the termination of the cortex, or outer bark of a plant; which, after accompanying the trunk or ſtem through all its branches, breaks out with the flower, and is preſent in the fructification in this new form. Its chief uſe is to encloſe and protect the other parts. It has received different appellations, according to the circumſtances that attend it; as *Perianthium*, or flower-cup, *Involucrum*, or cover, *Amentum*, or catkin, *Spatha*, or ſheath, *Glume*, or huſk, *Calyptra*, or veil, and *Volva*, which ſee reſpectively. See Calyx.

EMPANELLING, or Impanelling, in *Law*, ſignifies the writing and entering into a parchment ſchedule, or roll of paper, by the ſheriff, the names of a jury ſummoned by him to appear for the performance of ſuch public ſervice as juries are employed in. See Jury.

EMPARLANCE, or Imparlance, *Interlocutio*, or *licentia loquendi*, in *Law*, a deſire, or petition, in court, of a day to conſider, or adviſe, what anſwer the defendant ſhall make to the action of the plaintiff.

The civilians call it *petitio induciarum*. Kitchen mentions emparlance *general*, and *ſpecial;* the firſt ſeems to be only that made in one word, or in general terms without any ſpecial clauſe. This is of courſe where the defendant is not bound to plead the ſame term; and it is without ſaving to the defendant any exception, which is always to another term. It is granted to the defendant before he pleads by conſent of the court; to ſee if he can end the matter amicably without farther ſuit, by talking with the plaintiff:—a practice, which is ſuppoſed (Gilb. Hiſt. Com. Pl. 55.) to have ariſen from a principle of religion in obedience to that precept of the goſpel "agree with thine adverſary quickly, whilſt thou art *in the way* with him." (Matt. v. 25.) It may be obſerved, that this goſpel precept has a plain reference to the Roman law of the twelve tables, which expreſsly directed the plaintiff and defendant to make up the matter while they were *in the way*, or going to the prætor;—*in via, rem uti pacant orato*. Emparlance *ſpecial*, is where the party requires a day to deliberate, adding theſe words, "Salvis omnibus advantagiis tam ad juriſdictionem curiæ, quam ad breve et narrationem."

This emparlance is had on the declaration of the plaintiff; and it is of uſe where the defendant is to plead ſome matters, which cannot be pleaded after a general emparlance. (5 Rep. 75.) This ſpecial emparlance is with a ſaving of all exceptions to the writ or count which may be granted by the prothonotary; or they may be ſtill *more ſpecial*, with a ſaving of all exceptions whatſoever, which are granted at the diſcretion of the court. (12 Mod. 529.)

Imparlance is generally to the next term; and if the plaintiff amend his declaration after delivered or filed, the defendant may imparl to the next term, if the plaintiff do not pay coſts, but if he pay coſts, which are accepted, the defendant cannot imparl. Alſo, if the plaintiff declares againſt the defendant, but doth not proceed in three terms after, the defendant may imparl to the next term. (2 Lill. Abr. 35.) If the writ be returnable on the laſt day of term, the defendant is of courſe entitled to an imparlance, but muſt plead in four days of the next term, provided a rule be given either in a town or country cauſe. On a declaration delivered of *Hilary*, there may be an imparlance to *Trinity* term, if the defendant has not pleaded before; for it is the courſe of the court to give imparlance or declaration till the day of pleading. If a writ be returnable in one term, and the declaration is not delivered *before* the eſſoign day of the *ſecond* term, the defendant is not obliged to plead in the *ſame* term, but is entitled to an imparlance. (Impey, K. B.) The cauſes of imparlance are as follow. The not delivering a declaration in time is ſometimes the cauſe of imparlance of courſe, and where the defendant's caſe requires a ſpecial plea, and the matter which is to be pleaded is difficult, the court will, upon motion, grant the defendant an imparlance, and longer time to put in his plea, than otherwiſe by the rules of the court he ought to have: if the plaintiff keeps any deed or other thing from the defendant, whereby he is to make his defence, imparlance may be granted till the plaintiff delivers it to him, or brings it into court, and a convenient time after to plead. (Hil. 22 Car. I. B. R.) There are many caſes in which imparlances are not allowed. No imparlance is granted in an *homine replegiando;* or in an aſſiſe, unleſs on good cauſe ſhewn; nor ſhall there be an imparlance in an action of ſpecial *clauſum fregit,* though it is allowed in general actions of treſpaſs. (Hil. 9 W. III. 3 Salk. 186.) Where an attorney, or other privileged perſon of the court ſues another, the defendant cannot imparl, but muſt plead preſently: if the plaintiff ſues out a ſpecial original, wherein the cauſe of action is expreſſed, and the defendant is taken on a ſpecial capias, he ſhall not have imparlance, but ſhall plead as ſoon as the rules are out. (2 Lil. 35, 36.) In caſe of pleadings afterwards, a plea to the juriſdiction may not be pleaded after general imparlance. (Raym. 34.) Dilatory pleas cannot be pleaded after a general imparlance, which is an acknowledgment of the propriety of the action. After imparlance the defendant cannot plead in *abatement;* however, if it appear by the record that the plaintiff hath brought his action before he had any cauſe, the court *ex officio* will abate the writ. (2 Lev. 197.) Although a ſpecial imparlance ſhall not be allowed the defendant without leave of the court firſt obtained (R. E. 5 Ann.); yet if the writ be returnable *before the laſt return of any term,* and the declaration not filed, and notice given four days excluſive before the end of ſuch term, the defendant is entitled to an imparlance, (R. Trin. 22 Geo. III.) Blackſt. Com. vol. iii. Jacob's Law Dict. by Tomlins. Art. *Emparlance.*

Britton alſo uſes emparlance for the conference of a jury upon a cauſe committed to them.

EMPASMA, Εμπασμα, from εμπὰσσο; *I ſprinkle,* in *Pharmacy,* a powder thrown or ſprinkled over the body, to correct ſome ill ſmell thereof, or to prevent unneceſſary ſweats.

EMPASTING, or IMPASTING, a term uſed in *Painting,* for the laying on of colours thick and bold, or applying ſeveral lays of colours, ſo that they may appear thick. See COLOURING.

It is formed of the French, *empaſter,* which has the ſame ſignification of *paſte,* or *pâte, paſte.*

A painting is ſaid to be well empaſted with colours, when the colours are beſtowed plentifully, or it is well ſoaked, and ſaturated with colours.

The term is alſo uſed when the colours are laid diſtinct, and aſunder, and not ſoftened and loſt in each other: *e. g.* this head is not painted, it is only empaſted.

EMPATTEMENT, French, from *empater, to thicken,* in *Fortification,* a term uſed by ſome to denote the ſame with talus.

EMPEDOCLES, in *Biography,* a native of Agrigentum, in Sicily, was a diſciple of Telauges, a ſcholar of Pythagoras, and diſtinguiſhed for his knowledge in every department of ſcience and philoſophy, as a poet, an orator, an hiſtorian, and a phyſician. He adopted the Pythagorean doctrine of the tranſmigration of ſouls, and wrote a poem on the ſubject, which the ancients have highly praiſed. He ſtated the hiſtory of the different changes which his own ſoul had undergone during its tranſmigrations, as follows; it commenced its career in the perſon of a girl, next appeared in that of a boy, afterwards it animated a ſhrub, then a bird, a fiſh, and laſtly Empedocles. In the ſame poem, the title of which was, "On the Nature of Things," he explained his doctrine reſpecting the elements. He contended that "there were four of theſe elements, which are at continual war with each other, without the power of deſtroying each other; and that all bodies were produced by this conflict." The fragments of his verſes, which are diſperſed through various ancient writers, have been, in part, collected by Henry Stephens. (In Poeſi Phil. 1574, 8vo.) This circumſtance affords ſome ground for the opinion of Fabricius, (Bib. Græc. v. i. p. 466.) that Empedocles was the real author of that ancient fragment, which bears the title of "The golden Verſes of Pythagoras." From theſe fragments his philoſophical opinions have been collected. Beſides his hypotheſis of four elements, the firſt material principles of which were indefinitely ſmall, round, and ſimilar atoms, he maintained, that it is impoſſible to judge of truth by the ſenſes without the aſſiſtance of reaſon; which is led, by the intervention of the ſenſes, to the contemplation of the real nature, and immutable eſſences, of things. The firſt principles of nature are of two kinds, active and paſſive; the active is unity, or God; the paſſive, matter. The active principle is a ſubtle, ethereal fire, intelligent and divine, which gives being to all things, and animates all things, and into which all things will be at laſt reſolved. Many dæmons, portions of the divine nature, wander through the region of the air, and adminiſter human affairs. Man, and alſo all brute animals, are allied to the divinity; and it is therefore unlawful to kill or eat animals. The world is one whole, circumſcribed by the revolution of the ſun, and ſurrounded, not by a vacuum, but by a maſs of inactive matter. In the formation of the world, ether was firſt ſecreted from chaos, then fire, then earth; by the agitation of which were produced water and air. The heavens are a ſolid body of air, cryſtallized by fire. The ſtars are bodies compoſed of fire, they are fixed in the cryſtal of heaven; but the planets wander freely beneath it. The ſun is a fiery maſs, larger than the moon, which is in the form of a hollow plate, and twice as far from the ſun as from the earth. The ſoul of man conſiſts of two parts, the ſenſitive, produced from the ſame principles with the elements; and the rational, which is a dæmon ſprung from the divine ſoul of the world, and ſent down into the body as a puniſhment for its crimes in a former ſtate, where it tranſmigrates till it is ſufficiently purified to return to God.

The ſtyle of Empedocles, if we may believe the account of Ariſtotle, as quoted by Diogenes Laertius, very much reſembled that of Homer; it was extremely energetic and enriched with metaphor, and every variety of poetical figure. His talents drew upon him the eyes of all Greece: his verſes were ſung at the Olympic games, with thoſe of Homer, Heſiod, and the moſt famous poets; and at the games, and on all other public occaſions, he is ſaid to have been himſelf the moſt attractive part of the ſpectacle, ſo anxious were the people to behold him. He was greatly diſtinguiſhed too as an orator, and is ſaid to have been the firſt of the philoſophers who gave leſſons on rhetoric in Sicily. He uſefully employed this talent of oratory in reforming the licentious manners of the Agrigentines, whom he reproached "for purſuing pleaſures, with as much eagerneſs as if they were to die before to-morrow; and for building houſes as if they believed that they ſhould live for ever."

Empedocles was likewiſe celebrated as a phyſician, and wrote a poem "On Medicine," conſiſting of ſix hundred verſes. In this work he is ſaid to have boaſted, that he was able not only to cure diſeaſes, but alſo to drive away old age, and even to reſtore the dead to life; and to have intimated that the ſick would hereafter inveſt him with divine honours. Pliny affirms that he ſucceeded in reſtoring a female, who had lain thirty days, without any ſigns of reſpiration: and

Pauſanias, one of his diſciples, and a phyſician, wrote a treatiſe reſpecting the diſeaſe and recovery of this woman, whom he termed ἄπνους. He was greatly ſkilled in muſic, which, after the example of Pythagoras, he employed as a remedy, not only againſt the diſeaſes of the mind, but even againſt thoſe of the body. Being lodged in the town of Gela, with his friend Auchitus, he was informed that a young man in a great rage was determined to kill this friend, who had ſentenced his father to capital puniſhment. Empedocles endeavoured to calm his mind by perſuaſive diſcourſe; but his eloquence producing no effect, he took his lyre, and combined its melodious ſounds with the flowing numbers of poetry; and ſo employed the modulations, which made the greateſt impreſſion on the heart of the young man, that by degrees he was entirely ſoftened, and afterwards became his conſtant diſciple. As a phyſician, he is related to have been eminently ſerviceable to his country on many occaſions. He paid great attention to meteorology, and not only predicted ſtorms, but propoſed remedies againſt their effects. He counteracted the blighting influence of the Eteſian winds, by conſtructing walls in the narrow paſſages of the mountains, through which they blew, and occaſioned ſterility in the neighbouring land: hence, according to Jamblichus and Diogenes Laërtius, he was called *Alexanemos* and *Colyſanemos*, or repeller of the winds. Pliny relates that he allayed a peſtilence at Agrigentum, by means of fumigation (ignium ſuffitu); and Plutarch mentions another inſtance, in which he ſuppreſſed a plague, which raged with extreme violence and fatality, by cloſing an aperture or chaſm of the earth, in the vicinity of the mountains, from which he alone obſerved that peſtilential effluvia iſſued.

For theſe various ſervices to his country, the Agrigentines offered him the government; which he refuſed, preferring a philoſophical tranquillity to regal honours. He is ſaid, by ſome of his hiſtorians, to have been ever generous, humane, and moderate, and ready at all times to ſtand forth as the declared enemy of tyrants; and to have vigorouſly purſued all thoſe who ſeemed to aſpire at the ſovereign power. An anecdote is handed down to us in confirmation of this fact. A citizen of Agrigentum having invited him home to ſupper, and the hour of the repaſt being arrived, he inquired why it was not ſerved up; "becauſe," ſaid the hoſt, "we wait for the miniſter of the council." At length this officer appeared, and he was made maſter of the feaſt; during which he gave himſelf ſo many inſolent airs, that Empedocles began to ſuſpect that ſome ſecret project was concerted between the maſter of the feaſt and his inviter, with a view to re-eſtabliſh the tyranny. The ſuſpicion was but too well founded. The philoſopher next day citing the two perſons before the council, they were condemned to death.

A very different character, however, is aſcribed to Empedocles by many other writers. He is ſaid to have conducted himſelf with the utmoſt pride and haughtineſs towards his fellow-citizens, and to have aſpired to divine honours; walking pompouſly about the country, and through the cities, habited like the gods, and ſeeking the plaudits of the people. He wore a golden crown on his head, with Delphic chaplets in his hands, and brazen ſandals on his feet, and was clothed in a robe of purple and gold, his hair being long and flowing.

The accounts of his death are not leſs various and contradictory. Some authors affirm, that thinking to paſs himſelf for a deity, and to perſuade the people that he had been taken directly up into heaven, he aſcended Ætna in the night, and threw himſelf head-long into the burning crater of the mountain, imagining that his death would remain for ever concealed from mortals; but that the treacherous mountain threw up one of his brazen ſandals, and thus expoſed the folly of the viſionary, who diſdained to be thought man.

> "—— Deus immortalis haberi
> Dum cupit Empedocles ardentem frigidus Ætnam
> Inſiliit." Hor. Ars Poet. v. 465.

Others, however, admitting that he periſhed in mount Ætna, aſſert that, impelled by his paſſion for the ſtudy of nature, he reſolved to examine the crater of that volcano, and that having ventured too far, he accidentally fell into the burning gulf. Some authors, again, have affirmed, that he broke his leg, by falling from a chariot, which brought on a diſeaſe that proved fatal. Others pretend that he terminated his own exiſtence, ſome ſay by throwing himſelf into the ſea, and ſome by ſtrangulation with a rope: while others maintain that he died a natural death, at the age of 77 years. But the moſt commonly received opinion, notwithſtanding theſe contradictions, is, that this philoſopher, being extremely advanced in years, accidentally fell into the ſea, and was drowned, about 440 years before Chriſt, or in the 84th Olympiad. Timæus relates, that, towards the cloſe of his life, Empedocles went into Greece, and never returned, and on this account, the exact time and manner of his death remain unknown. According to Ariſtotle, he died at the age of 60 years. Some writers make a diſtinction between Empedocles the philoſopher, and another who was a poet. Caſtellani, upon what authority we know not, ſtates that Empedocles, the philoſopher and poet, was the ſon of Meto, and grandſon of Empedocles, who was an excellent poet.

A ſtatue was erected to the memory of Empedocles at Agrigentum. See Caſtellani Vit. Medicor. Illuſt. Mangeti Bibliotheca Scriptor. Med. Haller. Bibl. Med. Pract. Dict. Hiſtorique. Brucker's Hiſt. Philoſ. by Enf. vol. i.

EMPERESS, Empress, *Imperatrix*, the feminine of emperor; the wife or widow of an emperor; or a princeſs who is the ſupreme ruler of an empire in her own right.

Emperess, is alſo uſed in the *Ancient French Poetry*, for a particular kind of rhime, thus denominated by way of excellence.

The "rhime emperiere" was a ſort of crowned rhime, wherein the ſyllable that made the rhime was immediately preceded by two other like ſyllables of the ſame termination, which made a kind of echo, called the *triple crown;* and which, to the ſhame of the nation, (as ſome of their late authors expreſs it,) their beſt ancient poets took for a wonderful beauty and excellence.

Fa. Mourgues, in his treatiſe on French poetry, gives us an inſtance very proper to raiſe contempt of the miſerable taſte of that age, which knew no way of expreſſing that the world is impure, and ſubject to change, ſo excellent, as by ſaying,

> "Qu'es tu qu'un imonde, monde, onde."

EMPEREUR, Constantine, L', in *Biography*, a learned divine, was a native of Holland, where he took the degree of doctor of theology, and became diſtinguiſhed in oriental literature and Jewiſh antiquities. He was profeſſor of theology and Hebrew at Harderwyck during eight years, and then was appointed profeſſor of Hebrew at Leyden in 1627. He died in 1648, a ſhort time after he had been appointed theological profeſſor at Leyden. He obtained the character of a zealous defender of the Chriſtian religion, againſt the objections of the Jews. He was the friend of the moſt learned men of his age, *viz.* of Heinſius, Buxtorf, &c. and offered to ſuperintend an impreſſion of their Talmudical dictionary in Holland. His works were chiefly theological, and highly eſteemed by his contemporaries. Moreri.

EMPERICHORESIS. See Circumincession.

EMPEROR, as far as this word denoted formerly the head of the German empire. See Germany.

Emperor, *Imperator*, among the *Ancient Romans*, ſignified a general of an army, who, for ſome extraordinary ſucceſs, had been complimented with this appellation. It was emphatically beſtowed by the ſoldiers, when, on the field of battle, they proclaimed their victorious leader worthy of that title. When the Roman emperors aſſumed it in that ſenſe, they placed it after their name, and marked how often they had taken it. Thus Auguſtus having obtained no leſs than twenty famous victories, was as often ſaluted with the title emperor; and Titus was denominated emperor by his army, after the reduction of Jeruſalem. See Augustus and Titus.

Afterwards it came to denominate an abſolute monarch, or a ſupreme commander of an empire; a Roman emperor, &c. In this ſenſe Julius Cæſar was called emperor, and the title deſcended with the dignity to Octavius Auguſtus, and the ſucceeding emperors.

In ſtrictneſs, the title emperor does not, and cannot add any thing to the rights of ſovereignty; its effect is only to give precedence and pre-eminence above other ſovereigns; and as ſuch, it raiſes thoſe inveſted with it to the ſummit of all human greatneſs.

The emperors, however, pretend, that the imperial dignity is more eminent than the regal; but the foundation of ſuch prerogative does not appear: it is certain, the greateſt, moſt ancient, and abſolute monarchs, as thoſe of Babylon, Perſia, Aſſyria, Egypt, Macedonia, &c. were called by the name of *kings*, in all languages, both ancient and modern. See King.

It is diſputed, whether or not emperors have the power of diſpoſing of the regal title. It is true, they have ſometimes taken upon them to erect kingdoms; and thus it is that Bohemia and Poland are ſaid to have been raiſed to the dignity; thus alſo, the emperor Charles the Bald, in the year 877, gave Provence to Boſon, putting the diadem on his head, and decreeing him to be called *king*, "Ut more priſcorum imperatorum regibus videretur dominari." Add, that the emperor Leopold erected the ducal Pruſſia into a kingdom, in favour of the elector of Brandenburg; and though ſeveral of the kings of Europe refuſed for ſome time to acknowledge him in that capacity, yet by the treaty of Utrecht, in 1712, they all concurred.

In the Eaſt, the title and quality of emperor are more frequent than they are among us; thus, the ſovereign princes of China, Japan, Mogul, Perſia, &c. are all emperors of China, Japan, &c.

In the year 1723, the czar of Muſcovy aſſumed the title of emperor of all Ruſſia, and procured himſelf to be recognized as ſuch by moſt of the princes and ſtates of Europe. See Russia.

In the Weſt, the title has been a long time reſtrained to the emperors of Germany. The firſt who bore it was Charlemagne, who had the title emperor conferred on him by pope Leo III. though he had all the power before. His empire, however, was of no long duration. When the German branch of his family became extinct, the Germans exerciſed the right inherent in a free people, and, in a general aſſembly of the nation, elected Conrad count of Franconia emperor. After him Henry of Saxony, and his deſcendants, the three Othos, were placed, in ſucceſſion, on the imperial throne, by the ſuffrages of their countrymen: the extenſive territories of the Saxon emperors, their eminent abilities, and enterpriſing genius, not only added new vigour to the imperial dignity, but raiſed it to higher honour and pre-eminence. (See Otho.) But while the emperors, by means of new titles and new dominions, gradually acquired additional authority and ſplendour, the nobility of Germany went on at the ſame time extending their privileges and juriſdiction. Upon the whole, the imperial prerogatives were formerly much more extenſive than they are at preſent. At the cloſe of the Saxon race, A.D. 1024, they exerciſed the right of conferring all the great eccleſiaſtical benefices in Germany; of receiving the revenues of them during a vacancy; of ſucceeding to the effects of inteſtate eccleſiaſtics; of confirming or annulling the elections of the popes; of aſſembling councils, and of appointing them to decide concerning the affairs of the church; of conferring the title of king on their vaſſals; of granting vacant fiefs; of receiving the revenue of the empire; of governing Italy as its proper ſovereigns; of erecting free cities, and eſtabliſhing fairs in them; of aſſembling the diets of the empire, and fixing the time of their duration; of coining money, and conferring the ſame privilege on the ſtates of the empire; and of adminiſtering both high and low juſtice within the territories of the different ſtates. But in the year 1437, at the period of the extinction of the emperors of the families of Luxemburgh and Bavaria, they were reduced to the right of conferring all dignities and titles, except the privilege of being a ſtate of the empire; of *preces-primariæ*, or of appointing once during their reign a dignitary in each chapter, or religious houſe; of granting diſpenſations with reſpect to the age of majority; of erecting cities, and conferring the privilege of coining money; of calling the meetings of the diet, and preſiding in them.

In the one period, the emperors appear as mighty ſovereigns, with extenſive prerogatives; in the other, as the heads of a confederacy, with very limited powers. The revenues of the emperors decreaſed ſtill more than their authority. The early emperors, particularly thoſe of the Saxon line, beſides their vaſt patrimonial or hereditary territories, poſſeſſed an extenſive domain both in Italy and Germany, which belonged to them as emperors. Italy belonged to the emperors as their proper kingdom; and the revenues which they drew from it were very conſiderable. But the firſt alienations of the imperial revenue were made in this country. The Italian cities, having acquired wealth, and aſpiring at independence, purchaſed their liberty from different emperors. Many diſtricts, poſſeſſed by the emperors, which were intermixed with the eſtates of the dukes and barons, were ſeized by the nobles, during the conteſts that took place between the emperors and the court of Rome. The emperors were alſo almoſt entirely robbed of their caſual revenues; the princes and barons appropriating to themſelves taxes and duties of every kind, which had been uſually paid to them. From the reign of Charles IV., whom Maximilian called the peſt of the empire, the emperors were reduced to the neceſſity of depending entirely on their hereditary dominions, as the only ſource of their power, and even of their ſubſiſtence. Pfeffel Abregé de l'Hiſt. d'Allem.

One principal cauſe of the degradation of the emperors was the aggrandizement of the clergy. The popes, before the firſt period above mentioned, A.D. 1024, had been dependent on the emperors, and indebted for their power as well as dignity to their beneficence and protection. But they afterwards began to claim a ſuperior juriſdiction; and in virtue of authority, which they pretended to derive from heaven, tried, condemned, excommunicated, and depoſed their former maſters. Pope Gregory VII. combined political diſcernment and ſagacity with his preſumption and violence; and commenced his rupture with Henry IV. upon a pretext that was popular and plauſible. He complained of the venality and corruption with which the emperor had granted the inveſtiture of benefices to eccleſiaſtics. All the cenſures of the church were denounced againſt Henry; and the moſt conſiderable of the German princes and eccleſiaſtics were excited to take arms againſt him. So ſucceſsful was the court of Rome in inflaming the ſuperſtitious zeal, and conducting the factious ſpirit of the Germans and Italians, that an emperor, diſtinguiſhed not only for many virtues, but poſſeſſed of conſiderable talents, was at length obliged to appear as a ſupplicant at the gates of the caſtle in which the pope reſided, and to ſtand there three days, bare-footed, in the depth of winter, imploring a pardon, which was at length obtained with difficulty. This act of humiliation degraded the imperial dignity. Nor was the depreſſion momentary. The conteſt between Gregory and Henry gave riſe to the two powerful factions of the Guelfs and Ghibellines; the former of which ſupporting the pretenſions of the popes, and the latter defending the rights of the emperor, kept Germany and Italy in perpetual agitation during three centuries. A regular ſyſtem for humbling the emperors, and circumſcribing their power, was formed and uniformly adhered to during that period. The decline of the imperial authority may partly be aſcribed to the change which took place with regard to the mode of their election. During a long period, all the members of the Germanic body aſſembled, and choſe the perſon whom they appointed to be their head; but amidſt the violence and anarchy which prevailed for ſeveral centuries in the empire, ſeven princes, who poſſeſſed the moſt extenſive territories, and who had obtained an hereditary title to the great offices of the ſtate, acquired the excluſive privilege of nominating the emperor. This right was confirmed to them by the golden bull; the mode of exerciſing it was aſcertained; and they were dignified with the appellation of *Electors*. Theſe electors, by their extenſive power, and the diſtinguiſhing privileges which they poſſeſſed, became formidable to the emperors, with whom they were placed almoſt on a level in ſeveral acts of juriſdiction. See Elector, and Diet.

To the privileges and powers formerly belonging to the emperors, and which have been above enumerated, ſome have added, 1. That all the princes and ſtates of Germany are obliged to do them homage, and ſwear fidelity to them. 2. That they, or their generals, have a right to command the forces of all the princes of the empire, when united together. 3. That they receive a kind of tribute from all the princes and ſtates of the empire, for carrying on a war which concerns the whole empire, which is called the *Roman month*. As to the preſent mutilated ſtate of the German empire, ſee Elector and Germany.

The kings of France were anciently alſo called emperors, at the time when they reigned with their ſons, whom they aſſociated to the crown: thus, Hugh Capet having aſſociated his ſon Robert, took the title of emperor, and Robert that of king; under which titles they are mentioned in the hiſtory of the council of Rheims, by Gerbert, &c. King Robert is alſo called emperor of the French, by Helgau of Fleury. Lewis le Gros, upon aſſociating his ſon, did the ſame. In the firſt regiſter of the King's Charters, fol. 166, are found letters of Louis le Gros, dated in 1116, in favour of Raymond, biſhop of Maguelonne, wherein he ſtyles himſelf "Ludovicus, Dei ordinante providentia, Francorum imperator Auguſtus." The kings of England had likewiſe anciently the title of emperors, as appears from a charter of king Edgar: "Ego Edgarus Anglorum baſileus, omniumque regum inſularum oceani quæ Britanniam circumjacent, &c. imperator & dominus."

We alſo ſay the king of England, "Omnem habet poteſtatem in regno ſuo quam imperator vindicat in imperio:" whence the crown of England has been long ago declared in parliament to be an imperial crown.

Emperor, among *Hebrew Grammarians*, is an appellation given to a ſpecies of accents ſerving to terminate a ſenſe completely, and anſwers to our point. See Accent.

Emperor *Elect*. See Elect.

EMPETRON, in *Botany*, a name by which ſome authors, as Dodonæus, &c. have called the kali or glaſs wort. Ger. Emac. Ind. 2. See Kali.

EMPETRUM, from εν, *in* or *upon*, and πετρος, *a rock*, or *ſtone*, expreſſing its ſtony barren places of growth. Linn. Gen. 515. Schreb. 676. Sm. Fl. Brit. 1072. Mart. Mill. Dict. v. 2. Juſſ. 162. Gærtn. t. 106. Claſs and order, *Dioecia Triandria*. Nat. Ord. *Ericis affine*, Juſſ.

Gen. Ch. Male. *Cal.* Perianth in three deep, ovate, permanent diviſions. *Cor.* Petals three, ſometimes more, ovate-oblong, contracted at their baſe, larger than the calyx, withering. *Stam.* Filaments three, ſometimes nine, capillary, very long, pendulous; anthers erect, ſhort, deeply cloven.—Female. *Cal.* and *Cor.* as in the male. *Piſt.* Germen ſuperior, depreſſed; ſtyle ſhort, ſimple; ſtigmas nine, ſpreading, a little reflexed. *Peric.* Berry orbicular, depreſſed, of one cell, larger than the calyx. *Seeds* three or nine, ranged circularly, gibbous at the outer edge, angular at the other. The flowers are commonly dioecious, but ſometimes the two ſexes are found on the ſame plant, and even both organs united in one flower.

Eſſ. Ch. Male, Calyx deeply three-cleft. Petals three. Stamens capillary, from three to nine. Female, Calyx deeply three-cleft. Petals three. Stigmas nine. Berry ſuperior, with three to nine ſeeds.

The ſpecies are two.

1. E. *album*. Linn. Sp. Pl. 1450. (Erica coris folio decima; Cluſ. Hiſt. v. 1. 45. E. baccifera tenuifolia; Ger. em. 1381.) "Stem erect." Obſerved by Cluſius on ſandy heaths near Liſbon, bearing fruit early in November. He compares the berries, which are white, acid, and tranſparent, to pearls of an inferior kind. He generally found but three ſeeds in each, which accords with Gærtner's account of this ſpecies. The *ſtems* are ſhrubby, a foot and half high, erect, branched in a determinate order. *Leaves* ternate, evergreen, linear, obtuſe, revolute, ſmooth above, reſembling thoſe of many heaths. *Flowers* not obſerved. *Berries* lateral, ſolitary, the ſize of a moderate pea, reſembling thoſe of Miſſeltoe.

2. E. *nigrum*. Linn. Sp. Pl. 1450. Sm. Fl. Brit. 1072. Engl. Bot. v. 8. t. 526. (E. montanum, fructu nigro; Raii Syn. 444. Erica baccifera procumbens; Ger. em. 1383.) "Stems procumbent." Black Crow-berry, or Crake-berry. Plentiful on mountainous heaths in the north of England, as well as in Sweden, Lapland, Denmark, &c. bloſſoming in May, and ripening fruit in Auguſt. It differs from the former in its more humble and procumbent growth, and in having black berries, with nine ſeeds. *Flowers* reddiſh, axillary, plentiful about the tops of the laſt-year's branches. The fruit has a mild flavour of elder-

berries, and "affords ſuſtenance to ptarmigans, grouſe, partridges, and even to the hardy highlander himſelf."

EMPHASIS, in *Elocution*, a term generally, but abſurdly, uſed by modern writers, excluſively in the *ſingular* number. "Emphaſis," ſays Mr. Sheridan (Lecture iv.), "diſcharges in ſentences the ſame kind of office that accent does in words. As accent is the link which ties ſyllables together, and forms them into words; ſo emphaſis unites words together, and forms them into ſentences, or members of ſentences. As accent dignifies the ſyllable on which it is laid, and makes it more diſtinguiſhed by the ear than the reſt; ſo emphaſis ennobles the word to which it belongs, and preſents it in a ſtronger light to the underſtanding. Accent is the mark which diſtinguiſhes words from each other, as ſimple types of our ideas, without reference to their agreement or diſagreement. "Emphaſis is the mark which points out their ſeveral degrees of relationſhip," and the rank which they hold in the mind. Accent addreſſes itſelf to the ear only; emphaſis, through the ear, to the underſtanding. Were there no accents, words would be reſolved into their original ſyllables: were there no emphaſis, ſentences would be reſolved into their original words. And in this caſe, the hearer muſt be at the pains himſelf, firſt, of making out the words, and afterwards their meaning: and as this could not be done, without ſuch length of pauſes at the end of ſentences, and their ſeveral members, as would allow him time to revolve in his memory the ſounds which have been uttered, it would make the action of liſtening to diſcourſe laborious and diſguſtingly tedious. Whereas, by the uſe of accent and emphaſis, words, and their meaning, being pointed out by certain marks, at the ſame time that they are uttered, the hearer has all trouble ſaved, but that of liſtening; and can accompany the ſpeaker at the ſame pace that he goes, with as clear a comprehenſion of the matter offered to his conſideration as the ſpeaker himſelf has if the ſpeaker delivers himſelf well."

It is not very eaſy to diſcover what Mr. S. means, (even with his interpretation of the word accent,) when he ſays, that "were there *no accent*, words would be reſolved into their *original ſyllables*;" ſince monoſyllables, though denied the property of what is here called accent, are nevertheleſs admitted by Mr. S. and the grammarians in general to be words; and ſince, as will be ſhewn hereafter, the ear alone (unaſſiſted by the memory of impreſſions received through the eye) has even yet (with all the aſſiſtance derived from that *poiſe* and that *percuſſion* of particular ſyllables, ſo abſurdly confounded in the popular abuſe of the term accent) no poſſible means of diſtinguiſhing polyſyllabic words from ſucceſſive monoſyllables, when properly pronounced. Certainly he is not at all more intelligible, when he adds, "were there *no emphaſis*, ſentences would be reſolved into their *original words*;" or again, when he informs us, that "by the uſe of accent and emphaſis, *words, and their meaning*, are pointed out by certain marks, *at the ſame time* that they are uttered." That ſhifting the percuſſion, or varying the poiſe of ſimilar aſſociations of ſyllables, will eſſentially change the meaning even of words in their ſeparate capacity, (as *díffer, defér; déſert, deſért; préſent, preſént; réfuſe, refúſe; óbject, objéct; íncenſe, incénſe*, &c. ſee B. Jonſon's Gram.) and ſtill more of ſuch aſſociated ſyllables as may occaſionally be brought together in the compoſition of ſentences, muſt be readily allowed; and that the ſenſe of *all ſentences* would be much obſcured by the omiſſion, and of *many* entirely inverted by a tranſpoſition of the emphaſes: but ſtill the words, as words, and their meanings as words, (though not their ſpecific relations to the other words of the ſentence,) would be recognized "*at the ſame time* they were uttered," whether they were accompanied with emphaſes or not: and as for what is here miſcalled the accent, the *poiſe* at leaſt muſt of phyſical neceſſity be ſomewhere placed; and *ſpeech* without it could not be conducted at all. But Mr. S. never ſeems to have dreamed of ſubmitting either the proceſs or the nomenclature of elocution to phyſiological or critical analyſis. He uſed the terms of his art as he found them in the works of the grammarians and rhetoricians of modern times; and as their phraſeology was all confuſion and contradiction, his elucidations were not likely to be very ſatisfactory. The Lecture on Emphaſis, however, is by far the moſt valuable portion of this work.

"The neceſſity of obſerving propriety of emphaſis," ſays he, "is ſo great, that the true meaning of words cannot be conveyed without it. For the ſame individual words, ranged in the ſame order, may have ſeveral different meanings, according to the placing of the emphaſis. Thus, to uſe a trite inſtance, the following ſentence may have as many different meanings as there are words in it, by varying the emphaſis: "Shall you ride to town to-morrow?" If the emphaſis is on ſhall, as, *Shall* you ride to town to-morrow? it implies, that the perſon ſpoken to had expreſſed before ſuch an intention, but that there is ſome doubt in the queſtioner whether he be determined on it or not; and the anſwer may be, Certainly, or, I am not ſure. If it be on you, as, Shall *you* ride to town to-morrow? the queſtion implies that ſome one is to go, and do you mean to go yourſelf, or ſend ſome one in your ſtead? and the anſwer may be, No, but my ſervant ſhall. If on ride, as, Shall you *ride*, &c.? the anſwer may be. No, I ſhall walk, or go in a coach. If on town, as, Shall you ride to *town* to-morrow? the anſwer may be, No, but I ſhall ride to the foreſt. If on to-morrow, as, Shall you ride to town *to-morrow?* the anſwer may be, No, not to-morrow, but the next day."

Theſe obſervations and illuſtrations may ſerve to ſhew the importance of emphaſes in general; but they do nothing towards illuſtrating the ſpecific characteriſtics of ſuch emphaſes. Indeed, in all that Mr. S. has ſaid upon this ſubject, it ſhould ſeem as if he had no clear conception of any other ſpecies of emphaſis, than the emphaſis of force; and it is evident, indeed, that the conceptions of the generality of readers and reciters, practically, go no farther. Mr. S. does indeed ſay, in another place, "that emphaſis is of two kinds," (ſurely, then it ſhould have been that emphaſes are of two kinds,) "ſimple or complex. Simple, when it ſerves only to point out the plain meaning of any propoſition; complex, when, beſides the meaning, it marks alſo ſome affection or emotion of the mind; or gives a meaning to words, which they would not have in their uſual acceptation, without ſuch emphaſis. In the former caſe, emphaſis is little more than a ſtronger accent, with but little change of tone; when it is complex, beſides force, there is always ſuperadded a manifeſt change of tone. Simple emphaſis belongs to the calm and compoſed underſtanding; complex, to the fancy and the paſſions." But the concluding remark ſufficiently evinces how little the nature of theſe varieties was underſtood by this author, and how imperfectly the terms of his art were defined in his own mind; for it will preſently be ſhewn, that even without any neceſſity of appeal to the fancy and the paſſions, a much more complex ſyſtem of emphaſes is neceſſary fully to elicit, and agreeably to illuſtrate, the ſenſe of many paſſages. Mr. Cockin, in his "Art of delivering written Language," animadverts upon the want of clearneſs in this diſtinction, and upon the apparent confuſion between the ſignificant power of emphaſis and the various "tones, ſimply conſidered, of all the emotions of the mind;" and ſeems to imagine he has remedied the confuſion by contradiſtinguiſhing emphaſes into "emphaſis of ſenſe, and emphaſis of force;" and Mr. Walker, (Elements of Elocution, p. 190.) conſiders this diſtinction as having "thrown great light upon this abſtruſe ſubject." But as the emphaſis of force is moſt aſſuredly as indiſpenſable to the full expreſſion of the ſenſe, as any of the other *ſeveral* ſpecies of emphaſes, it is very queſtionable whether this pretended diſtinction does any thing more than render confuſion worſe confounded. Mr. Cockin proceeds; "now from the above account of theſe two ſpecies of emphaſis it will appear, that in reading, as in ſpeaking, the firſt of them muſt be determined entirely by the ſenſe of the paſſage, and always made alike: but as to the other, taſte alone ſeems to have a right of fixing its ſituation and quantity." Farther, "ſince the more eſſential of theſe two energies is ſolely the work of nature, (as appears by its being conſtantly found in the common converſation of people of all kinds of capacities and degrees of knowledge,) and the moſt ignorant perſon never fails of uſing it rightly in the effuſions of his own heart, it happens very luckily, and ought always to be remembered, that provided we underſtand what we read, and give way to the dictates of our own feeling, the emphaſis of ſenſe can ſcarce ever avoid falling ſpontaneouſly upon its proper place." That mere taſte has any thing to do with fixing the *ſituation* of the emphaſis of force (whatever it may have to do with its *quantity* or *degree*) we utterly deny; or that, in juſt reading or recitation, it can be determined by any thing but the *ſenſe* alone. And as for what is ſaid of even the moſt ignorant perſon never failing, in common converſation and the effuſions of his own heart, in the right application of the *emphaſis of ſenſe*, it is true of all the kinds of emphaſes; for, in ſpontaneous ſpeaking, all emphaſes are emphaſes of ſenſe; and in all other kinds of ſpeaking (reading or reciting) whatever emphaſes are not ſo, muſt be emphaſes of nonſenſe. Mr. Walker, indeed, has himſelf ſuggeſted a much more rational ſpecies of diſtinction, and has made ſome conſiderable advances towards a juſt ſyſtem or theory upon this ſubject, by drawing a clear line of demarcation between what, perhaps, might very properly have been called the inherent or *grammatical powers* of particular claſſes of words, and the arbitrary or *ſignificant emphaſes* of ſpecific words in a ſentence. Perhaps had Mr. W. ſo denominated them, not only his diſtinctions, ſo far as they go, might have been rendered more obvious, but the denomination itſelf would have led him to diſcover that there are ſtill diſtinct ſpecies of actual emphaſes, properly ſo called, which have eſcaped his obſervation. He would not then, perhaps, have told us, that "emphaſis, in the moſt uſual ſenſe of the word, is that ſtreſs with which certain words are pronounced, ſo as to be diſtinguiſhed from the reſt of the ſentence." He would have perceived that ſuch a definition was much too vague to meet even the full ſignification of the term in popular uſage: for no one does in reality apply the term emphaſis to the mere grammatical or inherent force that diſtinguiſhes, in all diſtinct and intelligible ſpontaneous ſpeech, the nouns and verbs above the articles, conjunctions, and prepoſitions. The term, on the contrary, always ſuppoſes ſome ſuperadded diſtinction given to a word or words of what deſcription ſoever, and conferring upon ſuch words a degree of importance in the ſentence, beyond what is inherent in their mere grammatical quality. Mr. W. proceeds, "among the number of words we make uſe of in diſcourſe, there will always be ſome which are more neceſſary to be underſtood than others: thoſe things with which we ſuppoſe our hearers to be pre-acquainted (he might have added, 'or which are neceſſary only for the mere grammatical connection of the more important words,') we expreſs by ſuch a ſubordination of ſtreſs as is ſuitable to the ſmall importance of things already underſtood; while thoſe of which our hearers are either not fully informed, or which they might poſſibly miſconceive, are enforced with ſuch an increaſe of ſtreſs, as makes it impoſſible for the hearer to overlook or miſtake them. Thus, as in a picture, the more eſſential parts of a ſentence are raiſed, as it were, from the level of ſpeaking; and the leſs neceſſary are, by this means, ſunk into a comparative obſcurity." This is both juſt and pertinent, and the ſimile at the concluſion is even more appoſite, than Mr. Walker ſeems himſelf to have been aware; for, to purſue the metaphor in elocution as in picture, it is not merely by the force of a line or the depth of a ſhadow, that all the varieties of emphatic effect are to be expected to be produced. "From this general idea of emphaſis," continues Mr. W., "it will readily appear of how much conſequence it is to readers and ſpeakers not to be miſtaken in it; the neceſſity of diſtinguiſhing the emphatical words from the reſt, has made writers on this ſubject extremely ſolicitous to give ſuch rules for placing the emphaſis as may, in ſome meaſure, facilitate this difficult part of elocution; but few have gone farther than to tell us that we muſt place the emphaſis on that word in reading which we ſhould make emphatical in ſpeaking; and though the importance of emphaſis is inſiſted on with the utmoſt force and elegance of language, no aſſiſtance is given us to determine which is the emphatic word, where ſeveral appear equally emphatical, nor have we any rule to diſtinguiſh between thoſe words which have greater, and thoſe which have a leſſer degree of ſtreſs; the ſenſe of the author is the ſole direction we are referred to, and all is left to the taſte and underſtanding of the reader."

He then proceeds to ſtate with high commendation the above-mentioned diſtinction of Mr. Cockin, whoſe definition he quotes as follows: "Emphaſis of force," he tells us, "is that ſtreſs we lay on almoſt every ſignificant word: emphaſis of ſenſe is that ſtreſs we lay on one or two particular words, which diſtinguiſhes them from all the reſt of the ſentence. The former ſtreſs," he obſerves, "is variable, according to the conception and taſte of the reader, and cannot be reduced to any certain rule: the latter," he ſays, "is determined by the ſenſe of the author, and is always fixed and invariable. This diſtinction, it muſt be owned," continues Mr. Walker, "is, in general, a very juſt one, and a want of attending to it has occaſioned great confuſion in this ſubject, even in our beſt writers. Thus, when the emphatical words were to be marked, by being printed in a different character, we find in ſeveral of the modern productions on the art of reading, that ſometimes more than half of the words are printed in italics, and conſidered as equally emphatical. The wrong tendency of ſuch a practice," continues Mr. W., "was never pointed out till the publication of the eſſay above-mentioned;" by the aſſiſtance of which Mr. W. profeſſes to endeavour to puſh his inquiries ſtill farther; "not only to eſtabliſh the diſtinction he has laid down, but to draw the line between thoſe two kinds of emphaſis, ſo as to mark more preciſely the boundaries of each. To this diſtinction of emphaſis he accordingly adds another, making a diſtinction of each into two kinds, according to the inflexion of voice they adopt; which, though of the utmoſt importance in conveying a juſt idea of emphaſis, had never been noticed by any of our writers on the ſubject." The diſtinction thus added is that which relates to the application of the riſing and falling inflexion, and which, though in reality ſuch inflexions apply not only to emphatic words, but in a ſmaller or greater degree to all the words and ſyllables of which language, properly delivered, is compoſed, (every ſyllable not delivered in a *monotone*, *i.e.* not ſung, having of neceſſity either an acute, a grave, or a circumflex accent,) is aſſuredly a diſtinction of much importance, in what relates to the practical adjuſtment of the emphaſis, and for the comprehenſion of Mr. Walker's theory, relative to which (imperfect as that theory, perhaps, may be) the ſtudent will do well to refer both to the "Elements" and to the "Rhetorical Grammar" of that elaborate profeſſor. "This," ſays Mr. W., "brings us to a threefold diſtinction of words, with regard to the force with which they are pronounced; namely, the conjunctions, particles, and words underſtood, which are obſcurely and feebly pronounced; the ſubſtantives, verbs, and more ſignificant words, which are firmly and diſtinctly pronounced; and the emphatical word, which is forcibly pronounced: it is the laſt of theſe only which can be properly ſtyled emphaſis; and it is to a diſcovery of the nature and cauſe of this emphaſis that all our attention ought to be directed. And firſt, we may obſerve, that if theſe diſtinctions are juſt, the common definition of emphaſis is very faulty. Emphaſis is ſaid to be a ſtreſs laid on one or more words to diſtinguiſh them from others: but this definition, as we have juſt ſeen, makes almoſt every word in a ſentence emphatical."

Mr. W. then adds, "the principal circumſtance that diſtinguiſhes emphatical words from others, ſeems to be a meaning which points out, or diſtinguiſhes, ſomething as diſtinct or oppoſite to ſome other thing. When this oppoſition is expreſſed in words it forms an antitheſis, the oppoſite parts of which are always emphatical. Thus, in the following couplet from Pope:

> 'Tis hard to ſay, if greater want of ſkill
> Appear in writing or in judging ill.

The words *writing* and *judging* are oppoſed to each other, and are therefore the emphatical words.

But this deſcribes only the emphaſis of antitheſis, which is certainly not the only ſpecies of emphaſis, properly ſo called, that is requiſite to well delivered ſpeech; for words are rendered important by appoſition, as well as by oppoſition; by their relative, and their abſolute conſideration in the ſentence, and by their reflective, as well as their antagoniſt meaning, and to aſcertain and exemplify all the varieties and circumſtances of emphaſes, were almoſt to illuſtrate the whole theory of the actual and practicable melody of ſpeech. The threefold diſtinction above quoted does, however, furniſh a clue to a part of this mazy labyrinth; and Mr. W.'s concluding definition, though imperfect, as excluding ſome eſſential claſſes of emphaſes, is ſtrictly applicable to the full extent of his view, which was certainly the moſt comprehenſive that had then been taken of the ſubject. "Emphaſis," ſays he, "when applied to particular words, is that ſtreſs we lay on words, which are, in contradiſtinction to other words, either expreſſed or underſtood. And hence will follow this general rule; wherever there is contradiſtinction in the ſenſe of the words, there ought to be emphaſis in the pronunciation of them; the converſe of this being equally true, wherever we place emphaſis we ſuggeſt the idea of contradiſtinction." Now though it is not true, that all emphaſis has an antitheſis, either expreſſed or underſtood, yet as the emphaſes of antitheſis conſtitute a very large and material claſs of theſe rhetorical diſtinctions, the following rules may be regarded as highly important. "If the emphaſis excludes the antitheſis, the emphatic word has the falling inflexion; if the emphaſis does not exclude the antitheſis, the emphatic word has the riſing inflexion. The grand diſtinction, therefore, between the two emphatic inflexions is this; the falling inflexion affirms ſomething in the emphaſis, and denies what is oppoſed to it in the antitheſis; while the emphaſis with the riſing inflexion, affirms ſomething in the emphaſis without denying what is oppoſed to it in the antitheſis; the former, therefore, from its affirming and denying abſolutely, may be called the ſtrong emphaſis; and the latter from its affirming only, and not denying, may be called the weak emphaſis."

They who purſue Mr. W. through all his diſtinctions of ſimple, double, and triple emphaſis, will undoubtedly, upon the whole, be much edified, though even with reſpect to the application of the inflexions they may not agree with him in every inſtance. But if Sheridan attempted nothing more than a practical elucidation of the application and miſapplication of emphaſis, without laying down any general principles, or rules of extenſive and perſpicuous application, or diſcriminations of the characteriſtic varieties of emphaſes; and if Cockin only ſuggeſted without properly defining the differences between the grammatical import, and the emphatic diſtinction of words; Mr. W. while he has in ſome inſtances well defined the principle of the application of the riſing, and the falling inflexions to emphatic words, has left it to more recent diſcovery to define, and to claſſify the ſeveral ſpecies of emphaſes, (properly ſo called,) and to point out the diſtinct properties, or actions both of the voice and the enunciation by which thoſe ſpecies are to be contradiſtinguiſhed. "All emphaſes," it is maintained by the lecturer on the ſcience and practice of elocution, "affect the words upon which they fall in the three predicaments, of time, of tune, and of force, but as ſome ſpecies of emphaſes require a preponderancy of one, and other ſpecies of another of theſe properties, emphaſes may properly be contradiſtinguiſhed into three kinds; emphaſis of time, or the condition of words rendered emphatical, by the encreaſed quantity aſſigned to the reſpective ſyllables; emphaſis of tune, or the condition of words rendered emphatical, by the diſtinction of a ſuperior degree of inflexion, or by a higher or lower pitch in the muſical ſcale; and emphaſis of force, or the condition of words rendered emphatical by the ſuperior energy with which they are uttered. And the adjuſtment of theſe reſpective varieties of emphaſes, to their reſpective occaſions, it is contended, is of equal importance with the ſelection of the proper ſituations for placing an emphaſis at all; ſince the ſenſe may be as completely perverted, or at leaſt the ear may be as much ſhocked by inſerting the emphaſis of force (a very common error in theatrical recitation,) where that of tune, or of quantity was required, as by placing it altogether on a wrong word. To elucidate this ſyſtem ſatisfactorily, would require more ſpace than can conveniently be ſpared, in a general dictionary of the circle of ſciences; but as there at preſent exiſts no printed copy of the lectures in queſtion, nor any book upon the ſubject to which the ſtudent can be referred, part of a column will not perhaps be miſapplied, by being dévoted to the ſubject. The kinds of emphaſes enumerated are principally as follows. 1. The objective emphaſis, or emphaſis of import, *i. e.* the ſtreſs of voice by which proportionate importance is given to the word or words, conveying the ſubſtantive matter, or leading object of the ſentence, as "I am deſirous of being acquainted with *the nature of Man.*" That is to ſay, "the nature of man is a ſubject to which I am deſirous of directing ſome enquiry;" an idea which may be expreſſed either with or without any reference to any other ſubject, either as aſſociated or rejected. In which latter caſe, no antitheſis is either expreſſed or implied, and the ſimple emphaſis of import is expreſſed, by an increaſed ſtreſs of the voice, thrown upon the whole of the ſyllables, compoſing the amalgamated ſubſtantive, or compound name of that object, to wit, "the nature of man." 2. Emphaſis of antitheſis, or that characteriſtic ſtreſs and inflexion of the voice by which the oppoſition between two ideas, or parts of a compound idea, is pointed out, and emphatically impreſſed upon the mind. The antitheſis may be either expreſſed or underſtood. Thus, if the preceding paſſage be requoted with an emphaſis upon the word nature only, and that emphaſis be principally ſpecified by a ſtrong circumflective accent (that is to ſay, by a partial increaſe of quantity and a ſpecific peculiarity of time) I am deſirous of becoming acquainted with the *nature* of Man;—the words have changed to a certain degree their ſignification; an antitheſis is underſtood; and the interpretation becomes "It is not the *hiſtory*—it is not the outward *form* and *complexion*, or any other particular incident relative to man, but his general nature, his phyſical and moral attributes that I am deſirous of knowing." Again, if the ſingle word Man be rendered emphatic by ſuperadding to the cuſtomary energy of the cloſing poiſe or final heavy ſyllable a certain portion of the ſame ſpecies of time, "I am deſirous of becoming acquainted with the nature of *man*," will then by another implied antitheſis come to ſignify, "It is not with the nature of ſtones, and earths, and ſhrubs, and herbs, and brute animals, that I am deſirous of becoming acquainted, but with that of man." Of the direct or expreſſed antitheſis we have an illuſtration in the following ſentence. "It is not with the nature of *Màn*, but with the nature of *Gód*, that I am deſirous of being acquainted." Upon this ſpecies of emphaſis little need be added to what has already been ſaid by Mr. Walker. 3. The emphaſis of coincidence, or the level and equal ſtreſs of the voice upon two or more words either in the ſame or different members of a ſentence; by which the relationſhip, agreement, and equal importance of the annexed ideas are indicated: as—"The *ſtature*, the *form*, and the *complexion* of man, as well as his *moral* and *phyſical attributes* are parts of his nature; and his *hiſtory* muſt be ſtudied that his nature may be underſtood." In this inſtance all the words diſtinguiſhed by italics demand the emphaſis of coincidence: a ſpecies of emphaſis which is expreſſed more by its time, or quantity, than either by its inflexion or its force. As this is the ſpecies of emphaſis that is leaſt obtruſive, it is that which may be uſed with the greateſt frequency and freedom. 4. Complicated emphaſes. Sometimes all the different kinds of emphaſes are mingled in one ſentence; ſo that ſeveral different words, or pairs of words, require to be diſcriminated in all the varieties and degrees of time, tune, and force. "It is not the NATURE of **Man** that I am *deſirous* of *STUDYING;* but the LAWS of **God** that I am *anxious* to *COMPREHEND*." Here NATURE, LAWS; **Man**, **God**; *deſirous*, *anxious; STUDYING*, *COMPREHEND*, require to be reſpectively balanced and coupled in the mind by appropriate reſponſes of quantity, tune, and force; which if the ſentence flowed ſpontaneouſly would as ſpontaneouſly be adjuſted in all propriety, but the due application and apportioning of which to written language conſtitutes one of the moſt difficult parts of the art of reading.

There is one thing more which it is neceſſary to obſerve on the ſubject of emphaſis, and then we have done with this long article. It has been miſtakenly ſuppoſed, that the diſtinction of emphaſis neceſſarily belongs to ſingle words; nay ſome there are, who, confounding emphaſis with mere percuſſion, would confine it to ſingle ſyllables; but the fact is, that emphaſis (properly ſo called) belongs not either to the ſyllabic ſeparation, or grammatical ſtructure of words, but to the idea; and whether the ſubſtantive idea be expreſſed by a ſimple or by a compound name, the *whole* name of that idea, not a part only of that name, muſt bear the equal impreſs of that emphaſis:—thus, for example, in the famous reply of the firſt William Pitt to Mr. Walpole,—"But youth it ſeems is not my only crime; I have been accuſed of acting a theatrical part." Here neither the word *acting*, nor the word *theatrical*, nor the word *part*, taken ſeparately, deſignates the jut of the accuſation, or conſtitutes the name of the idea included in the accuſation: for if we read, "I have been accuſed of *acting* a theatrical part," placing the emphaſis only on the word acting; may it not properly be aſked—Why, what would you do with a theatrical part but *act it?* If the emphaſis be placed on theatrical, "I have been accuſed of acting *a theatrical* part:"—what part ſhould be *acted*, but one that is theatrical?—if upon the word part alone—I have been accuſed of acting a theatrical *part?*—what that is theatrical can be acted but a *part?* The whole latter member of the ſentence conſtitutes therefore the jut or object of the accuſation.—"I have been accuſed"—(of what?)—*of acting a theatrical part!*" Theſe words therefore conſtitute, accordingly, the amalgamated ſubſtantive, or compound name of the indiviſible, accuſatory idea, and muſt receive throughout an equal portion of *objective emphaſis*. Not that the ſyllables are thereby to be rendered equally forcible, or to be otherwiſe reduced to one monotonous level. They are only to receive one common ſuperaddition of emphatic force; and as independently of ſuch ſuperaddition, they would have differed among themſelves in pauſe, quantity, accent, and grammatical, or inherent force; in all thoſe particulars they will ſtill continue to differ.

Such is the preſent ſtate of diſcovery and aſcertainment to which enquiries had been conducted upon the ſubject of emphaſis: by which it ſhould ſeem, that it conſtitutes an eſſential part of the theory and practice of the melody of ſpeech; to which we refer the reader; concluding the preſent article with the following definition. "Emphaſes conſiſt in the ſuperadditional importance given to particular words or parts of a ſentence, by an increaſed ſtreſs, tune, quantity, or force in the pronunciation of ſuch words or parts of a ſentence; and by which their relative importance is pointed out, and the contraſts and aſſimilations of different members of a deſcription, argument, or poſition, are diſcriminated to oral perception." Whether it be poſſible, or even deſirable that a ſyſtem of notation (the want of which is lamented by Sheridan and others) ſhould be invented and applied to the indication of theſe varieties, is a queſtion that may belong to the article NOTATION; but which ſhall not be here diſcuſſed.

EMPHATICAL, is uſed by the *Ancient Philoſophers*, to expreſs thoſe apparent colours which are often ſeen in clouds before the riſing or after the ſetting of the ſun; or thoſe in the rainbow, &c.

Theſe, becauſe they are not permanent and laſting, they will not allow to be true colours; but, ſince theſe emphatical colours are light modified chiefly by refractions and with a concurrence of reflections, and ſome other accidental variations; and ſince they are the proper objects of ſight, and capable as truly to affect it as other permanent colours are, there is no reaſon for excluding them from the number of true and genuine colours, ſince all other colours are only modifications of light, as theſe are.

EMPHEREPYRA, in *Natural Hiſtory*, a genus of ſiderochita, compoſed of various cruſts or coats, ſurrounding a nucleus of the ſame matter and ſtructure with themſelves. See Siderochita.

Of this genus we have five ſpecies. Hill's Hiſt. Foſſils, p. 532.

EMPHRACTIC, in *Pharmacy*, the ſame with *emplaſtic*. The word is formed from the Greek εμφρακτω, *I ſtop*.

EMPHRAXIS, in *Medicine*, an obſtruction in any part.

EMPHRUE, in *Botany*, the name given by the people of Guinea to a ſpecies of tree, the leaves of which they boil in wine, and give as a great reſtorative in caſes of weakneſs and decay. Its leaves are exactly of the ſhape of thoſe of the common mulberry. but they are not indented at the edge. Petiver has thence called it "arbor Guineenſis mori folio non crenato." Phil. Tranſ. N° 232.

EMPHYSEMA. The common meaning of this word, in *Surgery*, is an inflation of the texture parts, in conſequence of air getting out of a breach in the lungs, and paſſing into the communicating cavities of the cellular ſubſtance on the outſide of the cheſt, through another breach exiſting at the ſame time in the pleura coſtalis, or membrane lining the thorax. However, there are ſome leſs frequent caſes of emphyſema, which are not comprehended in the preceding definition, as will be explained in the courſe of the preſent article. The term is derived from the Greek εμφυσαω, *to inflate*. Dr. Halliday, in a late ingenious eſſay on the ſubject under conſideration, deſcribes the following as the ſymptoms of an emphyſema, when the affection proceeds from an injury of the thorax. A conſtant pain takes place in the ſide, that has been hurt. At firſt, the ſuffering is not increaſed even by a very full inſpiration; but, no great length of time elapſes, before a very conſiderable difficulty of breathing occurs, and the patient complains of a ſenſation, as if cords were drawn acroſs the cheſt, and of a peculiar tightneſs at the ſcrobiculus cordis. If the part, where the pain and uneaſineſs were firſt felt, is now examined, a ſoft puffy tumour may be noticed, which is ſo very prominent as to prevent the ribs immediately under it from being felt. This tumour increaſes very rapidly, and is ſoon diffuſed over all the cheſt; but is particularly conſpicuous on the neck, breaſt, and face. The rapidity, with which it now ſpreads over the whole ſurface of the body, is amazing, and, in many places, the ſkin is elevated ſeveral inches from the ſubjacent bones and muſcles. When the ſwelling has become general, the patient finds it extremely difficult both to expire and inſpire; the motion of the extremities is very much impeded, and, indeed, when the ſkin is conſiderably elevated, ſuch motion is almoſt entirely prevented. The integuments crackle under the hand; the ſkin is much paler than natural, feels cold, and when ſtruck, ſounds like a wet drum. The air may, in general, be eaſily preſſed from any part; but it returns to the ſame place again as ſoon as the preſſure is removed. The reſpiration is exceedingly laborious, and quick. The patient inſpires with a ſudden effort, and the air, in paſſing the epiglottis, makes a peculiar noiſe. Expiration follows inſpiration almoſt inſtantaneouſly, and is performed with a deep ſigh, or rather groan. The patient is incapable of lying with comfort on either ſide of his body, and feels moſt eaſe, and breathes beſt, when ſitting half erect in bed. The ſkin and extremities feel very cold. The pulſe is ſometimes quick and hard; at other times, it is hard and full; but it can only be felt with ſome difficulty. The eye-lids are frequently ſo puffed up that the patient cannot ſee; the features are very much deformed; and the lips aſſume a purple, or rather a livid hue. At the beginning of the caſe there is generally a ſhort tickling cough, which increaſes with the other ſymptoms, ſo as to become almoſt inceſſant. What the patient ſpits up is generally very frothy and mixed with blood. The tongue is dry, and the patient complains of a conſtant thirſt. The voice becomes very weak, and unleſs the effuſed air is ſpeedily let out, ſo as to reduce the ſwelling and preſſure, the patient dies ſuffocated. (See obſervations on Emphyſema, 1807.) It is utterly impoſſible for any one to underſtand the ſubject of emphyſema, without previouſly having ſome idea of the manner in which the function of reſpiration is naturally carried on. He muſt at leaſt know, that, in the perfect ſtate, the ſurface of the lungs always lies in cloſe contact with the membrane lining the ribs, both in inſpiration and expiration. The lungs themſelves are only paſſive organs, and are quite incapable, by any action of their own, of expanding and contracting, ſo as to maintain their external ſurface conſtantly in contact with the inſide of the thorax, which is continually undergoing an alternate change of dimenſions. Every muſcle that has any concern in producing an enlargement, or diminution, of the cheſt, muſt contribute to the effect of adapting the volume of the lungs to the ſize of the cavity in which thoſe organs are contained. This muſt happen while there is no communication between the cavity of the pleura and the external air, and while there is no breach of continuity in the ſurface of the lungs themſelves. In the act of inſpiration, the thorax becomes enlarged in every direction, the lungs are proportionally expanded, and the air entering through the windpipe, into the air-cells of theſe organs, prevents the occurrence of a vacuum. On the other hand, in the act of expiration, certain muſcles diminiſh the capacity of the thorax, and the lungs being of courſe compreſſed, a large portion of the air, which had juſt before been inhaled in the preceding inſpiration, is again expelled from the trachea.

The few obſervations, already made, muſt render it obvious to every reader, that by the conſtant continuance of the ſurface of the lungs in cloſe contact with the inſide of the cheſt, both in its enlarged and diminiſhed ſtate, the air is regularly drawn into, and expelled out of the air-cells of thoſe important viſcera. It muſt alſo be manifeſt, that immediately a free and direct opening is made through the ſkin and muſcles into the cavity of the cheſt, ſome air muſt enter through the wound, and inſinuate itſelf into this laſt ſituation, on the dimenſions of the thorax being enlarged by the action of the muſcles of inſpiration. The lungs on the wounded ſide, of courſe, remain collapſed, and leſs air is drawn into the trachea, in proportion as a larger quantity accumulates between the inſide of the cheſt and the outſide of the lungs. In this manner, the expanſion of theſe latter organs on one ſide becomes gradually more and more obſtructed. A certain part of the accumulated air, it is true, is forced out of the wound again in each expiration; but a larger quantity enters at every inſpiration, and the lungs on the injured ſide become at laſt quite collapſed.

Caſes of this kind, by which we imply wounds, attended with a free and direct opening into the cavity of the cheſt, can never be attended with any ſerious degree of emphyſema. If the wound be not quite ample and ſtraight, a certain quantity of air, expelled at each expiration, inſtead of getting out of the external orifice, may undoubtedly inſinuate itſelf into the adjoining cellular ſubſtance, and occaſion ſome emphyſematous ſwelling. However, this never ſpreads, under ſuch circumſtances, to any conſiderable extent.

The emphyſema alſo, abſtractedly conſidered, is never productive of much danger, when there is a free and direct opening into the cheſt; for it will be preſently underſtood that the danger, in emphyſematous caſes, depends on the manner in which the air is confined in the cavity of the cheſt, ſo as to produce ſuch a degree of preſſure on the mediaſtinum and diaphragm, as obſtructs the function of the oppoſite lung, and occaſions a fatal ſuffocation. Now the very exiſtence of a free opening removes the poſſibility of the air accumulating in ſuch a manner in the cheſt, as to cauſe any dangerous degree of preſſure on the diaphragm and other lung. This latter ſupports life, while the lung on the wounded ſide lies quietly collapſed, till the wound in the parietes of the cheſt has healed, and the air has been abſorbed.

The foregoing remarks muſt make us percieve what wiſdom there is in the arrangement, of having the cheſt divided into two cavities, which have no communication with each other. If things were not ſo ordained, ſuffocation would be a common conſequence of every large wound, that extended into the cheſt. Bertrandi informs us, that whenever a free opening is made into each ſide of an animal's thorax, the lungs collapſe, and ſuffocation is always the conſequence.

However, wounds which merely penetrate the cheſt, without wounding the lungs, are never attended with any conſiderable degree of emphyſema. Whatever emphyſematous ſwelling does ariſe is alſo produced by the external air, which paſſes into the thorax through the wound, in the act of inſpiration, and out of the orifice of the injury again, when the patient diminiſhes the capacity of the cheſt in expiration.

The caſes of emphyſema, moſt apt to be attended with alarming ſymptoms, interrupted reſpiration, and an extenſive diffuſion of air in the cellular ſubſtance of the body, are commonly produced by narrow oblique ſtabs, which penetrate the parietes of the cheſt, the pleura coſtalis, and pleura pulmonalis, ſo as to make an opening into the air-cells of the lungs. Emphyſema alſo frequently aſſumes the ſame urgent and dangerous form, in caſes of fractured ribs, the ſharp ſpiculæ of which, being driven inward, tear the pleura coſtalis, pleura pulmonalis, and ſurface of the lungs themſelves. The latter inſtances differ from wounds in the circumſtance of there being no breach of continuity in the integuments. We have already explained, that whatever air inſinuates itſelf into the cellular ſubſtance, in wounds, which ſimply enter the cheſt without injuring the lungs, muſt be derived from without; that is, it firſt paſſes into the thorax through the wound. But when emphyſema ariſes from narrow oblique ſtabs, which enter the cheſt and injure the lungs; or when the affection originates from the pleura coſtalis, pleura pulmonalis, and part of the ſubſtance of the lungs being torn by the ſharp points of a broken rib; whatever air becomes diffuſed in the cellular ſubſtance, firſt eſcapes from the breach in the air-cells of the lungs into the cavity of the thorax, and thence is expelled through the wound, or laceration in the pleura coſtalis, into the common cellular ſubſtance, ſituated on the outſide of this latter membrane. In wounds, which ſimply enter the thorax, without injuring the lungs, the air paſſes through the opening, into the cavity of the pleura in inſpiration, at the ſame time, and from the ſame cauſes, that the air alſo enters the lungs through the trachea. Circumſtances, however, are exceedingly different, when emphyſema ariſes from narrow oblique ſtabs, or fractures of the ribs, attended with an injury of the lungs. In the firſt of theſe caſes the air cannot enter the cavity of the cheſt in the ſame manner as it does when there is a free and direct opening made in the parietes of the thorax. In the ſecond inſtance, (namely, fractured ribs,) there is no external orifice at all. Both theſe latter kinds of caſes, being alſo accompanied by a wound of the lungs, are eſſentially different, in many reſpects, from ſuch examples of emphyſema as proceed from a wound, which only enters the cheſt without doing any miſchief to the lungs. When the ſurface of theſe organs is wounded, no ſooner does the cheſt become expanded in the act of inſpiration, than ſome of the air eſcapes from the breach in the ſubſtance of the lungs, gets into the cavity of the pleura, and afterwards inſinuates itſelf, through the opening in the pleura coſtalis, into the common cellular ſubſtance.

We ſhall next endeavour to make the reader underſtand more clearly the cauſe of the air collecting in the cheſt, and becoming effuſed in ſuch caſes of emphyſema as proceed from wounds, or injuries, which cauſe a breach either in the pleura pulmonalis alone, the pleura pulmonalis and pleura coſtalis together, or in the integuments, muſcles, and pleura coſtalis, without the pleura pulmonalis being at all concerned. We ſhall enter into this part of the ſubject rather fully, becauſe it is by no means well underſtood by the generality of ſurgeons, and, without a clear comprehenſion of it, the practitioner muſt feel completely in the dark, in regard to the right mode of treating the affection.

Dr. Halliday notices, that the lungs in the thorax have often, and not unaptly, been compared to a bladder in a cloſe pair of bellows; but, if we ſuppoſe the bellows to be divided into two compartments, and each of theſe to contain a bladder, which mutually communicate with each other, and with the external air by means of a tube, which is exactly adapted to the nozzle of the bellows, and which admits the air only into the cavity of the bladders, and not into the ſpace betwixt the bladders and bellows, we ſhall then have a perfect repreſentation of the mechanical ſtructure of the thorax. The bellows will repreſent the thorax divided in the middle by the mediaſtinum; the bladders will repreſent the lungs of the right and left ſides; and the tube, which communicates with the bladders and the external air, will repreſent the trachea. The only thing which is wanting to render this mechanical repreſentation perfect is, that the bladders ſhould exactly fill the bellows, ſo as to leave no air betwixt them and the bellows.

It is evident, ſays Dr. Halliday, that when we lift up the handle of the bellows, the bladders will be filled by the external air ruſhing in through the tube, which communicates with both, and that, when we depreſs the handle, the air will be again expelled. Dr. Halliday conceives that this is exactly the way in which the lungs are filled and emptied in reſpiration. The cavity of the thorax being enlarged, by the contraction of the diaphragm and intercoſtal muſcles, &c. a vacuum is formed, into which the air ruſhes through the trachea, and we perform what is called *inſpiration;* whereas, by the contraction of the abdominal muſcles, and relaxation of others, the cavity of the thorax is diminiſhed, and the air is expelled, or we *expire.*

The bellows and bladders, continues Dr. Halliday, will alſo ſerve to illuſtrate the caſes of injury mentioned as giving riſe to emphyſema, and firſt as occaſioned by the pleura pulmonalis of one ſide being wounded, or ulcerated. This caſe is, in many reſpects, the ſame as if an opening were made in one of the bladders, and which opening would form a communication with the ſpace betwixt the bellows and bladder on one ſide. Now, ſuppoſe that this takes place while the handle of the bellows is depreſſed, as ſoon as the handle is raiſed, air will ruſh into the ſpace betwixt the bladder and bellows, and, if you keep the handle up for a little time, the bladder will collapſe altogether, and the place which it naturally occupied, when diſtended, will now be occupied by the air. If we attempt to force out the air by depreſſing the handle of the bellows, we ſhall find that this cannot be done; for there is no direct communication betwixt the bellows and external air; and, as the effuſed air preſſes equally on all parts of the collapſed bladder, it cannot eſcape through it. Dr. Halliday next explains, that by the action of the muſcles of inſpiration, the preſſure is removed from the ſurface of the wounded lung, and the air, which ſhould have ruſhed in and diſtended the lung, now paſſes through the wound, into the ſpace betwixt the pleura pulmonalis and pleura coſtalis. In the living body the whole of the air inſpired will not be thus effuſed; but, as it muſt paſs through the lung, it will alſo at firſt diſtend it, more or leſs, according to the ſize of the opening in the pleura pulmonalis, and this partial dilatation of the wounded lung will always happen while air continues to be inſpired on that ſide. As ſoon as expiration begins, the general cavity of the thorax being thereby diminiſhed, the effuſed air will be compreſſed againſt the wounded lung; but none of the air which has eſcaped can re-enter the lung again, becauſe the whole of the air contained in the lung muſt be forced out, and the preſſure againſt every part of the collapſed lung being equal, will prevent the effuſed air from ſeparating any part, ſo as to make a paſſage for itſelf into the trachea. In this manner freſh air is accumulated in the ſpace betwixt the pleura at every inſpiration, while none is allowed to eſcape during expiration, and the quantity accumulated at laſt will be equal to that which was received into the other lung, during the moſt powerful inſpiration after the accident. Dr. Halliday next notices, that this kind of accumulation of air in the cheſt has been denominated *thoracic emphyſema*, and has been ſuppoſed to have ſometimes proved fatal, without any more extenſive diffuſion of the air.

Dr. Halliday afterwards informs us, that when an opening exiſts both in the pleura pulmonalis and pleura coſtalis, the ſame circumſtances happen as in the foregoing caſe, till the lung has collapſed; but, that if the patient now attempt to expire, the injured ſide of the thorax muſt continue diſtended, notwithſtanding every effort. However, in general the air makes a way for itſelf through the cellular membrane, and as the paſſage of air into the cavity of the thorax, during inſpiration, is eaſier than the return of that which has been already effuſed into the cellular membrane, this effuſion continues to go on with great rapidity, while the patient lives, ſo as to occaſion what has been termed *ſubcutaneous emphyſema*.

The above writer alſo obſerves, that in the caſe of a wound which ſimply penetrates the cheſt, without hurting the lungs, if the acceſs of air be more free by the wound than by the trachea, more air will enter during inſpiration into the cavity of the thorax than into the lungs; and that if the acceſs of air be, on the contrary, leſs free, then alſo leſs air will enter the thorax than the lungs. However, Dr. Halliday remarks, that in the ſame proportion as air enters into the lungs, or into the cavity of the thorax, it will likewiſe be expelled from theſe cavities during expiration. Hence, air would not accumulate in the thorax, did not the lungs always tend to collapſe from their natural gravitation. Perhaps no author has offered a more accurate and ſpirited deſcription of an emphyſema ariſing from a fractured rib than Mr. John Bell, of Edinburgh. This gentleman remarks, that when a rib is broken, the point of the broken bone is preſſed down upon the ſurface of the lungs, ſo as to lacerate them. It is often from the ſlighteſt and moſt ſuperficial wound of this kind, that the emphyſematous tumour proceeds, the laceration of the lungs extending to ſo inconſiderable a depth in the lungs, that it does not even occaſion the leaſt ſpitting of blood, or any other ſymptom of a deep wound; and Mr. John Bell obſerves, that if the patient die, the wound cannot be ſeen even after diſſection; but can only be diſcovered by inflating the lungs. Yet, ſays this gentleman, the ſurface of the lungs being touched even in this ſlight way, the air eſcapes from them at every inſpiration; the air which is then within the cavity of the thorax is of courſe compreſſed, ſo that at the next expiration this compreſſion muſt force the air either back again into the lungs, or elſe out of the wound in the parietes of the thorax, and thence among the cellular ſubſtance ſurrounding the broken rib. Thus, obſerves Mr. John Bell, in every inſpiration there is a ſuction of ſome air, which is drawn through the wounded lungs, the air expands in the cavity of the thorax, the lung which gave out that air ſubſides again, and lies almoſt entirely quieſcent, partly from the wound in it, which, like a rent in a bladder, prevents it from being inflated, and partly from the preſſure of the air in the cavity, in which there ought to be a vacuum to make the lung expand. Every new inſpiration draws more air from the wounded lung, and every new expiration drives more air out into the cellular ſubſtance. There is no further outlet for the air, which makes its way forwards, and (to uſe Mr. John Bell's expreſſion) undermines the common ſkin with wonderful rapidity. Thus, the emphyſematous crackling tumour appears firſt over the broken rib, or over the wounded point of the thorax; then extends over the whole cheſt, attended with great oppreſſion of the breathing; then over the neck and face, and filling the eye-lids particularly, ſo that the eyes are abſolutely cloſed. Next it ſpreads over the belly, and down the thighs. At laſt, the private parts become enormouſly ſwollen, and no part eſcapes this tumour, except the palms of the hands and ſoles of the feet. More air, ſays Mr. John Bell, is every moment drawn out from the wound of the lungs, and driven under the ſkin; the patient is every moment more and more oppreſſed; till, at laſt, the breathing is quite interrupted, the pulſe flags, the extremities grow cold, and the patient, if he be not relieved by ſome operation, muſt die.

According to the ſame writer, the wounded lungs collapſe, and continue in this ſtate until the breach in them has healed, which happens in a very few days. From the moment when the lungs are wounded, the uſe of the wounded lobe is loſt, ſo that if the right lung be the one injured, the breathing is entirely carried on by the left, only half the quantity of air is inſpired, and the reſpiration is attended with difficulty. Mr. John Bell conſiders this collapſe of the injured lung, which muſt inevitably continue for at leaſt a few days, a chief means of ſafety, at the ſame time that it is a cauſe of diſtreſs. He obſerves, that when the lungs are unfolded their veſſels have their full diameter, they hold their full proportion of blood, and, if they were not collapſed, their wounded veſſels would be in a condition to emit a conſiderable quantity of blood. But, the fact is, when one of theſe organs is wounded, it collapſes towards the ſpine, and can no more be filled than a torn bladder can be inflated. The lung is alſo oppreſſed by whatever air or blood may be effuſed in the cavity of the thorax. The collapſe of the lung cauſes leſs blood to be extravaſated in the cheſt, and leſs to be thrown into the bronchiæ, which latter kind of hemorrhage is even more dangerous than that which takes place in the cavity of the pleura, becauſe it may not only affect the wounded lung, but obſtruct the entrance of air into the other one, ſo as to produce a fatal ſuffocation.

Mr. John Bell very judiciouſly remarks, that, if the injured lung were not to collapſe, it would be difficult to conceive, how the breach could ever be healed; for, the air would be continually ſtreaming through the wound, which becoming alternately dilated and contracted, like that of an artery, could never cloſe. However, ſince the wounded lung lies in a collapſed ſtate, the edges of the wound are in contact with each other. We find by diſſection, that a ſlight effuſion of blood, a degree of livor, a ſwelling, thickening, and inflammation, take place round the wound, and thus, in two days, the breach is cloſed. The lung becomes again entire, and capable of reſuming its functions.

Mr. John Bell alſo takes notice, that the blaſt of air, from a wound in the thorax, is often ſo ſtrong, that at every breath it is capable of extinguiſhing a candle, and ruſhes out with a conſiderable noiſe. This ſtream of air, ſo far from being a ſign of wounded lungs, is often moſt remarkable, when the lungs are abſolutely entire. It is a ſign of a free and open wound in the cheſt; but, by no means of wounded lungs; for whether theſe organs be wounded or not, the air enters ſo freely by the outward wound, when ample and direct, that there is no vacuum formed to give the lung play, and it muſt collapſe, till the external wound has healed. Wounds of the thorax, therefore, are totally different caſes from wounds of the lungs. When the cheſt has a large free opening made into it, it is (as Mr. John Bell deſcribes) like a pair of bellows, having a large air-hole, which admits the air every time the breaſt riſes; and expels it again as often as the breaſt falls down. The air is alternately drawn in, and thrown out at every reſpiration, with a ſtrong blaſt; but, whatever air iſſues through the wound, had been drawn in by the wound, and had never paſſed through the lungs. Hence, when there is a free opening made in the thorax, no vacuum can form ſo as to lead to the expanſion of the lung, and whether entire, or injured, it muſt be in a collapſed ſtate.

We may be convinced, that the lung, on the ſide oppoſite the wound, is adequate to the temporary ſupport of life, by the recollection of ſeveral kinds of caſes. When a large free opening has been made into the cheſt by ſome accident, or by the ſurgeon's knife, the lungs on the injured ſide of courſe collapſe; yet, the patient has often been known to live with tolerable eaſe in this condition, until a perfect recovery has followed. When the right or left lung has been utterly prevented from becoming expanded, in conſequence of the preſſure of air in emphyſema, water in hydrops pectoris, or pus in empyema, the patient has often lived a conſiderable while in this ſtate, and ultimately got well. Perſons have lived ſo long with diſeaſe in the cheſt, that when they have died, and their bodies have been opened, only a ſmall knob, or tubercle of the lungs on one ſide, has been found remaining. See Koelpen de Empyemate Obſervatio, p. 135, 136.

When the lungs are wounded by the point of a broken rib, or when they are injured by a narrow ſtab in the thorax, the air cannot readily eſcape from the cavity of the cheſt, while at every inſpiration more and more is drawn out from the lungs, till at laſt ſuch a quantity accumulates, that it not only oppreſſes the lung, which is on that ſide, but by hindering the free action of the diaphragm, and loading the mediaſtinum, it oppreſſes the other lung alſo. In this manner, the breathing becomes gradually more and more interrupted; the pulſe ſinks; the extremities grow cold; and after great toſſing, and undeſcribable anxieties, the patient dies. All this may happen, even when a part of the air eſcapes through the breach in the pleura coſtalis, ſo as to inflate a great part of the common cellular membrane of the body. See Diſcourſes on the Nature and Cure of Wounds by John Bell, vol. ii.

From what has been ſtated, it muſt be evident, that the emphyſematous ſwelling itſelf, or, in other words, the diffuſion of air in the cellular ſubſtance, is a matter of ſecondary conſequence, and, that the great peril of an emphyſema depends on the manner in which one ſide of the cheſt may become ſo diſtended with air, that the preſſure produced on the diaphragm, mediaſtinum, and oppoſite lung, occaſions a fatal interruption of reſpiration.

However, in caſes in which there is a free and open wound in the parietes of the cheſt, or when the ſurgeon has made an ample and direct inciſion into the thorax, the opening, in fact, does not relieve the lung on the ſame ſide, but the oppoſite one, by obviating the preſſure of any confined air on it. In the mean while, the lung on the wounded ſide lies in a collapſed ſtate, till the wound in it has healed.

It is curious to obſerve, how few of our beſt modern ſurgical writers have had accurate notions concerning emphyſema. Hewſon, Benjamin Bell, and Bromfield, have all fallen into the miſtake of ſuppoſing it poſſible to make the wounded and collapſed lung immediately expand again by exhauſting the air from the cavity of the pleura. Mr. Bromfield writes, "in caſe an opening is made between the ribs, and a cannula introduced, whoſe diameter is larger than the wound of the lungs, the air will be forced out as faſt as it eſcapes from the lungs, therefore the lungs will have room for their *expanſion*," &c. See Chirurgical Caſes and Obſervations.

Mr. Hewſon obſerves, "it is natural to ſuppoſe, that the wound of the pleura and intercoſtals may ſometimes be too ſmall to ſuffer the air to get readily out into the cellular membrane, and to inflate it, but may confine a part of it in the cavity of the thorax, ſo as to compreſs the lungs, *prevent their expanſion*, and cauſe the ſame ſymptoms of tightneſs of the cheſt, quick-breathing, and ſenſe of ſuffocation, which water does." Mr. Hewſon ſeems to have no idea of the danger of ſuffocation proceeding from the preſſure on the oppoſite lung, and though he wrote profeſſedly to recommend paracenteſis thoracis in theſe caſes, he adviſes making a ſmall inciſion, rather than a large one, *leſt the air ſhould enter, and hinder the expanſion of the lungs.* Med. Obſ. and Inq. vol. iii.

Mr. Benjamin Bell has undoubtedly run into moſt ſtrange abſurdities in the deſcription in his Syſtem of Surgery, of plans for expelling the air from the ſurface of the lungs. "While the wound yet remains open," ſays he, "let the patient, in a ſlow gradual manner, make a full *inſpiration*, by which a conſiderable quantity of the collected air will be diſcharged. This being done, the ſkin muſt be inſtantly drawn over the *ſore*, ſo as to cover it completely during *expiration*; and if the wound be moderately opened during *inſpiration*, the whole quantity will be ſoon expelled."

In this paſſage, the author has obviouſly confounded the words expiration and inſpiration, beſides diſplaying ignorance in thinking it practicable to make the collapſed wounded lung riſe up again by ſuch proceedings.

The ſame author remarks: "the other means which we wiſh to propoſe for drawing off air from the thorax, is ſuction; an exhauſting ſyringe may be fitted with ſuch a mouth of ivory or metal, as will allow it to be cloſely applied over the orifice in the pleura:" He adds, that "as much diſtreſs has, on ſome occaſions, enſued from both cavities of the cheſt being at the ſame time laid open, it ought never to be attempted." He afterwards imputes the danger, not to the collapſe of both the lungs, but to the inflammation likely to ariſe from the admiſſion of air into the two cavities of the cheſt at once. The fact is, a free opening made into each ſide of the cheſt at the ſame time would be inſtantly followed by a collapſe of both lungs, and immediate ſuffocation. There would neither be time for any inflammation to ariſe, nor for relieving the patient with exhauſting ſyringes.

There is certainly a poſſibility of making the lungs expand again, by ſyringes, &c. as ſoon as the breach in them has healed, or the injured air-cells have been cloſed with coagulating lymph; but, the propriety and utility of the plan may be juſtly called in queſtion. The introduction of pipes into the cheſt cannot be done without irritation; no more air can eſcape from the lung now the air-cells are cloſed; what is already effuſed in the cheſt will be abſorbed, and the lung expand again, in proportion as this is effected; and ſhould the diaphragm and oppoſite lung ſuffer dangerous preſſure from the large quantity of accumulated air, relief may be derived from making an opening in the diſtended ſide of the cheſt, ſufficient for letting out a certain quantity of the confined air. In this inſtance, a ſmall puncture in the pleura would ſuffice: the caſe is not like ſome others, in which the breach in the lung is not cloſed, and a very free and direct opening is required, in order to let the air eſcape from the thorax, as faſt as it paſſes out of the wound in the lung itſelf. By this ſtep, and no other, can we prevent the ſpreading of the emphyſematous ſwelling over the whole body, and what is of ſtill higher moment, a perilous degree of preſſure on the diaphragm and oppoſite lung.

Some of the moſt remarkable caſes of emphyſema, on record, are related by M. Littre, M. Mery, Dr. Hunter, and Mr. Cheſton, in the Mem. de l'Acad. Royale des Sciences for 1713, Medical Obſervations and Enquiries, vol. ii, and Pathological Enquiries.

With reſpect to the treatment of emphyſema, when the air becomes effuſed in the cellular ſubſtance round a wound, which merely injures the parietes of the cheſt, the beſt plan muſt be to direct the patient to expel as much of the air from the thorax as he can, by making long expirations, the opening being regularly cloſed when the patient enlarges his cheſt in inſpiration. After getting as much air as poſſible out of the thorax in this manner, the edges of the external wound may be carefully brought together, and well covered with adheſive plaiſter, compreſſes, &c. ſo as to prevent the ingreſs of any more air into the cheſt. The emphyſematous ſwelling can now no longer increaſe, or, at all events, can only do ſo as long as whatever air is ſtill in the cheſt continues unexhauſted; and in proportion as it becomes effuſed, or is abſorbed, the lung muſt expand and reſume its function again. In this particular inſtance, as there is no breach in the lung, the practitioner, if he thinks proper, may endeavour to make the viſcus expand again at once, by drawing the air out of the cavity of the pleura with a ſyringe. However, ſince all examples of emphyſema, which are attended with urgent ſymptoms of ſuffocation, are accompanied by a wound or laceration of the air-cells of the lung, we cannot rationally attempt to make this organ immediately expand again by means of ſuction. The thing is not practicable, becauſe how can we exhauſt the air from the cheſt, as long as more is capable of paſſing out of the opening in the lung itſelf. We have likewiſe already explained, that the collapſed ſtate of the injured lung is the moſt favourable for the cloſure of the wound in it, and for the prevention of hemorrhage from its veſſels.

In all conſiderable caſes of emphyſema, the air, effuſed in the cavity of the thorax, and common cellular membrane, is derived from a rent, or wound in the ſubſtance of the lungs. The worſt ſymptoms in theſe inſtances, as we have already repeatedly inſiſted upon, depend on the preſſure of the air confined in the injured ſide of the thorax, on the diaphragm, and oppoſite lung. Both this accumulation of air, and the diffuſion of another portion of it in the cellular texture of the body, are entirely owing to one circumſtance, *viz.* there being no free and direct paſſage through which the air can eſcape outward, as faſt as it paſſes out of the breach in the lung.

The inflation of the external parts with air, a thing which often takes place in an enormous degree, is not itſelf a caſe of urgent danger, and, indeed, it is ſo far a favourable event, as it proves, that the air effuſed from the lung can eſcape from the cavity of the pleura in a certain meaſure. If it could do ſo with ſufficient celerity, no oppreſſion of the diaphragm and oppoſite lung would be occaſioned.

In caſes of emphyſema, Mr. John Bell recommended the following treatment to be adopted. 1ſt. Upon obſerving the crackling tumour begin to form over a fractured rib, ſmall punctures ſhould be made with the point of a lancet, and, if the inſtrument be carried deeply enough, the air will ruſh out in an audible manner. As this air was in the thorax before it came into the cellular ſubſtance, it is plain, that the thorax is ſtill full, and that the lung of that ſide is already collapſed and uſeleſs, and muſt continue ſo for a certain time; that is until the breach in it is cloſed. The purpoſe, therefore, of making theſe ſcarifications, and eſpecially of making them ſo near the fractured part, is not to relieve the lungs, but merely to keep the air from ſpreading more widely beneath the ſkin.

When the emphyſema proceeds from a narrow ſtab in the cheſt, the practice ſhould of courſe be the ſame, in the ſame ſtage of the caſe, or, in other words, at the period when the external emphyſematous ſwelling is in an incipient ſtate. The two examples reſemble each other, inaſmuch as the lungs and pleura coſtalis are wounded in both caſes, and the air, which paſſes through the breach in the pleura, cannot make its way completely outward; but becomes diffuſed in the cellular membrane.

2dly. If, before the ſurgeon arrives, the air ſhould have ſpread to very remote parts of the body, as to the ſcrotum and down the thighs, it will be eaſier, ſays Mr. John Bell, to make ſmall punctures in thoſe parts, in order to let out the air directly, than to preſs it along the whole body, till it arrives at the punctures, made on the cheſt, over the wounded part.

3dly. If, notwithſtanding free punctures, and preſſing out the air in this way, it ſhould be found by the oppreſſion, that either air or blood is accumulating within the cavity of the thorax, ſo as to oppreſs not the wounded lung only, which, from the firſt, is of courſe collapſed and uſeleſs, but, alſo, ſo as to oppreſs the diaphragm and other lung; then a freer inciſion muſt be made through the ſkin and muſcles, and a ſmall one in the pleura coſtalis, in order to let the confined air out of the thorax.

In the courſe of a few days the wound in the collapſed lung becomes cloſed by the adheſive inflammation, in which proceſs the breach in the air-cells is ſhut up with coagulating lymph, and the air can no longer get out of them into the cavity of the cheſt. The air, which is already there, is alternately abſorbed, and the lung, expanding in proportion, reſumes its original functions.

Emphyſema has been known to ariſe from the burſting of a vomica, and ulceration of the ſurface of the lungs; but the air, which eſcapes in this inſtance, cannot find its way into the cavity of the thorax, becauſe the inflammation, which precedes the abſceſs and ulceration of the air-cells, cloſes thoſe which are adjacent, and produces an adheſion of the edges of the vomica, or ulcer, to the inner ſurface of the cheſt, ſo as entirely to ſeparate the cavity of the abſceſs from that of the thorax. We do not know of any example, in which the ſymptoms imputed to the confinement of air in the cheſt, originated in conſequence of ſuppuration and ulceration of the ſurface of the lungs. However, Palfyn, Dr. Hunter, and the author of the article "Emphyſema" in the French Encyclopædia, have ſeen caſes, in which emphyſema has ariſen from abſceſſes of the lungs, attended with adheſion to the pleura, and ulcerations in the ſituation of ſuch adheſion. In theſe caſes, the pus having made its way through the pleura, and intercoſtal muſcles, the air eſcapes alſo through the ſame tract, ſo as to get into the cellular membrane on the outſide of the cheſt.

A certain degree of emphyſema has been obſerved to be occaſionally produced by a violent effort of reſpiration. In the inſtances referred to, the air is ſaid firſt to make its appearance about the clavicles, and afterwards to ſpread over the neck and adjacent parts. The violent efforts of parturition have alſo been remarked to occaſion a ſimilar ſymptom; but without being followed by any bad conſequences. See Medical Communications, p. 176.

In the fourth volume of the Mémoires de l'Academie de Chirurgie, 4to. M. Louis has deſcribed an emphyſema of this latter ſort, which, on account of its cauſe, and the indication which it affords the practitioner, is highly important. M. Louis had occaſion to remark the occurrence in a young girl, who died ſuffocated, from a bean falling into her wind-pipe, and he conſiders the kind of emphyſema in queſtion as a pathognomonic ſymptom of ſuch an accident. If this opinion be correct, a knowledge of the circumſtance muſt be of great importance to the practical ſurgeon; for, if making an opening into the trachea, and attempting to extract the foreign body be delayed, from any doubt concerning the nature of the caſe, the patient will inevitably die of ſuffocation. In the caſe which firſt attracted the attention of M. Louis to the ſubject, the emphyſema made its appearance on both ſides of the neck above the clavicles, and came on ſuddenly, on the third day after the foreign ſubſtance had fallen into the trachea. On examining the body, after death, the lungs and mediaſtinum were alſo found to be in an emphyſematous ſtate. The retention of air by the extraneous ſubſtance produced, according to M. Louis, at every attempt to expire, and, particularly, during the violent fits of coughing, a ſtrong propulſion of this fluid towards the ſurface of the lungs into the ſpongy ſubſtance of theſe viſcera. The air next inſinuated itſelf into the cellular texture, which unites the ſurface of the lung to the pleura pulmonalis; and, by communications from cells to cells, it occaſioned a prodigious ſwelling of the cellular ſubſtance, between the two layers of the mediaſtinum. The emphyſema increaſing, at length made its appearance above the clavicles. This tumefaction of the lungs and ſurrounding parts, in conſequence of air getting into their ſpongy and cellular texture, is an evident cauſe of ſuffocation, and M. Louis obſerves, that the ſwelling ſeems to be ſo natural an effect of the preſence of a foreign body in the trachea, that one can hardly fail to think it an eſſential ſymptom, though no author has made mention of it.

An emphyſema of the head, neck, and cheſt, has alſo been noticed in ſome typhoid fevers. Dr. Huxham relates an inſtance of this ſort, which took place in a ſailor of a ſcorbutic habit. Medical Obſervations and Inquiries, vol. iii. art. 4.

Surgical practitioners have frequent occaſion to remark the occurrence of a partial emphyſema in caſes of gangrene. Emphyſema, ariſing from wounds in the thorax, is very often a caſe, complicated with large extravaſations of blood in the cheſt, and inflammation of the pleura and lungs; circumſtances which muſt greatly increaſe the danger, and ought materially to influence the mode of treatment.

The adheſions, ſo frequently met with between the pleura coſtalis and pleura pulmonalis, muſt obviouſly have the effect of preventing the collapſe of the lung, in circumſtances under which it would otherwiſe happen. Were a wound to enter through the middle of any adherent parts, it is plain that no air could find its way out of the lung into the cavity of the thorax.

EMPHYTEUSIS, in the *Civil and Canon Law*, the letting out of poor barren lands for ever, or at leaſt for a long term of years, on condition of the tenants cultivating, meliorating, or mending them, and paying a certain yearly conſideration.

The word is formed of the Greek, εμφυτευσις, which ſignifies *an engraftment*, and by metaphor, a *melioration* or *amendment*; for as we only graft trees to mend them, ſo a man only alienates his land by emphyteuſis, on condition of having it amended.

Emphyteuſes are a kind of alienations, differing from ſales, in that they only transfer the *dominium utile*, the benefits of the ground, not the property, or fee-ſimple. Among the Romans they were at firſt temporary, afterwards perpetual.

The twentieth canon of the council of Carthage prohibits the biſhops ſeizing the church's emphyteuſis out of the hands of private perſons, unleſs they have been three years without paying rent.

EMPIRE, the territory or extent of land under the command and juriſdiction of an emperor. See EMPEROR.

We ſay the Roman empire, the empire of the Eaſt, the empire of the Weſt, or the weſtern empire, the empire of the Great Mogul, &c.

Antiquaries diſtinguiſh between the medals of the *upper* and *lower*, or *bas empire:* the curious only value thoſe of the upper empire, which commences with Cæſar or Auguſtus, and ends in the year of Chriſt 270.

The lower empire comprehends nearly 1200 years, reckoning as low as the deſtruction of Conſtantinople, in 1453.

They uſually diſtinguiſh two ages, or periods of the lower empire; the firſt beginning where the upper ends, *viz.* with Aurelian, and ending with Anaſtaſius, including about 200 years; the ſecond beginning with Anaſtaſius, and ending with the Palæologi, which includes about 1000 years. See MEDAL.

In ancient hiſtory we read of four great monarchies or empires, *viz.* that of the Babylonians, Chaldeans, and Aſſyrians; that of the Medes and Perſians; that of the Greeks; and that of the Romans. The firſt ſubſiſted from the time of Nimrod, the ſame with Belus, or, as others ſay, from the time of Ninus, the ſon of Belus, who founded it in the year B.C. 2059, according to Blair's tables, to Sardanapalus their laſt king, B.C. 820, and conſequently laſted about 1239 years. But chronologers differ much concerning both the commencement and duration of the Aſſyrian empire. (See ASSYRIA.) The empire of the Medes commenced under Arbaces in the year B.C. 821, and was united to that of the Babylonians and Perſians under Cyrus, in the year B.C. 538, and it cloſed in the 5th year of Darius Codomannus, who was conquered by Alexander B.C. 331. The dominion of Perſia, after the death of Darius, was transferred to the Greeks. The Grecian empire laſted only during the reign of Alexander the Great, beginning in the year B.C. 336, and terminating with the death of this conqueror B.C. 323, his conqueſts being divided among his captains. The Roman empire commenced with Julius Cæſar, when he was made perpetual dictator, after the battle of Pharſalia, in the year of the city 706, 48 years B.C. Some, however, date the commencement of the Roman empire after the battle of Actium, with the firſt year of Auguſtus, A.U.C. 723, B.C. 31. The decline of the Roman empire may be conſidered as principally owing to the deſpotiſm of Severus, and the paſſive obedience of the people. From this period we behold a train of emperors vicious, or impotent, either wilfully guilty, or unable to aſſert the dignity of their ſtation. The empire itſelf gradually decayed, harraſſed on all ſides by powerful invaders, and convulſed by the furious conteſts of domeſtic foes. During the reign of Gallienus, 30 pretenders contended for the ſupreme power, and added all the calamities of civil war to the misfortunes of this devoted empire. The power and influence of the emperors were likewiſe diminiſhed by the adoption of ſeveral colleagues, and by the diviſion of the empire between the two ſons of Theodoſius the Great, A.D. 295. Arcadius was proclaimed emperor of the Eaſt, and Honorius emperor of the Weſt. The weſtern empire contained all Italy, Spain, France, Britain, Germany, Pannonia, and Africa. The eaſtern empire comprehended Aſia the Leſs, Arabia, Syria, Egypt, Lybia, and the ſeveral regions on the Danube. The ſeat of the empire was removed to Byzantium by Conſtantine, in the year of our Lord 328: the Eaſt and Weſt were then united under the title of the Roman empire, till the Romans proclaimed Charlemagne emperor, A.D. 800. From this epocha the Eaſt and Weſt formed two ſeparate empires; that of the Eaſt, governed by Greek emperors, commenced under Nicephorus, A.D. 802, or, rather, was continued; but being gradually weakened, terminated under Conſtantine Palæologus, in 1453, when the Saracens, having ſubdued Syria, Paleſtine, Egypt, Cilicia, and other neighbouring countries, and having ravaged the reſt of the Roman territories in the Eaſt, beſieged Conſtantinople under Mahomet II. and became maſters of it. From this period the city has been the imperial ſeat of the Turkiſh or Ottoman emperors. The weſtern empire, properly ſo called, terminated with Auguſtulus, ſon of Nepos, A.D. 476, but being revived under Charlemagne, it ended with Charles Le Gros, who poſſeſſed all the dominions of Charlemagne, A.D. 887, and it was afterwards known by the appellation of the *empire* or German empire.

Empire, or *the* Empire, uſed abſolutely, and without any addition, long ſignified the empire of Germany, called alſo in juridical acts and laws, the *holy Roman empire*, *S. R. I.* q. d. *ſacrum imperium Romanum*, which conſtituted what was otherwiſe called the *Germanic body*.

The empire had its beginning with the ninth century; Charlemagne being created firſt emperor by pope Leo III. who put the crown on his head in St. Peter's church on Chriſtmas day, in the year 800.

Authors are at a loſs under what form of government to range the empire; ſome ſuppoſe it to have been a monarchical ſtate, becauſe all the members thereof are obliged to aſk the inveſtiture of their ſtates of the emperor, and to take an oath of fidelity to him.

Others maintain that it was a republic, or ariſtocratic ſtate, becauſe the emperor could not reſolve or determine any thing without the concurring ſuffrages of the princes. It is added, that if they required inveſtiture from, and ſwore fealty to him, it was only as head of the republic, and in the name of the republic, and not in his own; juſt as at Venice, every thing is tranſacted in the name of the doge. See Doge.

Laſtly, others will have the empire to have been a monarcho-ariſtocratic ſtate, *i. e.* a mixture of monarchy and ariſtocracy; becauſe, though the emperor in many caſes ſeemed to act ſovereignly, yet his decrees and reſolves had no force, in caſe the ſtate refuſed to confirm them.

In fine, we ſhould rather chooſe to call it an ariſto-democratic ſtate, becauſe the diet, wherein the ſovereignty is lodged, was compoſed of princes, and the deputies of the cities, and was divided into three orders, or bodies, called *colleges*, *viz.* the college of electors, the college of princes, and the college of cities.

We ſay, diet of the empire, circles of the empire, fiefs of the empire, princes of the empire, eſtates of the empire, members of the empire, capitulations of the empire, receſſus of the empire, &c. See College, Diet, Circle, Prince, Capitulation, and Recessus.

The ſtates or eſtates of the empire were of two kinds, *mediate* and *immediate*. The *immediate* ſtates were thoſe who held immediately of the empire, whereof, again, there were two kinds; the firſt, ſuch as had ſeats and voices in the imperial diet; the ſecond, ſuch as had none. The *mediate* ſtates were thoſe who held of the *immediate*.

The ſtates which afterwards compoſed the empire were the princes of the empire, the counts of the empire, the free barons of the empire, the prelates of the empire, the princeſſes or abbeſſes of the empire, the nobles of the empire, and the imperial cities. For an account of the ſubſequent changes which this empire has undergone, ſee Electors, Emperor, and Germany.

EMPIRIC, in *Medical Hiſtory*, from the Greek word ἐμπειρία, *experience*, an appellation aſſumed by a ſect of phyſicians, who contended that all hypothetical reaſoning reſpecting the operations of the animal economy was uſeleſs, and that obſervation and *experience* alone were the foundation of the art of medicine.

The origin of this ſect is variouſly ſtated by different writers of antiquity, who have attributed it to three different perſons. The empiric phyſicians themſelves ſeem to have conſidered Acron of Agrigentum, who was a contemporary and rival of Empedocles, (a pupil of Pythagoras,) in the 70th olympiad, as their founder; and Pliny has aſſerted the ſame opinion, in his ſketch of the hiſtory of medicine. (Nat. Hiſt. lib. xxix. cap. 1.) "Alia factio, ab experimentis ſe cognominans *Empiricen*, cæpit in Sicilia, Acrone Agrigentino, Empedoclis phyſici auctoritate, commendato." This account of the riſe of their ſect was maintained by the empirics, in order to obtain the advantage over the rational or dogmatic phyſicians, who could only date their origin from the time of Hippocrates. But it has been juſtly remarked, that the phyſicians, who lived between the time of Æſculapius, and the period, when philoſophy and reaſoning were applied to medicine, were empirics in fact, though not in name, in conſequence of the rude and imperfect ſtate of the art, and cannot be regarded as ſectaries, ſince all were at that time equally empirical.

The beſt hiſtorians refer the eſtabliſhment of this ſect to a much later period; namely, to about the 123d olympiad (A. C. 260); but they are not agreed as to the individual, who firſt promulgated the doctrine of empiriciſm. Galen and others have aſcribed the origin of the ſect to Philinus of Cos, who was a diſciple of Herophilus, to whom he was ſaid to be indebted for the firſt hints of his ſyſtem. Herophilus was doubtleſs more attentive to the uſe of drugs than any of his predeceſſors, and the empirics directed their views particularly to the diſcovery of medicines: his numerous diſcoveries in anatomy likewiſe led him, and ſtill more his diſciples, to queſtion the value of the reaſoning of their predeceſſors, in whoſe ſtatements of fact they found ſo much error, particularly in regard to the ſtructure of the human body. Little, however, is known with certainty reſpecting this Philinus. Galen quotes him, when writing on the ſubject of the compoſition of medicines; and he is ſaid to have written on the nature of plants, and to have commented on the writings of Hippocrates.

Celſus, however, aſſerts, that Serapion was the firſt who maintained the doctrine, that the application of reaſoning and philoſophy to the art of medicine was of no avail, and confined the ſtudy of it to practice and experience. (De Medicina, Præf.) Serapion was born, and practiſed medicine at Alexandria, and appears to have been contemporary with Philinus, and the diſciples of Herophilus. Galen accuſes him of having ſhewn a contempt for Hippocrates and all his predeceſſors, in his writings, and of praiſing himſelf on all occaſions. (Galen. de ſubſigurat. Empir. Cap. ult.) Apollonius, Glaucias, Heraclides of Tarentum, and others of no ſmall note ("non mediocres viri") followed in the ſteps of Serapion, according to Celſus. Heraclides was one of the moſt famous of the empirics, and appears to have been the firſt to employ that valuable ſubſtance, opium, in the practice of medicine. Many other names are on record, as belonging to this ſect, antecedent and poſterior to Heraclides: one of the lateſt was Marcellus, who lived in the time of Theodoſius, and appears to have held ſome office in the court of that emperor, and was probably therefore a Chriſtian. He has left a treatiſe on medicines, compiled from various writers, and adapted to the cure of all diſeaſes. The art of medicine, indeed, is indebted to the empirical phyſicians for many important additions to the Materia Medica. With reſpect to the doctrines of the ſect, however, and the principles on which they defended themſelves againſt the dogmatics, we have no other accounts, than thoſe which their adverſaries have given, in quoting them with a view to their refutation; all their works upon theſe topics have periſhed. Celſus and Galen have ſtated probably the greater part of the leading points of their tenets.

The *empiric* ſyſtem, as the term imports, was founded altogether upon *experience:* and thoſe, who belonged to this ſect have remarked, that there are three modes by which we learn, from experience, to diſtinguiſh what is advantageous and what is prejudicial, in regard to our health. The firſt of theſe, and the moſt ſimple, ariſes from *accident*. A perſon, for example, having a violent pain in the head, happens to fall, and divides a veſſel in the forehead; and it is obſerved that, having loſt blood, his pain is relieved. Under the ſame mode, they include the experience which is acquired by obſerving the ſpontaneous operations of the conſtitution, where no remedy has been applied, as in the following caſe: a perſon labouring under a fever, finds his diſeaſe mitigated, after a hemorrhagy from the noſe, a profuſe perſpiration, or a diarrhœa. The ſecond mode of gaining experience, is, that, in which ſomething is done by *deſign*, with a view to aſcertain what will be the ſucceſs of it: as, for inſtance, when a perſon, having been bitten by a ſerpent, or other venomous creature, applies to the bite the firſt herb that he finds; or when a man attempts to alleviate the ſymptoms of an acute and burning fever, by drinking as copiouſly as he is able of cold water; or when a perſon tries a remedy, ſuggeſted to him by a dream, as was frequently done in heatheniſh times. The third mode of experimenting, is that which the empirics termed *imitative;* which is purſued in caſes, when, after having remarked the effects reſulting from *accident*, or the ſpontaneous actions of the ſyſtem, on the one hand, or from *deſign* on the other, we make an attempt to accompliſh a ſimilar reſult, by imitating that which was done on thoſe occaſions.

This laſt ſort of experience, they contend, is that which peculiarly conſtitutes the art of medicine, when it has been frequently repeated. They call that *obſervation*, (τήρησις,) or *autopſia* (αὐτοψία,) which each individual ſees himſelf; and uſe the term *hiſtory*, or *record*, (ἱστορία) for ſuch obſervation when committed to writing; that is, the autopſia, or perſonal experience, conſiſts of the obſervations which each perſon has made, by his attention to the progreſs of a diſeaſe, whether in regard to its ſymptoms and changes, or to the remedies employed; while the record is a ſort of narration or regiſter of all that was obſerved by thoſe individuals; which regiſter being completed, (*i. e.* including all the diſeaſes, incident to mankind, and the remedies adminiſtered for their alleviation,) the art of medicine would be eſtabliſhed with a conſiderable degree of certainty. But as new diſeaſes ſometimes occur, in regard to which neither our perſonal experience, nor the obſervations of others, can furniſh us with any aſſiſtance; and we meet with diſorders in particular ſituations, where the means of relief, ſanctioned by experience elſewhere, are not within our reach; we muſt neceſſarily have recourſe to ſome other expedient in order to alleviate the ſufferings of the patient. The empirics were provided againſt this particular difficulty, in what they termed *a ſubſtitution* of ſimilar means, (*tranſitus ad ſimile*, as the Latins have tranſlated it.) This was a new experiment, which they inſtituted, after having compared one diſeaſe with another; or one part of the body with another, of ſimilar ſtructure; or, laſtly, one remedy, the nature of which was aſcertained by experiment, with another which reſembled it. "They tried, for example, in *herpetic* eruptions the remedies which had relieved *eryſipelas;* in the diſeaſes of the *arms*, they employed the expedients which had been practiſed in thoſe of the *legs;* and if they could not procure *quinces*, which are an auſtere fruit, they uſed *medlars*, which are not ſo."

Obſervation, then, *record*, and the *ſubſtitution* of ſimilar means, were the three fundamental reſources of the art of medicine; according to the empirics; and theſe were denominated by Glaucias, and others, the *tripod of medicine* (τρίπους τῶν τριῶν.)

There is obviouſly a great deal of good ſenſe and ſound philoſophy in this doctrine of empiriciſm. It points out the true mode of inveſtigating the phenomena of nature, by unwearied experiment; the mode which Bacon laboured to inculcate on the dogmatiſts, and hypotheſis-mongers of his age, which Newton ſucceſsfully purſued, and which has led the philoſophers of later times to the developement of that fund of natural knowledge in the ſciences of electricity, chemiſtry, mechanical, and every branch of natural philoſophy, by which modern inquiry is diſtinguiſhed. Compared with this ſpecies of inveſtigation, how futile are the ſpeculations, miſnamed philoſophy in the ſchools, relative to elements, and eſſences, which had no exiſtence, except in the imagination of the diſputants. For it muſt be obſerved, that the ancient empirics did not diſregard the dictates of reaſon and reflection; they only deprecated the application of them to circumſtances out of the reach of the ſenſes, and beyond the ſcope of experiment. Thoſe miſchievous principles and practices, which their ſucceſſors or at leaſt thoſe who have ſubſequently aſſumed the title, have made the refuge of ignorance and craft, cannot be alleged againſt them. This is evident, from the clear and explicit ſtatement of their tenets, which Celſus has tranſmitted to us: in order to underſtand which, it will be neceſſary to attend to the tenets of their opponents, the rationaliſts or dogmatics, as ſtated by the ſame elegant writer.

The dogmatic phyſicians maintained the neceſſity of a knowledge of the four following ſubjects, in order to be able to cure diſeaſes; namely, 1, of the occult and eſſential cauſes of diſeaſe; 2, of the evident cauſes; 3, of the natural actions of the conſtitution, (or phyſiology;) and, laſtly, of the internal parts, or anatomy. 1. By the *occult* cauſes, they meant the eſſential principles of the conſtitution, or of animal life, under its various conditions of health and diſeaſe. And they held, that it was impoſſible to cure diſeaſe, if we are ignorant of the circumſtances in which it conſiſts; for that different methods of cure muſt neceſſarily be requiſite, if a redundancy or deficiency of the *four elements* were the eſſential cauſe of diſeaſe, according to the hypotheſis of ſome philoſophers; or if all diſeaſe conſiſt in depravations of the fluids, as was the opinion of Herophilus; or, in diſordered reſpiration, as Hippocrates imagined; or in the paſſage of the blood into thoſe veſſels, which naturally convey air, cauſing inflammation, and that inflammation exciting the commotion obſerved in fever, according to the ſuppoſition of Eraſiſtratus; or in the obſtruction of the inviſible pores, by the corpuſcles, or atoms, as Aſclepiades contended. Againſt this ſyſtem of reaſoning by hypotheſis, beyond the bounds of experimental inquiry, the empirics objected upon the moſt irrefragable principles. "The attempt," ſay they, "to ſcrutinize the occult principles of animal life is fruitleſs; for 'nature is incomprehenſible:' we may aſcertain *what* ſhe performs; but *how* ſhe performs it, is to us inſcrutable. And the very diſſenſions among the theoriſts, and the difference of their accounts of thoſe operations, evince the inſcrutability of the ſubject. They cannot all be right; and why ſhould we believe the ſtatement of one, rather than that of another? Why is Hippocrates more entitled to credit than Herophilus, or Herophilus than Aſclepiades? It is obvious that we cannot decide in favour of the opinion of any of them, either from their arguments, or their practical authority; for the arguments of each may be ſufficiently plauſible and conſiſtent with probability; and their practice may have been equally ſucceſsful. Indeed this very fact, that phyſicians of the moſt oppoſite theoretical opinions have equally ſucceeded in reſtoring health to the ſick, proves the independence of the art of medicine upon ſuch diſquiſitions, and that their ſucceſs is to be aſcribed to their principles of cure having been deduced, not from their ſpeculations about occult eſſential cauſes, nor even about the natural actions, but from experiment, from what actual practice had taught them. And ſuch is the caſe in all other arts. The huſbandman and the pilot are not qualified for their reſpective occupations by theory and diſcuſſion, but by practice and experiment. Indeed if reaſoning could enable a perſon to cure diſeaſes, the philoſophers would neceſſarily be the beſt phyſicians; whereas, we obſerve that they are gifted with an abundance of words, but poſſeſs very little ſkill in the art of healing."

2. With reſpect to the *evident* cauſes, the dogmatiſts underſtood, by that term, the obvious exciting cauſes of diſeaſes, ſuch as heat and cold, faſting and exceſs in eating, &c., to the operation of which diſeaſes are often obſerved immediately to ſucceed. The empirics admit the utility and importance of attending to theſe cauſes; but they contend that, however obvious they may be in many inſtances, the method of cure is nevertheleſs not apparent from them, as in ophthalmia, or in a wound; but is aſcertained only from experience.

3. The *natural actions* of the body, a knowledge of which the dogmatiſts maintain to be abſolutely neceſſary to the phyſician, are thoſe operations of the conſtitution, which the moderns comprehend under the term phyſiology; namely, the nature of reſpiration; of the concoction or digeſtion of our food and drink, and its diſtribution to the different parts of the body, which it nouriſhes; of the "riſe and fall" of the arteries; of ſleeping and waking, &c. "Without an acquaintance with the cauſes of theſe actions," ſay the rationaliſts, "it muſt be impoſſible for any one either to ſuppreſs incipient diſeaſes, or to cure them when they are completely eſtabliſhed." But of all theſe actions, they deem the digeſtion of the food the moſt important, and inſiſt more particularly upon the neceſſity of its being underſtood. But in this point again there is great diſſenſion among them: ſome of them, following the hypotheſis of Eraſiſtratus, maintain that the food is concocted by mechanical attrition; others, after Pliſtonicus, the diſciple of Praxagoras, aſſert that digeſtion is produced by the putrefaction of the food; while others prefer the opinion of Hippocrates, and contend that it is effected by heat. The diſciples of Aſclepiades, again, affirm that all theſe hypotheſes are idle and futile, for that there is no ſuch thing as concoction, but that the alimentary matter, crude as it is received, is diſtributed through the whole body. Various as theſe opinions are, however, they do not diſpute the neceſſity of accommodating the food of the ſick to the nature of the function; that is, if the concoction be the reſult of attrition, then ſuch food ſhould be ſelected as is moſt eaſily broken down; if it be effected by putrefaction, then ſuch food is to be choſen as is moſt readily putreſcent; if by heat, ſuch as moſt effectually cheriſhes heat: but if there be no ſuch proceſs as that of concoction, then all theſe kinds of aliment are improper, and ſuch only ſhould be taken as moſt completely reſiſts all change. In the ſame manner, they contend, when a difficulty of breathing occurs, or a morbid degree of ſleep or watchfulneſs, that phyſician will be the moſt capable of curing them, who is acquainted with the nature of theſe functions.

Againſt this doctrine of the dogmatiſts, it is evident that the arguments of the empirics were equally concluſive, as againſt their preceding hypotheſes, reſpecting the occult cauſes. Their ſtatements, that the very difference of the theories of the dogmatiſts implies their want of foundation, and that the mode in which nature operates being incomprehenſible, we muſt be content with learning what ſhe operates, are obvious refutations of the futility of theſe, and indeed of all other hypotheſes. "It is of no importance," ſay the empirics, "to inquire in what manner the diſtribution of the aliment through the body is accompliſhed; our only uſeful inquiry is, what ſort of aliment is moſt eaſily diſtributed; and whether digeſtion is performed by heat or putrefaction, or whether it is not a digeſtion, but a diſtribution only, is altogether immaterial, provided we know, from experience, what is moſt eaſy of digeſtion, or the contrary. For," they continue, "the art of medicine, even in its infancy, was not deduced from ſuch hypothetical reaſoning, but from experiments. Whence it was obſerved, among thoſe who were ſick, and without phyſicians, that ſome, prompted by appetite, had immediately taken food at the beginning of their illneſs; while others, loathing victuals, had faſted altogether; and that the diſeaſe in thoſe who had abſtained from food had been alleviated. It would be remarked, too, that ſome took food in the paroxyſm of a fever, others a little before it came on, and others again after its remiſſion; and that it would agree the beſt with thoſe who ate after the removal of the fever. In like manner, it would be ſeen, that thoſe who took food freely in acute diſeaſes, ſuffered an aggravation of their ſymptoms, while the abſtemious would not thus ſuffer. Theſe and ſimilar circumſtances, occurring daily, would be noted by diligent obſervers; and what had been ſeen to ſucceed moſt generally, that they afterwards preſcribed to the ſick. Such was the origin of the art of medicine, which, in conſequence of the recovery of ſome, and the death of others, taught us to diſcriminate the uſeful expedients from thoſe that were pernicious: and when remedies were diſcovered by ſuch experiments, then men began to reaſon about their operation; for the art of employing remedies was obviouſly not the reſult of reaſoning, but explanatory hypotheſes were ſought for after the remedies were aſcertained.

4. The dogmatiſts contend, in the laſt place, that as pains and various diſorders attack the *internal parts*, no perſon, in their opinion, can apply proper remedies to them, when diſeaſed, if he is ignorant of their ſituation and appearance. Hence, they affirm, that it is neceſſary to diſſect the bodies of the dead, and to examine the viſcera and inteſtines: and they extol the method of Herophilus and Eraſiſtratus, who procured criminals out of priſon, by royal permiſſion, and, having diſſected them alive, contemplated, even while they were breathing, the parts which nature had before concealed; and remarked their poſition, colour, figure, ſize, arrangement, ſoftneſs, hardneſs, ſmoothneſs, and connection, as well as their proceſſes and depreſſions, or what is inſerted into and received by each part. "For," ſay they, "when any internal pain occurs, the ſeat of that pain cannot be aſcertained by one who is ignorant of the ſituation of the viſcera and inteſtines; nor can he cure any part diſeaſed, who does not know what the part is. Beſides, if the viſcera happen to be expoſed in conſequence of a wound, if the obſerver be unacquainted with the natural appearance of each part, he cannot diſcover what is found, and what injured or corrupted, and therefore is not qualified to cure that part which is diſeaſed. Even external remedies are applied with much more judgment by one who knows the ſituation, figure, and ſize of the internal parts. Nor can it be juſtly deemed cruel (although it is generally ſo repreſented) to put a few guilty individuals to torture, with a view to aſcertain means of relief for all the innocent among mankind in all ſucceeding ages.

To theſe arguments the empirics reply, that "the preceding doctrines of the dogmatiſts were only idle and frivolous, but in this there is the addition of exceſſive cruelty: for what can be more cruel than to cut open the abdomen and cheſt of living men, and thus to render that benign art, which is the guardian of the health of mankind, the inſtrument of torture, and that of the moſt atrocious kind? more particularly when it is conſidered, that ſome of the information, which is ſought after with ſo much barbarity, cannot be thus acquired at all, and that the reſt may be aſcertained without committing murder. For the colour, ſmoothneſs, ſoftneſs, hardneſs, and other ſuch qualities, are not the ſame in the body, when diſſected, as when it was found: even in bodies that have ſuffered no violence, theſe qualities externally are often changed by fear, grief, hunger, indigeſtion, fatigue, and a thouſand other inconſiderable affections. Whence it is ſtill more probable, that the internal organs, which are ſtill more delicate than the external, and to which even expoſure to the light is new, muſt be changed by the ſevereſt wounds, or rather by ſuch fatal mangling. Nothing can be more abſurd than to ſuppoſe that appearances are the ſame in a dying man, nay, in one already dead, as during life. The abdomen, indeed, may be opened, while a man yet breathes; but no ſooner does the knife reach the thorax, and divide the tranſverſe ſeptum, which ſeparates the upper cavity from the lower, (which the Greeks call the *diaphragm*, διαφραγμα,) than he immediately expires: it is, therefore, the præcordia and viſcera of a dead man which alone the butchering phyſician brings to his view; and which neceſſarily have the appearance of the organs of the dead, and not of thoſe of the living. Thus all that is gained by the phyſician is the opportunity of committing a barbarous murder, and not that of witneſſing the condition of the viſcera in a living man. If, however, any information can be obtained, as to the appearances of the internal parts while the individual yet breathes, accident often gives the practitioner opportunities for ſuch obſervation: for it frequently happens that a gladiator in the *arena*, a ſoldier in battle, or a traveller attacked by robbers, is wounded in ſuch a manner as to expoſe ſome internal organ to view; whence a ſagacious phyſician will learn the ſituation, poſition, connection, figure, and other circumſtances belonging to each, while he is endeavouring to relieve, and not to murder the patient; and thus will acquire, through compaſſion, that knowledge which others have obtained by the moſt horrid cruelty. Moreover, it is clear, from the arguments already ſtated, that it is not neceſſary to mangle even dead bodies; which, though not cruel, is loathſome to the ſight, as are moſt of the circumſtances connected with the dead; and whatever can be learned, reſpecting the living, may be acquired during the treatment of their diſeaſes and wounds." See Celſus, De Medicina, in Præf.

The concluding obſervations, which deny the neceſſity of anatomical knowledge, acquired by the diſſection of dead bodies, appear to be the only point in the tenets of the empiric phyſicians which is liable to diſpute. But even in this point, we are ſatisfied, there is a great portion of truth, ſo far as relates to the knowledge and treatment of thoſe internal diſeaſes, to which the knife of the ſurgeon cannot reach; for the knowledge of the appearances and connection of the viſcera does not enable us to ſuggeſt the practical means of relief, when they become diſeaſed: experience and obſervation alone, as the empirics contend, have taught us to apply the remedies. See an Eſſay on the Importance of Anatomical Knowledge to Medicine, in the Edinburgh Med. and Surg. Journal for Jan. 1809.

After having thus ſtated the doctrines of the empiric phyſicians, in oppoſition to thoſe of their opponents, Celſus has ſubjoined a ſenſible and judicious criticiſm reſpecting the merits of both. But this is not the place to enter more fully into the ſubject; we muſt therefore refer thoſe, who wiſh for the opinion of that claſſical phyſician, to his work already quoted.

There is one point, which could not be well introduced under any of the preceding heads, which the dogmatiſts conſtantly threw out againſt the empirics, namely, that *new* diſeaſes occaſionally occur, for the cure of which, conſequently, practice and experience have afforded no rules or information; whence, they ſay, it is neceſſary to inveſtigate their cauſes, both evident and occult, without a knowledge of which no mortal can find out why one curative expedient ought to be adopted rather than another. But the reply of the empirics to this point is not leſs accurate and ſatisfactory than in the preceding parts of the diſpute. "New diſeaſes," they ſay, "requiring new remedies, ſeldom if ever occur; but if any unknown diſorder ſhould appear, the phyſician would not require the hypothetical doctrines about occult cauſes to direct him in his method of treatment: he would immediately obſerve to what known diſeaſe it was moſt nearly allied in its nature and ſymptoms, and employ the remedies which experience had ſhewn to be ſucceſsful in the ſimilar malady; and by ſuch reſemblance he would be able to diſcover a proper remedy." Celſus.

It is evident, then, that both the dogmatic and empiric phyſicians appealed to experience, and that neither excluded altogether the dictates of reaſon and reflection. The principal difference in their tenets appears to have conſiſted chiefly in this: that the empirics reaſoned only from the facts aſcertained by obſervation, without attempting to explain their eſſential and inſcrutable nature by hypotheſes; and that the latter ſpeculated upon the mode and nature of every action and phenomenon in the animal body, and took theſe ſpeculations as the baſis of their reaſoning:—an error in the inveſtigation of nature, which, as we have before ſaid, was ſo well expoſed by lord Bacon, in modern times; and which was practically illuſtrated in the triumph of Newton's *empiric* doctrines, over the hypotheſes of Des Cartes.

No longer engaged in ſtudying ſyſtems, and averſe to ſpeculation, even in regard to the ſymptoms of diſeaſes, the empirics exerted their whole faculties in inveſtigating the power of medicinal ſubſtances, which laid the foundation of their pre-eminence in pharmaceutical ſkill, and gradually effected thoſe changes in the art of medicine which ſubſequently occurred. The properties of the productions of nature, eſpecially of the vegetable world, were extenſively examined; and the inſtruments of the phyſician, by which he could influence the functions of the living body, were greatly multiplied. It is chiefly to the induſtry of the ancient empirics that we are indebted for the introduction, or rather for the full knowledge, of ſedative and narcotic remedies; on the liberal uſe of which probably depended the ſuperior reputation acquired by ſome of them over their more cautious antagoniſts. Of this ſuperiority, a ſingular inſtance occurs in the many exiſting teſtimonies to the fame of Heraclides of Tarentum, before mentioned, who is recorded as the moſt ſucceſsful phyſician in any age or country of the world.

It is eaſy to ſee, however, that this direction of medical inquiry, given by the empiric phyſicians, to the diſcovery of the qualities of medicinal ſubſtances, or drugs, would in all probability lead to many abuſes and evils. Experiment of this ſort being much eaſier, at leaſt when careleſsly made, than that unremitting and accurate obſervation of the phenomena of diſeaſes, which alone can conſtitute the ſcientific phyſician, the ignorant and idle would content themſelves with pharmaceutic experiments, and neglect the taſk of pathological inveſtigation; and ſelfiſh craft and diſhoneſty would ſoon learn to impoſe on the credulity of the people, in the adminiſtration of ſecret remedies, when the uſe of a particular drug, and not the general treatment of a diſeaſe, was ſuppoſed to be the eſſence of medicine. Hence it actually happened, even in the early ages of phyſic, that theſe ignorant and illiberal pretenders to *panaceas*, and infallible remedies, who did not know one diſeaſe from another by its ſymptoms, appeared in Egypt, Greece, and Arabia, and were much complained of by their more rational contemporaries. In all ſucceeding ages, the race of theſe illiterate pretenders has been multiplied, under the abuſed name of *empirics*. In our own time, indeed, while a college of phyſicians, conſtituted by royal and parliamentary authority, exiſts in the metropolis, for the regulation of the practice of medicine, and the prevention of the miſchiefs occaſioned by noſtrum-mongers, and pretenders of all kinds, *quackery* thrives, unmoleſted by the college, and ſanctioned, licenſed, and protected by patent, on the part of government, to an extent heretofore unexampled. Le Clerc Hiſt. de la Med. Schulzii Hiſt. Med. Celſ. in Præf. Galen, Loc. Cit. Walker's Mem. of Medicine.

Empiric, in *Modern Medicine*, is applied to a perſon, who ſells or adminiſters a particular drug, or compound, as a remedy for a given diſorder, without any conſideration as to the variations of that diſorder, in its different ſtages, or degrees of violence, or as it occurs in different conſtitutions, climates, or ſeaſons, or in perſons of different age, ſex, ſtrength, &c. Such a practice implies a total ignorance of the nature of the human conſtitution, both in health and diſeaſe; and therefore is generally found to be the reſort of the illiterate and ſelfiſh, not to ſay diſhoneſt, part of mankind. See the preceding article. See alſo Quack.

EMPIS, in *Entomology*, a genus of dipterous inſects. The mouth is furniſhed with an inflected ſucker and proboſcis; ſucker with a ſingle-valved ſheath and three briſtles; feelers ſhort and filiform; antennæ ſetaceous. Theſe are carnivorous, and ſubſiſt on flies and other ſmall inſects, which they ſeize with their feet, and pierce with their roſtrum, to ſuck the blood and juices of their body. Some of the ſpecies are found on flowers, in the winged ſtate. None of the larvæ are known.

Species.

Borealis. Black; wings ſubrotund and ferruginous-brown. Linn.

Inhabits Sweden, Britain, and various other parts of Europe, and is often ſeen in ſwarms in the air, like the gnat, on a ſtill evening, about ſun-ſet.

Pennipes. Black, with the poſterior legs long and feathered. Fabr. *Aſilus pennipes*, Scop. Ent. Carn. 994.

Found in Europe, on the geranium ſylvaticum and cardamine pratenſis. A ſuppoſed variety is deſcribed by Linnæus, which has the four poſterior thighs feathered, and the wings brown, with a black rib.

Marginata. Black; wings white, with black margin. Fabr.

A ſmall ſpecies, found in Saxony.

Maura. Black; ſhanks of the fore-legs thick and ovate. Fabr.

Inhabits environs of Hamburgh, about ſtagnant waters.

Livida. Livid; thorax pale-green, with three black lines; baſe of the wings and legs ferruginous. Fabr.

Frequent on the flowers of the cow-parſnip (heracleum ſphondylium) in Europe. The wings are oblong, and veined with fuſcous.

Ciliata. Blackiſh; wings with fuſcous rib; legs black, four poſterior ones feathered. Fabr.

Inhabits Europe, and in ſize reſembles the laſt. The head is black, with a teſtaceous proboſcis; thorax hairy.

Cinerea. Cinereous; thorax immaculate; legs pale; wings at the tip browniſh. Fabr.

Inhabits Sweden, on umbellate flowers.

Maculata. Cinereous; ſnout, ſides of the abdomen, and legs teſtaceous; wings ſpotted. Fabr.

Native of Italy. The thorax is cinereous, with faint lines; legs teſtaceous, with black claws; abdomen with a teſtaceous line on each ſide.

Stercorea. Teſtaceous, with a dorſal black line; wings reticulated. Linn. Fn. Suec.

On umbellate flowers, in Europe.

Minuta. Black; legs teſtaceous; wings white. Fabr.

Inhabits Denmark, on fungi. Small.

Crassipes. Black; all the ſhanks with a long thick joint; wings white, lower half of the outer margin black. Schranck.

Very ſmall, and inhabits Auſtria.

Rufipes. Black, and ſomewhat cinereous, legs ferruginous. Linn.

Native of Europe.

Quadrilineata. Black, and ſomewhat greyiſh;

thorax with four lines; abdomen cylindrical, with the tip inflected. Linn.

Inhabits Europe.

TRILINEATA. Cinereous; thorax with three black impreſſed lines; wings white; legs pale-yellow. Linn.

Abdomen ſometimes yellow, ſometimes fuſcous. This and the three following ſpecies inhabit Europe.

NIGRICUS. Cinereous; thighs black; ſhanks and wings ferruginous. Linn.

GIBBOSA. Fuſcous; thorax gibbous; abdomen thin; wings ſpotted; ſhanks and ends of the legs white. Linn.

FUSCIPES. Brown-cinereous; wings white; legs livid; feet fuſcous. Linn.

LEUCOPTERA. Thorax cinereous; abdomen black; wings white; legs livid. Linn.

EMPLASTICS, in *Pharmacy*, are ſalves, or medicines, which ſtop up and conſtipate the pores of the parts they are applied on; otherwiſe called *emphractics*.

The word is formed from the Greek, *εμπλασσειν*, *to ſtop up*.

Such are fats, mucilages, wax, the whites of eggs, &c.

EMPLASTRA AMYNTICA. See AMYNTICA.

EMPLASTRUM, popularly called *plaſter*, a medicine of a ſtiff, glutinous conſiſtence, compoſed of divers ſimple ingredients, ſpread on leather, or linen, and applied externally.

The word is formed from the Greek, *εμπλαττω* or *εμπλασσω*, *to put in a maſs*, or *to ſmeer over*, becauſe the emplaſter is made of divers kinds of ſimple drugs, worked up into a thick tenacious maſs; or becauſe it covers over the piece of leather or linen to be applied on the part affected.

Emplaſters are made up in a ſtrong ſolid body, that by remaining a long time on the part, the medicinal ingredients they are chiefly compoſed of, may have time enough to produce their effect.

The drugs uſed to give a body and conſiſtence to emplaſters, are uſually wax, pitch, gums, fats, litharge, and other preparations of lead.

There are emplaſters of divers kinds, and uſed with divers intentions; ſtomachic emplaſters; cephalic, ſtyptic, hepatic, diaphoretic, reſolutive, deterſive, emollient, incarnative, aſtringent, conglutinative, &c. emplaſters.

In the preſcription of extemporaneous plaſters, the greateſt regard is to be had to that particular conſiſtence which the part can moſt conveniently bear, whereupon the application is to be made. Thus, plaſters to the breaſt and ſtomach, eſpecially in the intention of emollients or diſcutients, ſhould be yielding and ſoft, as in the officinal emplaſtrum ſtomachicum; but to the loins, or any of the limbs, where warm diſcutients and ſtrengtheners are to be applied, an higher and more adheſive conſiſtence is to be ſought for. The emollient plaſters likewiſe ſhould be laid on thick, and frequently repeated, if the ſymptoms continue, becauſe their better parts are ſoon ſpent. Diſcutients alſo applied to hard tumours, require repetition; but the ſtrengtheners, which are purpoſely contrived of a ſtrong adheſive conſiſtence, are permitted to lie on till they grow dry, and come off ſpontaneouſly. In ſome flatulent tumours, where a plaſter alone will not prevail, they are at intervals taken off, and diſcutient fomentations or lotions made uſe of; ſuch as are compoſed of bitters, carminatives, comprehending alſo lixivial ſalts or alkaline ſpirits.

EMPLASTRUM *Adhæſivum*, *Adheſive Plaſter*, now called "Emplaſtrum lithargyri cum reſinâ," or "litharge-plaſter with reſin," is compoſed of three pounds of litharge or common plaſter, with the proportion of half a pound of yellow reſin; and is prepared by melting the litharge plaſter with a ſlow fire, and mixing the powered reſin. The black ſticking-plaſter, called the lady's court-plaſter, is formed by diſſolving twelve ounces of the gum benjamin in twelve ounces of rectified ſpirit of wine, and ſtraining the ſolution. In a ſeparate veſſel, diſſolve a pound of the beſt iſinglaſs in five pints of pure water; and after ſtraining this ſolution, mix it with the former, and let them ſtand in a narrow veſſel, that the groſſer parts may ſubſide: when the liquor is cold, it will become a jelly, which will melt near the fire when it is to be ſpread. This quantity will be ſufficient for ſpreading on ten yards of half-yard wide ſilk; in order to which, the ſilk muſt be ſtretched in a frame, and the mixture may be ſpread upon it with a ſpunge or bruſh, which ſhould be done near a fire. As each ſpreading dries, it muſt be repeated to the tenth or twelfth time, and then touched lightly with a bruſh to give it a gloſs. The following more ſimple preparation may be ſubſtituted for the former; diſſolve a pound and a quarter of fine iſinglaſs in five pints of water, and before it cools ſpread it on ſilk in the manner above directed.

EMPLASTRUM *ex Ammoniaco cum Mercurio*, now called "Emplaſtrum ammoniaci cum hydrargyro," a form of medicine, ordered to be prepared in the following manner.

Take gum ammoniacum, ſtrained, a pound; purified quickſilver, three ounces by weight; ſulphurated oil, one dram by weight, or q. ſ. Rub the quickſilver with the ſulphurated oil till the globules no longer appear; then add by degrees the gum ammoniac melted, and almoſt cooled again, and make the whole into a plaſter.

This plaſter is recommended in pains of the limbs, ariſing from a venereal cauſe. Indurations of the glands, and other violent tumours, are likewiſe found ſometimes to yield to it.

EMPLASTRUM *Anodynum*, *Anodyne Plaſter*, is prepared by melting an ounce of the adheſive plaſter; and, whilſt it is cooling, mixing with it a dram of powdered opium, and the ſame quantity of camphor previouſly rubbed up with a little oil. This plaſter gives relief in acute pains, eſpecially of the nervous kind.

EMPLASTRUM *Attrahens*, *the Drawing Plaſter*, now "Emplaſtrum ceræ compoſitum," a plaſter ordered to be now made in this manner: take yellow wax and prepared mutton ſuet, of each three pounds; and yellow reſin, one pound: melt all together, and ſtrain the mixture while it is hot.

EMPLASTRUM *Cephalicum*, or "Emplaſtrum picis Burgundicæ compoſitum," is compoſed of Burgundy pitch, two pounds; ladanum, one pound; yellow reſin and yellow wax, of each four ounces by weight; and expreſſed oil of nutmeg, one once by weight: to the pitch, reſin, and wax, melted together, add firſt the ladanum, and then the oil of nutmeg.

EMPLASTRUM *Commune*, or "Emplaſtrum lithargyri," litharge plaſter, a name given to what has been long called *diachylon-plaſter*. It is ordered to be made of a gallon of oil of olives, and five pounds of litharge in very fine powder, boiled together on a ſlow fire, with about a quart of water, to keep them from burning, till they are perfectly mixed, and have the conſiſtence of a plaſter.

This plaſter is generally applied to ſlight wounds and excoriations of the ſkin; it keeps the part ſoft and warm, and defends it from the air, which is all that is neceſſary in ſuch caſes.

EMPLASTRUM *Commune cum Mercurio*, or "Emplaſtrum lithargyri cum hydrargyro," is made in the ſame manner as the ammoniacum-plaſter with quickſilver, of litharge-plaſter, one pound; purified quickſilver, three ounces by weight; and ſulphurated oil, one dram by weight, or q. ſ.

Emplastrum *é Cymino*, or "Emplaſtrum cumini," is compoſed of cummin, caraway, and bay-berries, of each three ounces by weight; Burgundy pitch, three pounds; and yellow wax, three ounces by weight. Let the pitch be melted with the wax; powder the reſt, and mix all together.

Emplastrum *Gummi*, *Gum Plaſter*, now called "Emplaſtrum lithargyri compoſitum." Take of the common or litharge plaſter, three pounds; ſtrained galbanum, eight ounces by weight; common turpentine, ten drams by weight; and frankincenſe, three ounces by weight. Melt the galbanum with the turpentine, and mix with them, firſt, the powdered frankincenſe, and then the litharge plaſter, previouſly melted with a ſlow fire. This is uſed as a digeſtive, and for diſcuſſing indolent tumours.

Emplastrum *Roborans*, the *Strengthening-Plaſter*, now called "Emplaſtrum thuris compoſitum," or compound frankincenſe plaſter, is ordered to be made thus: take of the common or litharge-plaſter, two pounds; of frankincenſe, half a pound; and dragon's blood, three ounces by weight: melt the plaſter, and then add to it the other ingredients in powder.

Emplastrum *Saponis*, *Soap-Plaſter*, is made by mixing half a pound of ſoap with three pounds of melted litharge-plaſter; and boiling them to the conſiſtence of a plaiſter.

Emplastrum *Stomachicum*, *Stomach-Plaſter*, or "Emplaſtrum ladani compoſitum," is compoſed of ladanum, three ounces by weight; frankincenſe, one ounce by weight; cinnamon, powdered, expreſſed oil of nutmeg, of each half an ounce by weight; and oil of ſpearmint, one dram by weight. To the melted frankincenſe add, firſt, the ladanum ſoftened by heat, and then the expreſſed oil of nutmeg. Mix theſe and the cinnamon with the oil of mint, and beat them together in a warm mortar. Let it be kept in a cloſe veſſel. An ounce or two of this plaſter, ſpread on ſoft leather, and applied to the region of the ſtomach, will be of ſervice in flatulencies, ariſing from hyſteric and hypochondriac affections.

Emplastrum, *Veſicatorium*, *Bliſtering-Plaſter*, or "Emplaſtrum cantharidis," is formed by melting two pounds of plaſter of wax, and half a pound of prepared hog's lard; and a little before they coagulate, ſprinkling one pound of cantharides, finely powdered. In order to render bliſtering-plaſters efficacious, care ſhould be taken that the flies be good, freſh powdered, and the powder fine; and that the plaſter ſhould neither be made in too great quantity at once, nor ſpread with a ſpatula too much heated. See Blister.

EMPLEURUM, in *Botany*, from εν, *in* or *upon*, and πλευρα, the *ſide*, alluding to the lateral inſertion of the ſtigma upon the germen. Soland. in Ait. Hort. Kew. v. 3. 513. Schreb. 812. Willd. Sp. Pl. v. 4. 333. Mart. Mill. Dict. v. 2. Juſſ. 298. Claſs and order, *Monoecia Tetrandria.* Nat. Ord. *Rutaceæ*, Juſſ.

Gen. Ch. Male. *Cal.* Perianth of one leaf, bell-ſhaped, four-cleft, permanent. *Cor.* none. *Stam.* Filaments four, thread-ſhaped, equal, ſimple, longer than the calyx, a little ſpreading; anthers erect, oblong, obtuſe, ſomewhat quadrangular, of two cells, each burſting by a lateral fiſſure. Abortive germen ſometimes preſent. Female on the ſame plant. *Cal.* as in the male. *Cor.* none. *Piſt.* Germen ſuperior, oblong, compreſſed, of one cell, terminated by an erect leafy appendage; ſtyle none; ſtigma placed on a lateral tooth at one edge of the germen, erect, cylindrical, ſmooth, deciduous. *Peric.* Capſule oblong, compreſſed, crowned with a leafy oblique appendage, of one cell, burſting at its ſtraighteſt edge. *Seed* ſolitary, oblong, inſerted laterally, encloſed in a bivalve, elaſtic, rigid arillus.—Very rarely two capſules are ſaid to be found in one calyx.

Eſſ. Ch. Male, Calyx four-cleft. Corolla none. Sometimes with the rudiment of a germen. Female, Calyx four-cleft, inferior. Corolla none. Stigma cylindrical, ſtanding on a lateral tooth of the germen. Capſule beaked, of two valves. Seed ſolitary, with an elaſtic arillus.

E. *ſerrulatum.* Soland. in Ait. Hort. Kew. v. 3. 340. Sm. Exot. Bot. v. 2. 7. t. 63. (Dioſma unicapſularis; Linn. fil. in Suppl. 155. D. enſata; Thunb. Prod. 43.) This is the only ſpecies hitherto obſerved. Native of the Cape of Good Hope, where Thunberg, Maſſon, and others have gathered it. Maſſon ſent it to Kew in 1774. It requires the ſhelter of a green-houſe, and the ſame treatment as other Cape plants of the Rutaceous order, *Dioſma*, *Erioſtemon*, &c. but is leſs ornamental than moſt of them, on account of the want of petals. The *ſtem* is ſhrubby, and much branched. *Leaves* ever-green, ſmooth, ſhining, alternate, almoſt ſeſſile, linear-lanceolate, acute, bordered with ſhallow glandular ſerratures, deſtitute of ſtipulas. *Flowers* on ſimple, axillary, cluſtered ſtalks, reddiſh, but inconſpicuous. *Capſules* more ſtriking, from their enlarged leafy termination. The whole plant, when bruiſed, ſmells ſtrongly of rue or juniper, like moſt of its natural order. See Diosma and Eriostemon.

EMPNEUMATOSIS, from εμπνεω, *I inflate*, in *Medicine*, a word uſed by ſome writers to ſignify an inflation of the ſtomach; but by others, in a more general ſenſe, for inflations of the womb, or of any other part.

EMPOLI, Jacopo da, in *Biography*, a painter of the Florentine ſchool, who was born at Empoli, as his name deſignates, in 1554; and was firſt inſtructed in his art in the ſchool of Maſo di San Friano. He afterwards applied himſelf to ſtudy the works of Andrea del Sarto, and with very conſiderable ſucceſs, acquiring very much his ſtyle of deſign, and hues and tones of colouring. He copied Del Sarto's works very cloſely, and not only his, but thoſe of other maſters, with ſo much accuracy, as to deceive the judgment of thoſe well verſed in the art. So much talent for this kind of exerciſe in art, is ſeldom accompanied by a power of invention or execution of original works. But Empoli had conſiderable reputation for this alſo, and his compoſitions are ſpoken of as poſſeſſing much ſpirit and ingenuity, and alſo exhibiting conſiderable feeling of beauty and elegance.

Empoli, in *Geography*, a town of Italy, in the duchy of Tuſcany, ſituated on the Arno; 15 miles W. of Florence.

EMPORETICA Charta. See Charta and Paper.

EMPORIA, in *Ancient Geography*, a country of Africa, on the Leſſer Syrtis, in which Leptis ſtood. This territory was under the dominion of the Carthaginians, and was put under contribution by Maſiniſſa. Leptis is ſaid to have paid a talent *per* day to the Carthaginians. No part of the Carthaginian dominions was more fruitful than this. Polybius (l. i.) ſays, that the revenue which aroſe from hence was ſo conſiderable, that all their hopes were almoſt founded on it; and he deduces the origin of its name from its great fertility, and the commerce which diſtinguiſhed it. To this were owing the anxiety and ſtate-jealouſy of the Carthaginians, leſt the Romans ſhould ſail beyond the fair promontory, that lay before Carthage, and become acquainted with a country which might induce them to attempt the conqueſt of it.

EMPORIÆ, Ampourias, a town of Hither Spain, which lay towards the ſouth, and which was, as its name imports, a commercial port. Strabo ſays, that the Maſſilians were eſtabliſhed here: but Pliny and Silius Italicus ſay, that they were the Phocæans; both which reports may agree, as the inhabitants of Marſeilles profeſs to have derived their origin from the Phocæans. According to Livy, this place conſiſted of two towns ſeparated by a wall; that on the ſea-coaſt, encompaſſed by a wall of 400 paces, was inhabited by Greeks, a colony of Maſſilians, who ſprung from the Phocæans; and the other part, which had no communication with the ſea, was ſurrounded by a wall of 3000 paces. This hiſtorian informs us, that Cæſar, after having defeated Pompey's party, eſtabliſhed a body of Romans in this place. The Greeks, who were eſtabliſhed in this place, had previouſly inhabited a ſmall iſland oppoſite to it, from which they paſſed over to the continent. They worſhipped Diana of Epheſus.

EMPORICUS Sinus, a gulf of Africa, in Mauritania. Ptolemy places it in the Adriatic ſea, at 34° 20′ of latitude.

EMPORIUM, a fortreſs of Italy, in Emilia, 5 miles from the Po.—Alſo, a place of Macedonia.—Another of Sicily.—Another of Italy, in Campania.—Another in Celtica. Steph. Byz.

Emporium, in *Phyſiology*, is often uſed for the common ſenſory in the brain. See Brain.

EMPRIMED, among *Sportſmen*, a term applied to a hart, when he forſakes the herd.

EMPRION, from πριω, *to ſaw*, in the *Medical Writings of the Ancients*, a word uſed to denote a peculiar pulſe, in which the artery is felt to be diſtended in one part more than another at every ſtroke, and by that means is made to reſemble any ſerrated body, or the light teeth of a fine ſaw.

EMPROSTHOTONOS, in *Medicine*, from ἔμπροσθεν, *forwards*, and τείνω, *I ſtretch*, is the term applied to that form of tetanus, or general ſpaſm, in which the muſcles which bend the body forwards are moſt ſtrongly affected, ſo that the whole body is rigidly fixed in a bent poſition, the neck and back being bowed forwards, the chin fixed upon the breaſt, &c. The term is uſed in oppoſition to Opisthotonos, in which the body is bent backwards. (See Tetanus.) The emproſthotonos, however, is a very rare occurrence; and ſome writers have altogether denied its exiſtence, except as a partial affection confined to the neck.

EMPTOR Familiæ, *buyer of a family*, in the *Roman Law*, one who purchaſed the inheritance of a perſon, or the privilege of being appointed his heir by will.

This was done by the ceremony of ſcales and weights, before five witneſſes, with the uſe of a peculiar formula of words.

Such buyer differed from the heir, *hæres*, as the teſtator in ſome meaſure alienated the right to the former during his own life-time, whereas the latter had only a right by his death. Briſſon. de Formul. lib. vii. p. 585. Pitiſc. Lex. Ant. tom. i. p. 713. voc. *Emptor*.

Emptor *fiduciarius*, *fiduciary buyer*, one who receives a thing in the way of pledge, till the money he has advanced be repaid. Salmaſ. de Mod. Uſur. cap. 14. Pitiſc. Lex. Ant. tom. i. p. 713. voc. *Emptor*.

EMPTYSIS, in *Surgery*, bleeding from the mouth and fauces.

EMPUS, in *Geography*, a town of France, in the department of the Var, and diſtrict of Draguignan; 5 miles N.W. of Draguignan.

EMPUSA, Εμπουσα, among the *Ancients*, a kind of hobgoblin, or bugbear, under the direction of Hecate, who uſed to ſend it to frighten people who laboured under misfortunes. Hofm. Lex. in voc.

EMPYEMA, in *Surgery*, ſignifies a collection of matter in the cavity of the thorax. The term is derived from εν, *within*, and πυον, *pus*, or *matter*.

The ancients made uſe of the word "empyema" to expreſs every kind of internal ſuppuration. Ætius firſt employed the term to denote the collections of purulent matter, which ſometimes form in the cavity of the pleura, or membrane lining the cheſt; and all the beſt modern ſurgeons invariably attach this meaning alone to the expreſſion.

The operation for empyema means the making of an opening into the thorax, for the purpoſe of giving vent to the matter collected in the cavity of the pleura. The neceſſity for having recourſe to ſuch an operation, however, does not often preſent itſelf. We would not wiſh to be thought to aſſert, that inflammation of the lungs, pleura, mediaſtinum, diaphragm, and even of the liver, does not ſometimes terminate in ſuppuration. Certainly, the latter event is occaſionally produced; but, when it does happen, the matter does not always make its way into the cavity of the cheſt. Very frequently external abſceſſes form, or the pus is either coughed up, or diſcharged with the ſtools.

When the ſurface of the lungs and pleura coſtalis have become adherent together, in the ſituation of the abſceſs, the pus, always diſpoſed by a law of nature to make its way to the ſurface of the body, occaſions ulceration of the intercoſtal muſcles, and collects on the outſide of them. An abſceſs of this kind comes on with a deep-ſeated pain in the part affected; an œdematous ſwelling, which retains the impreſſion of the finger; and a fluctuation, which is at firſt not very diſtinct, but from day to day becomes more and more palpable, and, at length, leads the ſurgeon to make an opening to let out the matter.

If an opening be not made, when the fluctuation becomes perceptible, there is ſome riſk of the matter inſinuating itſelf into the cheſt, in conſequence of the adheſion being in part deſtroyed by ulceration. M. Sabatier affirms, that the caſe may take this courſe, even when the abſceſs has been punctured, and while a free external opening exiſts. This experienced ſurgeon had occaſion to remark ſuch an occurrence in a ſoldier. The patient had a collection of matter in the thorax, which was only indicated by a pain all over the ſide; a difficulty of lying in any other poſition in bed, than on the back; and an undulating noiſe in the cheſt, whenever he altered his poſture. When M. Sabatier made the patient hold his breath, the diſcharge, which was very copious, was not increaſed; the pus did not contain any bubbles of air; there was no emphyſema round the wound; nor any blaſt of air from it in the motions of reſpiration. On opening the body, M. Sabatier found, that the abſceſs had been originally ſituated between the intercoſtal, and the pectoralis minor, and major, muſcles, and that the matter had made its way, by ſeveral ulcerated openings, into the cheſt. The lung, in ſome places, was adherent to the pleura. The quantity of effuſed matter was very conſiderable. See Medecine Opératoire, tom. 2. p. 249.

In the ſame manner, if inflammation ſhould occur in the anterior mediaſtinum and end in ſuppuration, the abſceſs may poſſibly burſt into neither of the cavities of the cheſt; but make its way outward, after having rendered the ſternum carious. The following caſe, illuſtrative of this fact, is taken from Van Swieten's Commentaries on Boerhaave's 895th Aphoriſm.

A young man was attacked with a violent pleuriſy, which ſeemed to terminate in copious expectorations, which began about a fortnight after the commencement of the indiſpoſition, and continued for a long while. The patient became exceedingly reduced, and his fate ſeemed inevitable. In the tenth month of his illneſs, however, a ſmall ſoft ſwelling, about the ſize of a filbert, made its appearance upon the middle of the ſternum, the ſubſtance of which bone appeared to be obviouſly carious round the margin of the tumour. The ſwelling burſt of itſelf, and a diſcharge of matter enſued. Pus continued to be emitted from the opening for eight months. The cavity of the abſceſs was capable of containing a pint of the fluid, which was uſed as a detergent injection. The matter had collected between the pleura and the ribs. The patient recovered of this alarming diſeaſe, and was ſeen by Van Swieten in good health, eight months afterwards. There only remained a ſmall fiſtulous opening, from which an inconſiderable quantity of matter continued to be diſcharged.

The foregoing caſe of abſceſs in the anterior mediaſtinum originated from an internal cauſe. It was the conſequence of a violent pleuriſy, or rather of a ſimilar diſorder, which is attended with nearly the ſame ſymptoms, but has a different ſituation, and has been very accurately deſcribed by Salius Diverſus. The ſame ſort of abſceſs may ariſe, in conſequence of a wound in the forepart of the cheſt. An intereſting caſe of this deſcription is related by Galen. A young man, who had been wounded in the region of the ſternum, ſeemed to have got completely well. An abſceſs then formed in the ſituation where the injury was received; it was opened, and healed. The part, however, ſoon inflamed and ſuppurated again. The place could not now be healed. A conſultation was held, at which Galen attended. As the ſternum was obviouſly carious, and the pulſation of the heart was viſible, every one was afraid of undertaking the cure of the caſe, ſince it was conceived, that it would be neceſſary to open the thorax itſelf. Galen, however, engaged to manage the treatment without making any opening of the kind alluded to, and he expreſſed his opinion, that he ſhould be able to effect a cure. Not finding the bone ſo extenſively diſeaſed, as was apprehended, and the mammary veſſels being ſound, he began to indulge conſiderable hopes of ſucceſs. After the removal of a portion of the bone, he ſaw the heart quite expoſed, by reaſon of the pericardium having been deſtroyed by the previous diſeaſe. The patient, after the operation, experienced a ſpeedy recovery.

M. J. L. Petit met with a caſe of an abſceſs in the mediaſtinum, in conſequence of a gun-ſhot wound, in the ſituation of the ſternum. The injury had been merely dreſſed with ſome digeſtive application; no dilatation, nor any particular examination of the wound had been made. The patient, after being to all appearances quite well, and joining his regiment again, was ſoon taken ill with irregular ſhiverings, and often febrile ſymptoms. M. Petit probed the wound, and found the bone affected. As there was a difficulty of breathing, he ſuſpected an abſceſs either in the diploe, or behind the ſternum, and, conſequently, he propoſed laying the bone bare, and applying a trepan. This operation gave vent to ſome ſanious matter, and, as ſoon as the inner part of the ſternum was perforated, a glaſs full of pus was diſcharged. The patient was relieved, and afterwards recovered.

When, in conſequence of inflammation, an abſceſs forms deeply in the ſubſtance of the lungs, the pus more eaſily makes its way into the air-cells, and tends towards the bronchia, than towards the ſurface of the lungs, and into the cavity of the thorax. In this caſe, the patient ſpits up purulent matter. When the opening, by which the abſceſs has burſt, is large, and the pus eſcapes from it in a conſiderable quantity at a time, the patient is in ſome danger of being ſuffocated. However, if the opening be not immoderately large, and the pus, which is effuſed, be not too copious, a recovery may follow. Abſceſſes in the ſubſtance of the diaphragm, and collections of matter in the liver, may alſo be diſcharged by the pus being coughed up from the trachea, when the parts affected have become connected with the lungs, by adheſions, and the abſceſſes of the liver are ſituated on its concave ſurface. When the collection of matter in the liver occupies any other ſituation, the abſceſs frequently makes its way into the colon, and the pus is diſcharged with the ſtools. Several caſes of this kind are related by authors; Sabatier has recorded two in his Médecine Opératoire; Le Dran mentions his having ſeen others; and Pemberton, in his book on the diſeaſes of the abdominal viſcera, p. 36, relates the occurrence of additional inſtances of a ſimilar nature.

We ſhall now proceed to the conſideration of empyema, ſtrictly ſo called. No ſurgical writer, with whom we are acquainted, has written with more diſcrimination, than Mr. Samuel Sharp, on the ſymptoms produced by collections of matter in the cavity of the cheſt. He remarks, that it has been almoſt univerſally taught, that when a fluid is extravaſated in the thorax, the patient can only lie on the diſeaſed ſide, the weight of the incumbent fluid on the mediaſtinum becoming troubleſome, if he places himſelf on the ſound ſide. For the ſame reaſon, when there is fluid in both cavities of the thorax, the patient finds it moſt eaſy to lie on his back, or to lean forwards, in order that the fluid may neither preſs on the mediaſtinum, nor the diaphragm. But, Mr. Sharp takes notice, that however true this doctrine may prove in moſt inſtances, there are a few (Le Dran's Obſ. 217. vol. i. Marchetti, 65.) in which, notwithſtanding the extravaſation, the patient does not complain of more inconvenience in one poſture, than another, nor even of any great difficulty of breathing.

On this account, obſerves Mr. Sharp, it is ſometimes leſs eaſy to determine, when the operation is requiſite, than if we had ſo exact a criterion, as we are generally ſuppoſed to have. However, he informs us, that though this may be wanting, there are ſome other circumſtances, which will generally guide us with a reaſonable certainty. He ſtates, that the moſt infallible ſymptom of a large quantity of fluid in one of the cavities of the thorax, is a preternatural expanſion of that ſide of the cheſt, where it lies; for in proportion as the fluid accumulates, it will neceſſarily elevate the ribs on that ſide, and prevent them from contracting ſo much in expiration as the ribs on the other ſide. Mr. Sharp refers alſo to Le Dran's Obſerv. 211. vol. i. to prove, that the preſſure of the fluid on the lungs may ſometimes be ſo great, as to make them collapſe, and almoſt totally obſtruct their action. When therefore, ſays Mr. Sharp, the thorax becomes thus expanded after a previous pulmonary diſorder, and the caſe is attended with the ſymptoms of a ſuppuration, it is probably owing to a collection of matter. The patient, he obſerves, will alſo labour under a continual low fever, and a particular anxiety from the load of fluid.

Mr. Sharp alſo obſerves, that, beſides this dilatation of the cavity from an accumulation of the fluid, the patient will be ſenſible of an undulation; and ſometimes the undulation is ſo evident, that a by-ſtander can plainly hear it in certain motions of the body. Mr. Sharp adds, that this was the caſe with a patient of his own, on whom he performed the operation; but the fluid, in the example alluded to, he ſays, was very thin, being a ſerous matter, rather than pus.

According to the ſame author, it will alſo frequently happen, that though the ſkin and intercoſtal muſcles are not inflamed, they will become œdematous in certain parts of the thorax; or if they are not œdematous, they will be a little thickened. Theſe ſymptoms, joined with the enlargement of the thorax, and the preceding affection of the pleura or lungs, ſeem unqueſtionably to indicate the propriety of the operation. But, obſerves Mr. Sharp, amongſt other motives to recommend it upon ſuch an emergency, this is one, that if the operator ſhould miſtake the caſe, an inciſion of the intercoſtal muſcles would neither be very painful, nor dangerous. See Critical Enquiry into the preſent State of Surgery; ſect. on Empyema.

Although we would wiſh the reader to underſtand, that patients with empyema can ſometimes lie in any poſition, without any particular aggravation of the difficulty of breathing, yet, we muſt diſtinctly ſtate, that the generality of patients with this diſeaſe cannot place themſelves on the ſide oppoſite to that where the collection of pus is ſituated, without having their reſpiration very materially obſtructed. Another circumſtance, alſo, which we wiſh to mention, now that we are treating of the ſymptoms of empyema, is, that the œdema of the integuments is ſometimes not confined to the thorax, but extends to more remote parts, on the ſame ſide of the body as the collection of matter. Both the foregoing remarks are confirmed by an intereſting caſe, which Mr. Hey, of Leeds, has lately publiſhed.

Sept. 3, 1788, Mr. Hey was deſired to viſit John Wilkinſon, who had been ill ten days of the influenza. The patient was found labouring under a fever, attended with cough, difficulty of breathing, and pain in the left ſide of the thorax. He was bled once; had repeated bliſters applied to the thorax; took nitre and antimonials, with a ſmooth linctus to allay his cough. He was repeatedly relieved by theſe means, eſpecially by the application of the bliſters; but repeatedly relapſed. At laſt, he became ſo ill, that he breathed with the utmoſt difficulty, and "could not lie on the right ſide without danger of immediate ſuffocation."

Mr. Hey found the patient in the ſtate juſt now deſcribed on the 17th of September. "His face, and eſpecially the eye-lid, were a little ſwollen on the left ſide." The left ſide of the thorax was larger than the right, and its integuments were œdematous. Upon preſſing the intercoſtal muſcles they felt diſtended; they yielded a little to a ſtrong preſſure, and rebounded again. The abdomen, eſpecially at its upper part, appeared to be fuller than in its natural ſtate. See Practical Obſervations in Surgery, p. 476.

Another remarkable ſymptom, which is occaſionally produced by collections of matter in the cheſt, is an alteration in the poſition of the heart. Mr. Samuel Cooper has made mention of a patient who was in St. Bartholomew's hoſpital, whoſe heart was puſhed quite to the right ſide of the cheſt, by an empyema in the left bag of the pleura, and pulſated on the right of the ſternum. Firſt Lines of the Practice of Surgery; part 2. chap. 29.

The ſymptoms of empyema are frequently very equivocal, and the exiſtence of the diſeaſe is generally ſomewhat doubtful. Panarolius opened a man, whoſe left lung was deſtroyed, at the ſame time that the thorax contained a conſiderable quantity of pus. Although the patient had been ill for two months, he had ſuffered no difficulty of breathing, and had had only a ſlight cough. Le Dran met with a caſe of nearly the ſame kind. A patient who had been for three days affected with a conſiderable oppreſſion, and an acute pain on the left ſide of the cheſt, got ſomewhat better. He felt no material difficulty of breathing, on whatever ſide he lay. The only thing which he complained of, was a ſenſe of a fluctuation in his thorax, and a little obſtruction to his reſpiration, when he was in a ſitting poſture. Theſe ſymptoms did not ſeem ſufficiently decided to juſtify the operation, and it was delayed. The febrile ſymptoms continued with cold ſweats, and the patient died on the eighth day. Five pints of pus were found collected in the cheſt.

With reſpect to opening ſuch abſceſſes as preſent themſelves at ſome part of the parietes of the thorax, in conſequence of a pleuriſy, or an inflammation of the diaphragm, or mediaſtinum, it is not attended with any peculiarity. It ſhould be done as ſoon as a fluctuation can be felt, and the aperture ſhould be made of ſufficient ſize to give free vent to the matter. As ſome of theſe abſceſſes communicate with the external ſurface of the lungs, and others with that of the liver; as ſome of them are accompanied with a caries of the ribs, or the cartilages of theſe bones, while others are attended with an alteration of the ſubſtance of the ſternum; the cure muſt frequently be interrupted by unpleaſant ſymptoms, and very often retarded for a long while, eſpecially when there are ſome pieces of bone to exfoliate.

We ſhall next conſider the operation for empyema, in the common ſignification of this term.

Mr. Samuel Sharp adviſes the inciſion to be made between the ſixth and ſeventh ribs, half way from the ſternum towards the ſpine; which, ſays he, though not the moſt depending part of the thorax, when we are erect, yet is ſituated ſufficiently low to give iſſue to the fluid, when we lie down.

This author was certainly miſtaken in his opinion, that the expanſion of the lungs always propelled the pus out of the wound, but the action of ſuch muſcles, as diminiſh the capacity of the thorax, may undoubtedly produce this effect. The reader, on looking over the article EMPHYSEMA, will be perfectly convinced, that the lungs cannot become diſtended with air, and expanded on one ſide, while, on this ſide of the cheſt, there exiſts a free communication between the outward air and the cavity of the pleura.

Mr. Sharp quotes the practice of Marchetti, who always made the opening between the fifth and ſixth ribs, to confirm the prudence of chooſing this ſituation for the inciſion. See Critical Enquiry, &c.

A great many of the moſt eminent writers on the operations of ſurgery have had hardly any other object in view, in the operation for empyema, than making an opening into the thorax in ſuch a ſituation, as would be a moſt depending one, in the erect poſition of the body. Hence theſe authors even ſanction and recommend the unneceſſary plan of cutting through the muſcles of the back to make an iſſue for the matter in the exact place, which, according to their principle, ought to be choſen. We are ſorry, that the reſpectable names of Bertrandi and Sabatier might be adduced in favour of this mode of proceeding.

The ſafeſt, and moſt convenient ſituation, for making an opening into the cheſt, is between the ſixth and ſeventh true ribs, on either ſide, as circumſtances may render neceſſary. The ſurgeon ſhould only recollect, that the two cavities of the pleura are completely diſtinct from each other, and have no communication whatſoever, ſo that, if fluid were contained on the left ſide of the thorax, making an opening into the right cavity would not ſerve for diſcharging the accumulated matter. The practitioner ſhould alſo remember, that, when there is a fluid on both ſides of the cheſt, paracenteſis muſt never be done for the relief of the two collections at the ſame time; becauſe, there is great reaſon to believe, that, as the lungs on one ſide uſually collapſe, when there is a free communication between the air and inſide of the thorax, they would do ſo on both ſides, were an opening made at the ſame time into each bag of the pleura. It is hardly neceſſary to remark, that, in this condition, the patient could not breathe and would die ſuffocated. The operation conſiſts, in making an inciſion, about two inches long, through the integuments, which cover the ſpace between the ſixth and ſeventh true ribs, juſt where the indigitations of the ſerratus major anticus muſcle meet thoſe of the externus obliquus. Here it is unneceſſary to divide any muſcular fibres, except thoſe of the intercoſtal muſcles, and, by putting the patient in a proper poſture, the opening that is made, will be depending enough for any purpoſe whatſoever. The ſurgeon, avoiding the lower edge of the upper rib, where the intercoſtal artery lies, is then cautiouſly to divide the intercoſtal muſcles, till he brings the pleura into view, when this membrane is to be very carefully divided with a lancet. The inſtrument ſhould never be introduced in the leaſt deeply, leſt the lungs ſhould be injured. The ſize of the opening in the pleura ſhould never be larger than neceſſary. The diſcharge of blood and matter will of courſe require a freer aperture, than that of air, or water. If requiſite, a cannula may be introduced into the wound, for the purpoſe of facilitating the evacuation of the fluid, and it may, even in ſome caſes, be proper to let this inſtrument remain in the part, in order to let the water, or pus eſcape, as often as another accumulation takes place. It is obvious, however, that a cannula, for this object, ſhould only be juſt long enough to enter the cavity of the pleura, and ſhould have a broad rim to keep it from ſlipping into the cheſt. A piece of ſticking plaſter would eaſily fix the cannula, which might be ſtopped up with a cork, or any other convenient thing, or left open according as the circumſtances of the caſe, and the judgment of the ſurgeon, may direct.

It is proper to ſtate, that ſome practitioners make the wound between the fifth and ſixth ribs: thus, Mr. Hey, in relating an intereſting caſe of empyema, informs us, that the pain which the patient had felt in his ſide had been moſt acute betwixt the fifth and ſixth ribs, and that there he (Mr. H.) made an opening into the cavity of the thorax. His firſt inciſion was about two inches in length. He cut through the ſerratus and intercoſtal muſcles cloſe to the upper edge of the ſixth rib, and made an opening into the cheſt capable of admitting the tip of his finger. A large quantity of matter was thus diſcharged, and a leaden cannula was introduced into the wound on the ſecond day after the operation, and was retained in its place by a flannel bandage. Mr. Hey did not allow the patient to leave off wearing the cannula, until the diſcharge from the thorax had ceaſed, and he had completely regained his ſtrength. He wore it fifteen months.

Mr. Hey thinks it of great conſequence to retain a cannula in the wound, until all probability of relapſe is removed. This precaution, he apprehends, will not hinder the patient from recovering his ſtrength, even when the uſe of the inſtrument is not abſolutely neceſſary. See Hey's Practical obſervations in Surgery, p. 477, &c.

EMPYEMATA, ſuppurating medicines.

EMPYI, patients with empyema.

EMPYREUM, among *Divines*, denotes the higheſt of the heavens, where the bleſſed enjoy the beatific viſion; called elſo empyrean heaven, and paradiſe.

The word is formed of εν and πυρ, *fire*, becauſe of its ſplendour.

EMPYREUMA, in *Chemiſtry*, is that ſmell and taſte of ſcorching which takes place in moſt animal and vegetable ſubſtances, when heated to that point at which decompoſition by fire begins. It is always attended with a darkening of colour of ſubſtances naturally clear and limpid. The degree of heat at which this change occurs is various, but it is always above that of boiling water, ſo that the uſe of a boiling water-bath for digeſtions, or deſiccations, is an effectual mode of preventing empyreuma. There is, however, a change that takes place in vegetable decoctions or infuſions when evaporated to the conſiſtence of an extract, however low the heat is kept, ſince when theſe extracts are again diluted to their original conſiſtence, they differ both in ſenſible and chemical properties, from the original liquor. The cauſes of this change are, probably, in part the action of the external air, but principally, ſeveral complicated chemical actions that take place between the various component parts of the vegetable ſubſtance itſelf, when their particles are concentrated by evaporation of the water which held them in ſolution. This circumſtance is often confounded with empyreuma, properly ſpeaking, or the changes produced by heat puſhed to the degree at which decompoſition occurs, and as ſome of the effects appear to be nearly ſimilar, it is perhaps impoſſible to adhere ſtrictly to the real diſtinction. The leading circumſtance that indicates empyreuma in vegetable and animal matters is the *charring*, or converſion into black carbon, of part of the ſubſtance thus heated, whence a carbonaceous inſoluble powder is produced, which partly ſubſides on dilution with water, and partly remains finely ſuſpended.

The ſmell and taſte of empyreuma in vegetable infuſions, may be in many caſes got rid of by filtering through recently-burned charcoal powder.

Empyreuma is alſo uſed for the heat remaining upon the declenſion of a fever.

EMPYREUMATIC Acid and Oil, in *Chemiſtry*. When moſt animal and vegetable ſubſtances are diſtilled *per ſe* in a heat gradually urged to redneſs, a dark-coloured ſtrong ſmelling oil almoſt invariably riſes towards the end of the proceſs, which is ſtrongly empyreumatic.

Many vegetable ſubſtances yield alſo, at the ſame time, a ſtrongly acid and empyreumatic liquor, which appears to be chiefly acetous acid generated in the proceſs, and holding much carbonaceous matter in ſolution, from which it may be partly freed by a ſeparate diſtillation in a gentle heat. See Pyroligneous and Pyromucous Acid.

EMRODS, or rather Hæmorrhoids. See Hæmorrhoids.

EMS, in Latin *Amiſia*, or *Amaſius*, in *Geography*, is a conſiderable river of Germany, which has its ſource in the county of La Lippe, in Weſtphalia, flows through Eaſt Frieſland, and falls into the North ſea, near Emden. It gives its name to one of the new departments of Holland, which is the ancient province of Eaſt Frieſland, whoſe chief place is the town of Leuwarden.

Ems, a town of Germany, in the circle of the Upper Rhine, and principality of Heſſe-Darmſtadt; ſeven miles E.S.E. of Coblentz.

EMSBACH, a river of Germany, in the circle of the Lower Rhine, which runs into the Lahne, three miles E. of Limburg, in the electorate of Treves.

EMULATION, is a generous ardour kindled by the brave examples of others, which impels us to imitate, to rival, and, if poſſible, to excel them. This paſſion involves in it eſteem of the perſon whoſe attainments or conduct we emulate, of the qualities and actions in which we emulate him, and a deſire of reſemblance, together with a joy ſpringing from the hope of ſucceſs.

The word comes originally from the Greek αμιλλα, *diſpute, conteſt;* whence the Latin *æmulus*, and thence our emulation.

Dr. Hartley refers emulation to a claſs of the ſympathetic affections, by which we grieve for the happineſs of others; and Dr. Reid, in his "Eſſays," (p. 167,) defines it as a deſire of ſuperiority to our rivals in any purſuit, accompanied with an uneaſineſs at being ſurpaſſed. He claſſes it, together with reſentment, under the head of the malevolent affections, which, though they are parts of our conſtitution, given us by our Maker for good only, and, when properly directed and regulated, of excellent uſe, are nevertheleſs ſubject to exceſs or abuſe, and thus become the ſource and ſpring of all the malevolence that is to be found among men. From the obſervations which he has introduced for the illuſtration of this affection, he infers, that emulation, as far as it is a part of our conſtitution, is highly uſeful and important in ſociety; that in the wiſe and good, it produces the beſt effects without any harm; but in the fooliſh and vicious, it is the parent of a great part of the evils of life, and of the moſt malignant vices that ſtain human nature.

Plato obſerves of emulation, that it is the daughter of envy; if ſo, there is a great difference between the mother and the offspring; the one is a virtue, and the other a vice. Emulation admires great actions, and ſtrives to imitate them; envy refuſes them the praiſes that are their due; emulation is generous, and only thinks of ſurpaſſing a rival; envy is low, and only ſeeks to leſſen him.

Perhaps, therefore, it would be more juſt to ſuppoſe emulation the daughter of admiration: admiration, however, is a principal ingredient in the compoſition of it.

EMULGENT, in *Anatomy*, a term applied to the blood-veſſels of the kidnies. See ARTERIES and VEINS.

EMULSION, from *emulgere*, to milk, in *Chemiſtry* and *Pharmacy*, is any milky opake liquor formed by the diffuſion of any oily or reſinous matter in water, through the medium either of alkalies, or of mucilage, or any other viſcid matter ſoluble in water.

Milk itſelf is a natural emulſion, and when viewed in a powerful microſcope is ſeen viſibly to conſiſt of oily particles ſuſpended in a ſerous liquor. Many vegetable matters form natural emulſions when merely triturated with water, of which kind are almonds, and moſt of the oily nuts, the oil being held ſuſpended by the mucilage or farina with which theſe ſubſtances naturally abound.

All the oils are rendered miſcible with water, when rubbed with mucilage of gum arabic, or with the yolk of egg, or with a ſmall quantity of any alkaline ſalt, and all theſe mixtures are common in pharmacy. Thick ſyrups alſo promote the diffuſion of oily matters in water, but leſs perfectly.

This combination, however, is but temporary, as all the emulſions are decompoſed by mere reſt for ſome hours, and as beſides they are very apt to ferment, they are only uſed in extemporaneous preſcription.

The common emulſion, now called "Lac Amygdalæ," is made by beating an ounce and a half by weight of ſweet almonds, with half an ounce by weight of double refined ſugar, in a marble mortar, and rubbing them well together; adding gradually the quantity of two pints of diſtilled water, and ſtraining the liquid. If two ounces and a half of the mucilage of gum arabic are added to the almonds whilſt they are pounded in the mortar, we ſhall have the arabic emulſion. Theſe emulſions may be uſed as ordinary drink, in caſes which require ſoft cooling liquors. The camphorated emulſion is prepared by grinding half a dram of camphor, and half a dozen ſweet almonds together in a ſtone mortar, and adding by degrees eight ounces of mint water, ſtraining the liquor, and diſſolving in it half an ounce of white ſugar. A table ſpoonful of this emulſion may be taken in fevers, and other diſorders which require the uſe of camphor, every two or three hours.

The emulſion of gum ammoniac is made by grinding two drams of the gum with eight ounces of water poured gradually upon it till it is diſſolved.

This emulſion is uſed for attenuating viſcid phlegms, and promoting expectorations. In obſtinate coughs, two ounces of the ſyrup of poppies may be added to it. It may be adminiſtered in a doſe of two table ſpoonfuls, three or four times a day. The oily emulſion, prepared by mixing ſix ounces of ſoft water with two drams of volatile aromatic ſpirit, and an ounce of Florence oil, and half an ounce of ſimple ſyrup, is ſerviceable in recent coughs: in more obſtinate coughs, it will be better to ſubſtitute for the aromatic ſpirit the paregoric elixir of the Edinburgh Diſpenſatory. A table-ſpoonful of it may be taken every two or three hours.

EMUNCTORY, in *Anatomy*, from *emungo*, to clean or wipe the noſe, is any part of the body, which ſeparates from the blood humours judged to be impure or excrementitious, and therefore hurtful. This proceſs is ſuppoſed to purify the blood. The kidnies and ſkin are called the common emunctories, as they afford very copious ſecretions. This notion of the ſeparation of noxious particles is built on the opinions of the older phyſiologiſts; and conſequently the uſe of the term emunctory has at preſent nearly ceaſed.

EMUNGS, in *Geography*, one of the Pelew iſlands.

ENABY, a town of Sweden, in the province of Eaſt Gothland; 20 miles S. of Linkioping.

ENADA, in *Ancient Geography*, a town of Paleſtine, in the tribe of Iſſachar, according to the book of Joſhua.

ENÆMON, Εναιμων, from αιμα, *blood*, an external medicine which ſtops or ſtanches the blood; or which, by binding, cooling, or drying, cloſes the paſſages of the veſſels before open, or diminiſhes the fluidity and motion of the blood. See STYPTIC.

ENÆOREMA, Εναιωρημα, from αιωνω, *to exalt*, expreſſes ſuch contents of the urine as float about in the middle, reſembling a cloud; and thence alſo called nubecula. See URINE.

ENAGARA, in *Ancient Geography*, an iſland of Aſia Minor, in the Mediterranean ſea, placed by Pliny over-againſt Lycia, and near the iſle of Crete.

ENAIM, a town of Judea, in the tribe of Judah, according to the book of Joſhua.

ENALLAGE, in *Rhetoric*, a figure whereby we change and invert the order of the terms in a diſcourſe, againſt the common rules of language.

The word is derived from the Greek, εναλλαγη, formed of εναλλαττειν, which ſignifies *to change*, as well as the ſimple verb αλλαττειν.

The grammarians too have a kind of enallage, whereby one part of ſpeech, or one accident of a word, is put for another.

Such is the change of a pronoun, as when a poſſeſſive is put for a relative, *e. gr. ſuus* for *ejus;* or of a verb, as when one mood or tenſe is put for another.

ENALURON, in *Heraldry*, is uſed by Guillim to expreſs a bordure charged with birds; as an enaluron of martlets,

martlets, &c. but Mackenzie charges this as a miſtake ariſing from ignorance of the French tongue; enaluron properly ſignifying orle, or in manner of a bordure, and being applicable to a bearing of any thing in that form.

ENAMBUSH, in *Military Affairs*, relates to a device uſed for the purpoſe of ſurpriſing an enemy, either on his route, or when purſuing a ſmall body of troops ſent out for the purpoſe of decoying him into the ſnare. This inſidious practice is often of conſiderable ſervice in the minor branches of warfare, but can rarely be practiſed on a great ſcale; though hiſtory furniſhes us with inſtances of armies having been taken by ſurpriſe, owing to the cunning of their adverſaries, in lying concealed in ſuch places as enabled them to take advantage of an unſuſpecting commander. This, however, is not what in ſtrictneſs is termed an *ambuſh*. That term more properly is confined to that kind of preconcertion, which rather leads an enemy into the danger, by ſome ſuppoſed advantage held out to his acceptance, whether it be for forage, the ſeizing of a depot, the interception of a convoy, or the attack upon ſome weak poſt. Here we ſee an immenſe field open for contrivance and ſpeculation. It is to be underſtood, that when a body of troops is placed in ambuſh, certain intelligence has been obtained of the numbers, route, and object of thoſe who are to be intercepted. If theſe be not previouſly aſcertained, the ambuſcade may prove fatal: ſince, ſhould it turn out that, inſtead of five hundred, five thouſand were to be attacked; that, in lieu of their being foragers laden with booty, they ſhould prove to be a body of light horſe, with riflemen at their backs; or that, inſtead of being a detachment ſent to ſurpriſe ſome ſmall outpoſt, they ſhould be the advanced guard of a ſtrong column:—in either of theſe caſes, a ſad reverſe would take place; for, although at the firſt bruſh, there might be ſome ſurpriſe, and poſſibly ſome confuſion, it would in all probability be but for the moment; after which the aſſailed party would preſs forward with great eagerneſs, and by means of their flanking parties cover the ſpeculators with diſgrace and ruin. The moſt deadly kind of ambuſcade is that wherein fire-arms are rejected, the whole depending upon pikes and cutlaſſes: in ſuch, ſilence is an important object, even in the very moment of falling upon the enemy. This not only prevents the other parts of the line from being able to aſcertain the exact ſituation of the aſſailants, as may always be done by obſerving the flaſhes from muſketry, &c.; but renders it impoſſible to aſcertain their numbers. Add to this, that when men fire, in the dark eſpecially, at a moving object, they are by no means certain of their aim; nor can they ſo ſpeedily recover themſelves, after their pieces may have been diſcharged. Beſides, it is well known that pikes cauſe infinite conſternation, when coming to cloſe quarters; being much longer than the muſket with the bayonet attached, they are infinitely more deſtructive, when properly uſed in this ſpecies of warfare. In many countries, it is next to impoſſible to enambuſh the enemy; while, in others, almoſt every ſpot affords the means of concealment. The great art is, to avoid all common-place modes of laying *perdue*: ſuch are rarely ſucceſsful, owing to that invariable attention paid towards the examination of every ſuch ſuſpicious ſituation. On the other hand, thoſe parts which are leaſt ſuſpected often prove particularly formidable; but where ſuch are reſorted to, the means of retreat, or at leaſt of defence, ought to be fully eſtabliſhed. Thoſe ambuſcades which are the moſt collected, always carry the greateſt probability of ſucceſs: they are leaſt liable to detection, far more pointed in their attack, and moſt calculated for reſiſtance, when prematurely diſcovered. Cavalry is rarely employed in ambuſhes, though a conſiderable body may, if convenient, be poſted in a proper direction, for the purpoſe of ſupporting the infantry concealed in woods, &c. On ſome occaſions, it is even advantageous that ſuch cavalry ſhould be viſible, but in an oppoſite quarter; ſo as to cauſe the force to be attacked to be concentrated, by calling in their ſcouts and videttes; by which thoſe in ambuſh might elſe be diſcovered. This device likewiſe occaſions the baggage to be ſent upon the other flank, out of the way of the cavalry, and leaving that flank towards them free from incumbrance. When this happens, and that the cavalry make a ſhew of charging, the baggage will commonly fall into the hands of thoſe in ambuſcade. Naval ambuſcades are by no means uncommon: it often happening that a well-concerted decoy lures an enemy into ſuch a ſituation as at leaſt places him under conſiderable diſadvantage, or eventually cauſes him to ſurrender. Thus, diſguiſing veſſels by means of new painting; changing their mode of rigging; appearing to avoid rather than to purſue; ſending out a ſlow ſailing veſſel to paſs between a cruiſer and an iſland, behind which a ſuperior force is concealed, &c. &c. are all *ruſes de guerre* in common uſe. One device, which probably would otherwiſe be often practiſed, is contrary to the laws of honour and the rules of war, namely, making ſignals of diſtreſs, with the view to draw an enemy's veſſel to give aſſiſtance, and then to capture her. To aſſume the appearance of being damaged, either by weather or by action, is all fair; becauſe then the enemy bears down as upon a prey, and not as a protector. However, the practice of enambuſhing, whatever advantages it may ſeem to offer, is ſubject to extreme danger: unleſs guided by the moſt certain knowledge of the force to be ſurpriſed, it becomes almoſt invariably a loſing concern, and has the pernicious tendency of creating great diffidence in the conduct of that commander by whoſe inſtructions it is made. Nor can the ſmalleſt ſucceſs be hoped for, unleſs where the peaſantry are friendly diſpoſed, and the country around thoroughly known.

ENAMEL, in *Anatomy*, the hard ſubſtance which covers the crown of the tooth. It is deſcribed in the account of the teeth, contained in the article CRANIUM.

ENAMEL, in the *Arts*. Enamels are vitrifiable ſubſtances, and may be arranged into three claſſes, *viz.* tranſparent, ſemi-tranſparent, and opaque. The two former are chiefly employed in enamelling on gold and ſilver, for watch-caſes, trinkets, and other ſmall articles of jewellery; the latter is principally uſed on copper, for the making of clock and watch-dial plates, and for other plates which, when properly fluxed, are fit for the purpoſe of enamel-painting.

The baſis of all kinds of enamel is a perfectly tranſparent and fuſible glaſs, which is rendered either ſemi-tranſparent or opaque, by the admixture of metallic oxyds. White enamels are compoſed by melting oxyd of tin with the glaſs, and adding a ſmall quantity of manganeſe, to increaſe the brilliancy of the colour. The addition of oxyd of lead, or antimony, produces a yellow enamel; and Kunckel affirms that a beautiful yellow may be obtained from ſilver. Reds are formed by an intermixture of the oxyds of gold and iron; that compoſed by the former being the moſt beautiful and permanent. Greens, violets, and blues, are procured from the oxyds of copper, cobalt, and iron; and theſe, when intermixed in different proportions, afford a great variety of intermediate colours. Sometimes the oxyds are mixed before they are united to the vitreous baſes. Such are the principal ingredients employed in the production of the various enamels; but the proportions in which they are uſed, as well as the degree and continuance of the heat neceſſary to their perfection, conſtitute the ſecrets of the art. Other ſubſtances than thoſe here mentioned are occaſionally uſed in the compoſition of enamels; and it has been ſaid, that the peculiar quality of the beſt kinds of hard or Venetian enamel is owing to the admixture of a particular ſubſtance found on mount Veſuvius, and known to be thrown up by that volcano.

The work of Neri on glaſs, with the notes of Merret and Kunckel, afford many good precepts for making enamels; yet the exact nature and methods of compoſition of the beſt kinds, both of the hard and ſoft enamels, ſtill remain among the arcana of enamelling. The ſoft white enamel is generally called glaſs, and is manufactured at the glaſs-houſe, near the ſite of the Albion mills, on the Surrey ſide of Blackfriars-bridge; the hard enamels are chiefly made at Venice, and, from the operations of the war, are not at preſent to be procured in London. In conſequence of this, the beſt enamel, which formerly, when ſmuggled into the kingdom, has been ſold as low as from 2*s.* to 2*s.* 6*d.* *per lb.*, and even when the duty has been paid at the Cuſtom-houſe, at from 3*s.* to 4*s.*, has progreſſively advanced to a guinea, and from that to 50*s.*; and it cannot now be obtained at any price.

ENAMEL-*Painting*. See PAINTING *on Enamel*.

ENAMELLING. The art of enamelling is of great antiquity, but of unknown origin. That it was practiſed by the Egyptians is evident, from the remains that have been obſerved on the ornamental envelopes of mummies. From them it probably paſſed to the Greeks, and afterwards to the Romans, who appear to have introduced the art into this country; as various Roman antiquities have been dug up in different parts of Britain, in which enamels have formed portions of the ornaments. That the Britons received the art from their conquerors may be conjectured from the circumſtance of enamelled trinkets having been found in Britiſh barrows. That the Saxons practiſed it is certain, from the jewel found at Athelney in Somerſetſhire, and now preſerved at Oxford; which jewel, as appears by the inſcription, was made by command of the great Alfred. The gold cup, given by king John to the corporation of Lynn in Norfolk, proves that the art was not loſt under the Normans; for the ſides of that cup are embelliſhed with various figures, whoſe garments are partly compoſed of coloured enamels. The tomb of Edward the Confeſſor in Weſtminſter Abbey, conſtructed in the reign of Henry III., was alſo ornamented with enamels, pieces of which ſtill remain. The beautiful crozier of the celebrated William of Wykeham, of the time of Edward III., may be alſo adduced as exhibiting ſome curious ſpecimens of the application of this art: and other examples might be pointed out, of its progreſſive deſcent to our own age.

It would ſeem from the above brief review, that anciently enamels were principally applied to the purpoſes of ornament; but ſince the invention of clocks and watches, their uſefulneſs has been proportionally increaſed. For clock and watch dials there is probably no ſubſtance that could be ſubſtituted, that can equal enamel in permanence and beauty: in ſeveral reſpects, it poſſeſſes advantages even over the rich metals of ſilver and gold. Within the laſt 30 or 40 years, an *imitative enamel* has been uſed, and, through the ſcarcity of real enamel, is now in much demand for clock plates; but it is by no means comparable with its prototype: for, being chiefly compoſed of flake white, ground up with ſpirits of turpentine, and afterwards mixed with copal varniſh, it will neither aſſume an equal brilliancy in colour, nor continue unchanged in different climates; on the contrary, the action of the air occaſions it to become dingy and yellow. In fact, imitative enamelling is nothing more than a branch of the art of *japanning*; which ſee.

The proceſſes of enamelling have never been accurately deſcribed. The jealouſies that exiſt in all arts in which any thing like a ſcientific knowledge is wanting, operate to ſecluſion. The practitioner conceals his information from motives of profit, and the amateur ſeldom acquires an inſight ſufficiently minute to enable him to unfold the modes of operation. Whatever may be the defects of the preſent attempt, it will be found to contain a better account of the practical branches of the art than has before appeared.

Enamels are commonly laid upon a metal ground, yet they have been ſometimes uſed in ſubſtance, for diſhes, flower-pots, ornamental veſſels, figures, vaſes, &c. In theſe caſes, the enamel is run into moulds immediately from the pots in which it has been melted. The metals employed to enamel on are gold, ſilver, and copper. Of the other metals, ſome are too fuſible to endure the action of the fire, and the remainder, as platina, &c. are, to uſe the language of the art, too *ſtrong*, for the enamel: that is, the adheſion between the two ſubſtances is not powerful enough to keep them together, the enamel cracking as it grows cold, and flying off the metal in flakes. It appears, therefore, that a certain, however ſlight, degree of oxydation is neceſſary to make the enamel and the metal unite with ſufficient firmneſs. Gold is unqueſtionably the beſt ſubſtance to enamel on, its richneſs of colour ſhowing a beautiful tinge through the enamel: yet the metal generally uſed, except for watch-caſes, and valuable articles of jewellery, is copper; and that on account of its ſuperior cheapneſs. Both the gold and the copper ſhould be of the finer kinds, the others being too refractory to agree properly with the enamel.

By the cuſtom of the trade, rather than from any principle of utility, enamelling is now divided into two branches, *viz.* dial-plate enamelling, and tranſparent enamelling. The former includes the manufacture of clock and watch plates, with fluxed plates for enamel painting, the latter comprehends the enamelling of watch caſes, broaches, pins, and other bijoux: of late years the making of theſe leſſer articles has gradually grown into great diſuſe in this country.

Dial-Plate Enamelling, conſiſts of the two diviſions of hard-enamelling, and ſoft, or glaſs enamelling; in the firſt branch, the Venetian enamels only are employed, in the laſt, the Engliſh or glaſs enamels. The practice of hard-enamelling requires more ſkill, time, and labour than the others, and is conſequently eſteemed the moſt. In preparing the metals to be enamelled on, whether of gold, ſilver, or copper, the proceſs is ſimilar; one deſcription will therefore ſuffice for the whole:—and firſt of the making of watch dials.

The copper being evenly flatted in long ſlips (which is done at the flatting mills between ſteel rollers) and to a proper thickneſs, pieces are cut off for uſe according to the ſize wanted. They are then annealed in a clear fire, in order to make them ſufficiently pliable to take the required forms which is given to them by means of dies. The dies are ſmall circular plates of braſs evenly turned, varying in thickneſs, perhaps, from the ſixteenth of an inch to an eighth, or more, according to their diameter. Some of them are flat, others are hollowed out for the purpoſe of giving a ſlight curve to the *copper*, as the metal to be enamelled on is technically termed when prepared for uſe: the edges of the dies are turned off in an oblique direction, and in the centre is a ſmall hole, rather larger than that which is wanted in the dial-plate. A complete ſet of dies varies in ſize from about three-fourths of an inch to two inches and a half, the gradations being very ſmall, perhaps not more than the thirty-ſecond part of an inch between each.

The copper being cut with a pair of ſciſſars nearly to the ſize required and properly annealed, is next placed on the die beſt adapted for the purpoſe, and the eye, or centre hole, is made. This is effected by firſt forcing up the copper into the hole of the die with a ſmall round-headed punch; by this means a ſmall concave bulge is formed, the upper ſide of which is then filed through with a ſmooth grained file; it is then again placed on the die, and preſſed gradually open till it nearly fills the hole with an oval burniſher; it is afterwards preſſed tighter into the hole with a round broach, the burr being occaſionally taken off by the file, and care employed to prevent the eye from cracking. The punch, burniſher, and round pin, are all of ſteel; the two latter taper in regular gradation towards the handles.

When the eye is completed, the edge of the copper is cut round, ſo as to leave a ſmall part, probably about the thirtieth of an inch, projecting beyond the die. The projecting part is then turned up, or burniſhed, againſt the edge of the die, the copper being firſt laid ſmooth and flat by the burniſher. The turned-up edge of the copper is afterwards filed evenly round, and reduced to the proper height, according to the thickneſs of the braſs-edge, or rim, to which it is to be fixed when in the watch. The inſide burr is then ſcraped off with a graver, and ſtill further cleared away by means of a ſcratch-bruſh: this latter tool is compoſed of ſmall braſs or ſteel wire tied together in a round bundle, about the ſize of the little finger. The purpoſe for which the eye of the copper is formed, and the edge turned up, is to retain the enamel in its proper place, ſo that the plate may be finiſhed both ſquare and neat.

According to the kind of watch to which the dial is to be applied, the copper, if for a ſeconds watch, muſt be kept almoſt flat; or if for a watch where a greater ſpace is wanting beneath, to give more ſcope for the wheels, muſt be raiſed from the edge to the centre in a regular and exact manner. To effect this a ſmall circular block or ſetting die is uſed, made of box or other hard wood turned out to the neceſſary degree of concavity, and having a hole in the middle to receive the eye of the copper when placed within the hollow of the block. The copper is then gradually ſet up to the convexity or height required by rubbing it gently yet firmly with a bent, or ſetting ſpatula, formed of a thin ſlip of ſteel, about five inches long, properly fixed. It is now ready to have the feet ſoldered on, by which it is to be pinned down to the braſs edge or frame of the watch; and the places for the feet being marked on the back of the copper, through the holes drilled for the purpoſe in the edge or frame, the feet are prepared for ſoldering.

The feet are always of wire of the ſame kind of metal as that to be enamelled on, and the wire is drawn into different thickneſſes, proportioned to the ſize of the intended dial-plate; thus varying perhaps from the tenth to the ſixteenth of an inch. In the more common kinds of enamelling, the feet are generally cut off from ſilvered wire, that is, copper wire plated with ſilver; the ſilver itſelf forming the ſolder when the feet and copper are expoſed to the united action of the lamp and blow-pipe. In the beſt kind of work plain copper wire is uſed, and the feet are faſtened to the copper by means of ſpeltre, or of ſilver ſolder. When ſufficient care is exerciſed, either of theſe modes is equally appropriate, but the feet ſoldered on with ſpeltre take the firmeſt hold; thoſe with the ſilvered wire the ſlighteſt. The feet are evenly filed, either to a flat face, or an angular one, according to the deſcription of copper for which they are wanted; and are cut off the wire into proper lengths by a pair of cutting-pliers or nippers. In order to make the feet remain in their places, and facilitate the ſoldering, the end of each foot, before putting it on the copper (which is done by means of a pair of corn-tongs or tweezers), is dipped into a ſlight waſh of borax and water, through which it adheres with ſufficient force to admit of its being expoſed to the power of the blow-pipe. The lamp in common uſe contains from a pint to a quart of oil, and has a cylindrical ſpout projecting about three inches, and being an inch or more in diameter. This ſpace is filled with cotton, which being lighted, a good ſtrong flame is produced. The copper is carefully placed upon a piece of ſolid charcoal, long enough to be held in the hand, and the flame being then propelled by the blow-pipe againſt the ſolder, or ſilvered wire, as the caſe may be, the feet are firmly united to the copper. In this operation, attention muſt be given to the exact degree of heat required to fuſe the ſolder, for ſhould it be too powerful, the copper itſelf will melt at the ſame inſtant: care muſt be taken alſo that all the feet keep in their due places, otherwiſe the copper will not fit properly, and the feet muſt either be cut off, and new ones ſoldered on, or much trouble will be found in drawing the holes of the braſs-edges or frames, to get the coppers into their proper centrical ſituations.

The copper being thus far advanced is thrown into the pickling-pan, in order to free it from the ſcale or oxydable covering acquired from the heat. The *pickle* is either oil of vitriol, ſufficiently neutralized for the purpoſe by water, or elſe a ſolution of the beſt double aquafortis. When the ſcale is enough ſoftened to admit of its being removed by a ſoft bruſh, uſed with water and a little white ſand, the copper is taken out of the pickle, and all the impurities being waſhed away, it is dried by means of heat, or elſe with a ſoft cloth. In this ſtate, the copper will generally require to be again put into a proper ſhape, by means of the braſs die, and ſetting block, as it is ſcarcely poſſible but that ſome irregularities will be produced through the operations laſt deſcribed. It is alſo hardened in a ſlight degree by rubbing the under ſide with the ſetting ſpatula, and the ſurface with the ſcratch-bruſh. When this is done, the copper is completed, and fit to be enamelled on. It is to be remarked, that when many coppers are prepared at once, much time is ſaved by turning off the edges by means of the lathe and arbour, inſtead of by filing them even in the manner detailed above.

The above are the methods by which the common coppers are prepared; it is now requiſite to deſcribe what are called *French edges*, from their having been firſt made in France. Theſe are of two kinds, the ſolid French edge and the laid-down French edge. To make the former, a piece of copper is taken, either about a ſixteenth or a twelfth of an inch thick, according to the diameter of the intended plate, and a hole being drilled in the centre, the copper is placed upon an arbour, and fixed tightly by means of a ſmall cone and ſcrew-nut fitted to the maundrel. The arbour being then fixed upon a lathe, the edge of the copper is next turned off in an oblique direction, inclining inwards, with a graver, and the copper is then reduced to the proper thickneſs for enamelling from the edge to the centre, by means of a ſcorper and other tools; thus leaving the edge ſolid, and taking care alſo that a ſufficient ſubſtance is left unreduced round the cone, to form the outer circle of the eye. The laid-down French edge is made by preparing a copper in the common way from a thin ſlip, the edge being left rather higher than uſual, and then fixing it upon the arbour, when the edge of the copper being firſt turned perfectly even with a graver, is next forcibly bent inwards by a ſmall triangular tool, (perhaps formed from the end of a three-ſquare file worn ſmooth,) and afterwards ſquared and finiſhed by the graver and ſcratch-bruſh. It is in general neceſſary to reverſe the coppers on the arbour, and turn a ſmall portion of the under ſide away, both of the ſolid and laid-down kinds, in order to make the edge of a due ſharpneſs. The coppers are laſtly ſet up, and the feet ſoldered on, as before deſcribed. French edges are moſtly uſed for watches of a particular kind, where room is wanting, and the dials are fixed upon the frames without a braſs-edge.

When a dial is made for a ſeconds' watch, or for one requiring ſtill more circles than two, the additional eye, or eyes, is made by marking the centres accurately with a point on the under ſide of the copper, and then bulging the copper upwards with a ſmall punch from each centre, by ſtriking it gently with a ſmall hammer into a piece of lead, about three times the thickneſs of a die; the lead forms a ſufficient reſiſtance to prevent the eye from cracking, and is yet ſoft enough to admit of the copper being bulged up evenly. The ſmall eyes are afterwards evened with the file, and opened with a ſmall needle or round-pin to the required ſizes. Some trivial variations in the mode of making the ſeconds' holes, &c. occaſionally occur.

The coppers being thus prepared, the next proceſs is that of *enamelling*, properly ſo called. Where the operations of *hard* enamelling, and *glaſs* enamelling, are diſſimilar, the difference will be deſcribed in proceeding, but to a certain extent they are the ſame.

The enamel, as it comes from the makers, is generally in ſmall cakes from four to five or ſix inches in diameter. In preparing it for uſe, a ſmall hammer is uſed, having one end flat, and the other of the ſhape commonly employed to rivet with. With this the enamel is broken into thin pieces or flakes, by ſtriking the edge of the cake ſmartly as it reſts upon the fore finger of the left-hand. The pieces are then put into an agate mortar, and with a peſtle of the ſame kind are finely pulverized, the ſplinters being prevented from flying about, by keeping the enamel covered with pure water all the time the proceſs of *grinding* is going on. The point at which the trituration ſhould be diſcontinued, can only be aſcertained from experience, as the different kinds of enamel, and the different modes of its application, require the *ground* enamel to be either more or leſs fine. In general it may be ſtated, that the *backing* ſhould be much finer than the *firſt coat;* the *ſecond coat* of an intermediate fineneſs; the hard enamels conſiderably finer than the glaſs, and the flux ſtill finer than thoſe, as the fire operates with leſs effect upon the flux than upon either of the former ſubſtances. In grinding, great care muſt be taken to keep the enamel free from dirt, and the light flue which ariſes muſt be waſhed away three, four, or more times, as may be neceſſary in the courſe of the operation, till the water comes off quite clear. A ſmall tea-pot is commonly uſed to pour the water from, and when the enamel is ground ſufficiently, the produce is emptied into ſome other ſmall cup for uſe, the ſurface being kept juſt covered with water.

The manner in which the grinding is performed, is by placing the mortar upon the work-board, on a coarſe piece of flannel or linen, twice or thrice doubled, and wetted to prevent its ſlipping. The handle of the peſtle is then graſped firmly about the middle with one hand, and the palm of the other being placed upon the top, the operator inclines the upper part of his body over the mortar, and cruſhes the enamel by preſſing forcibly with his breaſt upon that hand which covers the peſtle. This motion is repeated in quick ſucceſſion, till all the larger pieces are reduced into coarſe and uneven grains; which grains are afterwards ground to the requiſite equality and fineneſs, by holding the mortar firmly down with one hand, and with the other giving a circular direction to the peſtle, uſing at the ſame time as much ſtrength as can be conveniently exerted.

In enamelling watch dials, many coppers are uſually prepared to go on with at once; that method poſſeſſing the three-fold advantage of ſaving time, materials, and labour. When the enamel is ground, therefore, the coppers having been firſt cleanſed by the pickle, and carefully bruſhed out with water, are ſpread, face downwards, over a ſoft half-worn cloth, or ſmooth napkin, and a thin layer of hard enamel, called, in its ground ſtate, the *backing*, is ſpread over the under ſides with the end of a quill, properly cut, or with a ſmall bone ſpoon. The coppers are then ſlightly preſſed on by another ſoft cloth or napkin, which, by imbibing ſome portion of the water, renders the enamel ſufficiently dry to be ſmoothly and evenly ſpread with the rounded ſide of a ſteel ſpatula. The water is then again dried out by the napkin, and a yet further evenneſs produced by going over the enamel as before, with the ſpatula, and theſe operations are repeated, till the back becomes completely ſmooth, and the enamel is of an equal thickneſs all over. It muſt be obſerved, that the water ſhould not be *entirely* abſorbed, as in that caſe the enamel would fall off, in powder, before the ſubſequent operations are completed. When the enamel is properly ſpread, the looſe particles are carefully cleared away from the edge and eye of the coppers; from the former by the ſpatula, from the latter by twiſting round it the pointed end of a quill, and the proceſs of *laying the bottoms* is thus finiſhed. Some ſlight variations to the above method are in uſe among different artiſts, but the difference is ſcarcely important enough to require deſcription. In ſome inſtances the enamel is laid on with the ſpatula itſelf, and the coppers, inſtead of being held between the fingers, are placed upon the round pin, by means of the centre holes, till the backs are duly ſpread: in both modes due care muſt be taken that the coppers are not bent out of their proper forms.

The next operation is to lay the *firſt coats;* that is, to ſpread a layer of *glaſs* enamel over the upper ſides of the coppers. In doing this, the ſurface is firſt bruſhed ſlightly over with a ſmall camel-hair bruſh, or a hare's foot, to remove any dirt or extraneous particles of enamel, as the mixture of any hard enamel with the glaſs would infallibly ſpoil the work. The glaſs is then ſpread upon the coppers in a layer, the thickneſs of which is commonly the ſame as the height of the edge and eye. The water is afterwards ſlightly abſorbed with a clean napkin ſmoothly folded, and the enamel ſpread by a thin, flat ſpatula, till all unevenneſs is removed, and the ſurface lies regularly from edge to centre. The edge being then gently tapped twice or thrice at different places with the ſpatula, the water riſes towards the top, and is again dried off by the napkin, when the enamel is once more made ſmooth by the ſpatula, and the water being wholly taken up by the napkin, or as nearly ſo as can be effected, without diſturbing the enamel, the *firſt coats* are placed upon rings for *firing*.

The rings uſed in enamelling are generally made of a mixture of pipe-maker's clay and Stourbridge clay, rolled up into the form of cylinders, and turned in a lathe by means of a cylindrical piece of wood forced through the centre of the maſs when wet. Each ring is about a quarter of an inch in thickneſs, and the ſame in depth; the upper ſide is prepared for uſe by rendering it ſlightly concave, which is done by rubbing it carefully upon a half globe of lead ſprinkled over with fine ſilver ſand: the under ſide is nearly flat. Through the concavity thus given to the rings, the edge of the copper or dial-plate only is ſuffered to touch, by which means the enamel on the back remains undiſturbed, and the edges are prevented from ſticking by rubbing over the ſurfaces of the rings with ſoft chalk or whiting.

The firſt coats having been placed carefully upon the rings, are next put into a ſhallow tin veſſel, called a tin cover, which is either made ſquare or round, according to the fancy of the artificer, and is commonly about three quarters of an inch in depth. All the moiſture is then ſlowly evaporated from the enamel, by placing the cover upon a German ſtove, or in ſome other convenient ſituation near a fire, where the evaporation can be properly regulated: for, ſhould the water be dried off too quickly, the work would be in danger of ſpoiling from *blebs* or *bliſters*. Theſe are very ſmall air-bubbles, which, by riſing to the ſurface of the dial-plates, deſtroy their ſmoothneſs and beauty. They appear to be occaſioned, partly by want of due care in laying on the enamel, and partly by the confinement of the air which the water contained, and which, in the proceſs of firing, becomes rarefied; throwing off, by its expanſion, a portion of the ſurrounding enamel, yet not entirely eſcaping without a very vivid heat, and even then reſolving into black or green ſpecks, ſo coloured through the oxydation of the copper.

The *firing* is executed beneath a muffle, placed in a ſmall furnace ignited with coke and charcoal. (See MUFFLE and FURNACE *Enamellers*.) The furnace being drawn up to a ſufficient heat by means of a regiſter, the firſt coats are taken ſeparately from the tin covers, and placed upon thin planches of clay, or iron, chalked over, and gradually introduced beneath the muffle; where, in a very ſhort time, the enamel melts, or technically *runs;* and becoming properly conſolidated, the firſt coat is complete. Great attention is requiſite in this operation, to prevent the enamel from being over-fired; as in that caſe, the glaſs would loſe ſome portion of its opacity, and other defects alſo be produced, to the detriment of the work. The planches are placed towards the further extremity of the muffle, by means of a pair of ſpring tongs; and as ſoon as the fuſion is ſeen to take place, are turned carefully round, in order that every part ſhould be equally fired. The planches are generally made circular, and ſlightly concave, for the convenience of moving the work without danger of ſhaking off the enamel before it becomes fixed by the heat.

As all ſolids, when reduced to a granulated ſtate, occupy a greater ſpace than before, *et vice verſâ*, it will be found that a very conſiderable depreſſion has been produced in the enamel of the firſt coats by the act of fuſion; and that the edge and eye are now much above the ſurface. This deficiency in ſubſtance it is the office of the *ſecond coats* to ſupply. When the work is cooled, therefore, the ſcale is wholly removed from the edges and eyes by means of a fine-grained Lancaſhire file, or a ſmooth grey-ſtone; and being then waſhed and dried, each plate is put upon a ſmall round wax-block, of ſufficient bulk to be held in the hand, and about four or five inches high. The feet are then either preſſed firmly into the wax which covers one end of the block, or the plate is otherwiſe fixed by means of three ſmall cones of wax placed triangular-wiſe upon the block; care being taken not to ſtrain the enamel by too weighty a preſſure. A ſecond layer of ground enamel is then gently ſpread with a quill, and prepared for firing by the napkin and ſpatula as before; after which the ſecond coats are placed upon the rings, and the moiſture being evaporated in the tin-cover, (one edge of which, both in this and in the preceding operation, ſhould be left a little open to give iſſue to the ſteam,) they are ready for a ſecond fire.

The ſecond firing requires an equally cautious management as the former one. The plates muſt not be over-fired, nor muſt the heat be ſuffered to melt the enamel too rapidly; but a kind of rotatory motion, called *coddling*, muſt be given to the work, by holding the loaded planch lightly with the tongs, and gently drawing the edge of it towards the mouth of the muffle, and then returning it to its former place, till the fuſion be complete; a proper knowledge of which can be gained only from practice. The work is now in a fit ſtate for poliſhing.

Poliſhing, in this art, has a twofold ſignification: it not only means to render bright, according to the common acceptation of the term; but alſo to make even, without any reference to gloſſyneſs. The enamel has a natural brightneſs of ſurface acquired from the fire; and when this is removed, it is only neceſſary again to expoſe it to a due heat, to cauſe it to reaſſume its former character. Yet as this brightneſs exiſts independent of evenneſs, and as evenneſs is eſſential to the perfection of enamelling, it is requiſite, in moſt caſes, to produce that quality by the methods next to be deſcribed.

The materials uſed in poliſhing glaſs plates are grey-ſtones, rag-ſtones, ſometimes called burrs, fine ground ſilver ſand, and water. The grey-ſtones ought to be of a fine grain and even texture, without knots, which would be very detrimental by making deep ſcratches in the enamel, inſtead of wearing it away evenly. The plates are taken ſeparately, and the thin edges are firſt worn off by one of the finer grey-ſtones, till they become ſmooth and equal; after which the eyes are rubbed down, till the centre of each plate is even and ſquare. Either the grey-ſtone or the rag-ſtone is next employed, according to the nature of the work, to wear away all the irregularities that may exiſt on the ſurface of the enamel; the rag-ſtones being only uſed for the more common kinds of dials. This is done in different ways; *viz.* firſt, either by holding the plate upon the fore and middle finger of one hand, and giving it a ſort of circular motion by means of the thumb, whilſt with the other hand the poliſhing-ſtone is rubbed with a forward and backward ſtroke over every part of the ſurface; ſecondly, by holding the poliſhing-ſtone on the work-board with one hand, and with the other rubbing upon it the face of the enamel; or, thirdly, by fixing the plate upon a cork, either by means of the feet, or with a piece of wet flannel, and with the fingers giving it a kind of rotatory motion, whilſt the poliſhing-ſtone is rubbed over it in a ſimilar manner. The ground ſilver ſand is uſed to give ſharpneſs to the poliſhing-ſtones, and wear away the enamel with greater celerity than would be otherwiſe acquired; and the act of poliſhing is continued till all the gloſs is ground off the ſurface. In this operation great care muſt be taken that the preſſure be not too powerful, as the plates will then crack in the fire, and can never, or very rarely, be properly mended.

When the enamel is ſufficiently poliſhed, which is eaſily known by the criterion of all the gloſs being removed, the plates muſt be clean waſhed, and the ſpecks of dirt, &c. picked out with a ſharp graver. They are then well rubbed over with ſome fine ground glaſs, either by means of a cloth, a glaſs mull, or perhaps a ſmall bit of fir-wood cut ſmooth, in order to remove the ſtains that may be left by the poliſhing-ſtones; and the clean water being ſuffered to run over them, they are wiped dry, and again placed upon the rings for firing.

The degree of heat neceſſary for poliſhed plates is determined by the finer or coarſer modes in which they were prepared; as the fuſion is much facilitated by the enamel being free from ſcratches. When the ſurface is properly run, that is, when it becomes perfectly ſmooth, even, and bright, the plate is completed; and when cold, is fit for painting on. See PAINTING *of Clock and Watch Dial-Plates.*

The above deſcription regards more particularly the beſt kinds of work; but for the more common work there are two other modes of enamelling practiſed, which it will be requiſite briefly to explain. The plates made in theſe ways are called *run-down plates*, and *run-down ſecond coats*.

Run-down plates are thoſe which are made by laying the enamel upon the coppers in ſufficient quantity to form plates of the required thickneſs, without putting on a ſecond coat. Both labour and fire are thus ſaved; but that neatneſs, regularity, and ſquareneſs, which are acquired by the firſt method, are rarely obtainable in this: and indeed flat plates can hardly be managed at all in this mode. Run-down plates require more coddling than any other; and a longer continuance of vivid heat is neceſſary to make the glaſs flow to a proper evenneſs of ſurface: the plates being wholly completed with one fire, and without poliſhing. It is obvious that the moſt common work only can be thus manufactured; for that of the next ſuperior deſcription, the run-down *one coats*, are poliſhed off with the rag-ſtone, and undergo a ſecond firing. The run-down ſecond coats are thoſe which are reduced to a ſurface comparatively even by the ſecond fire, and are then painted on without being poliſhed off.

In enamelling *hard-plates* for watches, the coppers and the firſt coats are prepared in the manner above deſcribed; excepting perhaps that the layer of glaſs is rather thinner than in glaſs-work only. The hard enamel, which is generally moſt valued as it approaches to a rich cream colour, is broken down, and ground in the ſame way as the glaſs, if a ſmall quantity alone be wanted; but if otherwiſe, it is firſt broken from the cake with the hammer, and then pounded in a ſteel mortar, till reduced into coarſe grains. Theſe grains are then expoſed to the action of a magnet, in order that all the particles of ſteel that have been broken off the mortar in the act of pounding may be taken away, as they would infallibly ſpoil the work, by riſing in black ſpecks to the ſurface of the enamel, when in the fire. As an additional precaution, alſo, it is neceſſary to put the granulated enamel into a ſmall baſon, and pouring upon it a ſtrong ſolution of oil of vitriol, or aquafortis, to ſuffer it to ſtand for ſome hours, that the ſteel particles, &c. may be wholly diſſolved; after which, the enamel muſt be very carefully waſhed, till the water comes off pure and taſteleſs: for ſhould any of the acid remain, the work would certainly bliſter. The enamel is then ground to the neceſſary fineneſs in an agate mortar, and afterwards ſpread over the firſt coat with a quill, in ſmall quantities, and as evenly as it can be laid, that it may require the uſe of the ſpatula as little as poſſible. The water is then partly abſorbed by a very fine and clean napkin, and the enamel ſmoothly ſpread and cloſely compreſſed with the ſpatula; after which, more water is abſorbed, and the ſpreading is continued till the ſurface lies true and equal. The plate is then put upon a ring, and properly fired; and is afterwards poliſhed by placing it upon a cork, (the top edge being firſt taken off with a fine grey-ſtone,) and wearing away the ſurface, firſt, by a very fine-grained Lancaſhire file, or ſmooth piece of ſteel, and ſilver ſand, ground to an almoſt impalpable powder; ſecondly, by a fine blue-ſtone and ſand; and thirdly, by the blue-ſtone alone. With the latter a ſort of half-poliſh ſhould be given to the enamel; and the nigher that poliſh approaches to complete gloſſyneſs, the better; as the plate will then be finiſhed in the third fire with a leſs degree of heat than would be otherwiſe wanted. In this proceſs, much caution is required to prevent ſcratches, which cannot be *run up* by the fire without giving the enamel a greater heat than it will well bear. When the poliſhing is completed, the plate is carefully cleaned with ground enamel; and ſhould there be any ſpecks, they muſt be picked out with a ſmall and ſharp diamond, and the hollows very dextrouſly filled up with enamel from a quill-point, that they may neither riſe above or ſink below the common ſurface, when the plate is again fired: ſhould they actually do ſo, they muſt be made ſmooth with a blue-ſtone, and the plate muſt undergo a fourth fire, to render the ſurface of one uniform texture and gloſſyneſs. Hard-enamel dials are always conſiderably dearer than glaſs ones, through the greater labour, attention, &c. that are requiſite in making them; and the beſt watches are almoſt always made up with dials of this kind.

In the poliſhing off both of glaſs and hard plates, much addreſs is neceſſary to prevent a ſeparation between the enamel and the edge of the copper; for if too great a preſſure is exerciſed, or if the grey-ſtones, which are employed to wear down the copper, are of too rough a grit, the adheſion will be deſtroyed, and various black indents ariſe round the edge of the enamel, when the plate is again expoſed to the fire. In glaſs dials, theſe defects may be ſometimes amended; but in hard-enamel dials, ſcarcely ever.

The operations of *tranſparent enamelling* are nearly ſimilar to what have been already deſcribed in the making of watch dials. As the work is generally of a more minute kind, greater delicacy of handling perhaps is required; and as the enamels are of various colours and deſcriptions, more cups, veſſels, &c. and additional ſoft cloths or napkins, are wanting to keep them from mixing. Watch caſes are commonly enamelled upon gold, as well as moſt ſuperior articles of the fancy kind; and the ſurface of the gold is frequently engraved into different figures and compartments, before the enamel is laid on; by which means the work aſſumes a beautiful variegated appearance through the vitreous coating.

In enamelling the backs and edges of watch-caſes, &c. quince-water is frequently uſed as the medium by which the enamels are laid on; for this poſſeſſing a more adheſive and retentive quality than common water, better prevents the enamel from flowing from its proper ſituations: for where the convexity is conſiderable, the enamel will of courſe have a tendency to float towards the loweſt part. When enamels of different colours are intended to be employed on the ſame article, which is frequently the caſe in ornamental works, ſmall edges or prominent lines are left in the ſubſtance of the metal, for the purpoſe of keeping the enamels ſeparate; and theſe are poliſhed with the enamel, and reduced with it to a ſimilar equality of ſurface. Tranſparent enamels are not unfrequently poliſhed to complete gloſſyneſs, without expoſing them to an additional fire: in theſe caſes, the work is finiſhed with rotten-ſtone.

It is ſometimes deſirable to take off the enamel from a watch-caſe or trinket, without injuring the metallic part. For this purpoſe it has been recommended to lay a mixture of common ſalt, nitre, and alum in powder, upon the enamel requiring to be removed; and afterwards to put it into the furnace: and when the fuſion has commenced, to throw the caſe, &c. ſuddenly into water, which cauſes the enamel to fly off in flakes.

In ornamental tranſparent work, a very pretty effect is often produced by applying ſmall and very thin pieces of gold or ſilver, cut or ſtamped, into different figures, as acorns, oak-leaves, vine-leaves, bunches of grapes, fruits, &c. upon the ſurface of the firſt coating of enamel, where they are fixed by the fire; and are afterwards covered over by the ſecond layer, through which they appear with conſiderable beauty. When any quantity of fancy-works of ſimilar deſign is wanting, this mode of enamelling is much cheaper to execute than to have the ſurface of the metal itſelf engraved into the required forms.

Clock Dial-Plate Enamelling, is far more laborious than the other branches, and requires conſiderable experience to be properly executed, though the methods of operation are ſoon explained. The copper, being procured from the flatting mills in thin ſlips, and of an adequate diameter and thickneſs, is cut to nearly the required ſize with a pair of ſtrong ſciſſars, a circle having been firſt ſtruck with the compaſſes. If in a ſoft ſtate, it is then cleaned by the pickle, and having been bruſhed out with ſand on a flat board, is waſhed and dried for planiſhing; if otherwiſe it muſt be well annealed before it is thrown into the pickle, where it muſt lie till all the ſcale is enough ſoftened to be removed by the hand-bruſh, ſand, and water.

Planiſhing is a very important part of clock-plate enamelling, and too much care cannot be exerted in the proceſs, as the neceſſary regularity of ſurface almoſt wholly depends upon it. In large plates the action of the fire has a very conſiderable effect, as it cauſes an expanſion in the metal, which, unleſs properly guarded againſt, cannot but operate to the imperfection, and perhaps total ſpoiling of the work. In flatting alſo, a ſort of twiſt is not unfrequently given to the copper, during its paſſage through the rollers, that would aſſuredly cauſe the plate to become uneven and out of ſhape, were it not to be removed by planiſhing and repeated annealings. Another effect produced by the fire, is occaſioning the plate to riſe, perhaps irregularly, towards the centre, and this can only be checked by counteracting the action which the heat would otherwiſe generate in the metal by good planiſhing. To keep a large plate entirely flat is impoſſible; or at leaſt no means have as yet been diſcovered through which that aim can be attained. The beſt way, therefore, to provide againſt the irregularities which the fire might cauſe, is to give to the copper, in the courſe of planiſhing, a ſlight and even riſe or curve from the edge to the centre; this can either be effected by the uſe of large braſs dies, or by a machine adapted for the purpoſe.

The *machine* of which, probably, there is only one in the trade, conſiſts of two principal parts; the one a ſolid maſs of iron, with a concave and poliſhed face, imbedded immoveably in a ſtrong oak block, firmly fixed on a foundation of brick-work, and the top edge hooped with a thick iron ring, to prevent ſplitting; the other, an anſwering and weighty maſs of iron with a convex face, ſimilarly poliſhed, and fixed in an upright frame of timber, but ſo contrived as to become *moveable* by means of ſliding grooves, a rope, a pulley, and a lever, and ſo placed as to fall directly upon the maſs beneath, in a ſimilar way to the monkey of a pile-driving engine. The diameter both of the hammer and the anvil, as the upper and under maſſes of iron may be called, for the ſake of perſpicuity, is about thirteen inches; that ſize being nearly as large as clock dials are ever made or wanted. The convexity of the hammer is exactly fitted to the concavity of the anvil, and may be deſcribed, perhaps, as forming a portion of a circle fifty feet in diameter; and the centres of both are kept true to each other, and conſequently to the regularity of curve, by means of large ſcrews and nuts, which adjuſt the poſition of the hammer by altering the perpendicularity of the bars of iron that the grooves act upon. The power of this machine ſaves much labour in planiſhing, as well as time; yet as it is inſufficient wholly to prepare the coppers, and as the charge of erecting one would be very conſiderable, it will never, perhaps, come into general uſe.

In planiſhing with this machine, it is neceſſary to be provided with various thin circular pieces of lead, evenly flatted, and adapted in ſize to the diameters of the coppers to be planiſhed. Without theſe the ſtroke given by the hammer would have a very imperfect effect; and the impulſe given by the weight of its fall would alſo be continually weakening the foundation and bed of the anvil.

The coppers prepared for planiſhing by this machine are taken ſeparately, (the eyes having been previouſly cut out to a proper ſize by means of an iron punch, an hammer, and a lead block,) and each one is laid upon a lead of a correſpondent diameter, and placed upon the anvil in ſuch a manner that all the centres agree. The hammer, which has been hitherto retained at ſome height by an iron ſtay fixed in one of the timbers, and moving on a pivot, is then let fall, three or four times in quick ſucceſſion, it being each time lifted up to the height of three feet or more, by means of the lever. The hammer is then again faſtened by the ſtay, whilſt the copper is turned over on the lead, after which the operation is repeated, and the copper is then taken off, and another laid down till the whole are gone through. The weight of the hammer, and the impetus acquired by its deſcent, remove moſt of the unevenneſſes in the coppers, yet cannot entirely remedy them: a ſtrong and unequal ſpring will ſtill be felt, and the metal being now rendered hard by the action of the hammer, annealing muſt again be reſorted to, and the coppers muſt be pickled and cleaned as before. The machine is then uſed a ſecond time in a ſimilar way; and afterwards a third, a fourth, a fifth, and even a ſixth and ſeventh time, according to the diameters of the coppers, or to the refractorineſs of the metals, due care being taken properly to anneal and pickle them between every operation.

The coppers will now be found of a regular ſhape, and the ſpring in the metal tolerably uniform; it is eſſential, however, to the perfection of the plate, that the ſpring ſhould be *entirely* uniform from edge to centre, otherwiſe the plate would warp and cockle in the fire. A kind of intermediate proceſs muſt therefore be carried on between the taking the coppers from the machine, and before repeating the annealings. This is performed by means of a circular braſs die, about a quarter of an inch in thickneſs, and from fifteen to eighteen inches in diameter, ſcrewed firmly down to a ſtrong oaken block, having three ſtout legs, placed triangular-wiſe, and of a ſufficient height to uſe conveniently when the artiſt is in a ſtanding poſture. The die ſhould have the ſame degree of curve as the machine, otherwiſe the effect produced by each would occaſion a ſort of reciprocal counteraction. The coppers, having paſſed through the machine, are placed in ſucceſſion upon the die, and a wooden box-hammer (ſomewhat reſembling that uſed by gold-beaters) with two faces, the one a circle about three inches over, the other cut away on the front edges, ſo as to leave only a portion about an inch or an inch and a quarter in breadth remaining in the middle, is then taken, and the copper is both rubbed and ſtruck with it till the metal becomes too hard for any further impreſſion to be made, and requires annealing. The circular end is uſed to ſtrike the copper with, which is done by ſhort, quick beats of the hammer, the artiſt working from centre to edge, and communicating the neceſſary motion and direction to the coppers by means of the fingers of one hand, ſo extended over the work as to give the requiſite command in guiding it: the other end is employed in rubbing the coppers ſtrongly with a backward and forward action, under which they are moved upon the die by the fingers as before. Where the machine is not uſed, the planiſhing muſt then be entirely performed in the way juſt deſcribed, and great care muſt be taken, that in the rubbing, the coppers be not bent, which would occaſion both additional labour, and further annealing. No poſitive direction can be given as to the number of times that the coppers muſt be annealed in the courſe of the planiſhing; as a general rule, it may be ſaid that the larger the ſize, the more frequently muſt the annealings be repeated. For plates of from three to four inches, twice or thrice is commonly enough; from five to eight inches, about four or five times are requiſite; for larger ſizes, the annealings muſt be continued till the ſpring or action in the metal becomes uniform, as already mentioned. This is beſt determined by the regularity with which the copper will flap or jerk into the curve given by planiſhing when turned either ſide uppermoſt upon the die. When the planiſhing is completed, the coppers are cut exactly to the ſizes required, and having been pickled and cleaned, they are then ready to be enamelled on. After the laſt annealing, it is beſt to planiſh but ſlightly, that the coppers may be left in a ſtate of comparative ſoftneſs.

For time-pieces, table clocks, and ſome others, *round* plates are commonly uſed, and in theſe caſes it is neceſſary to have moveable braſs dies formed into the curves required. Round plates are thoſe which have a conſiderable riſe in the centre, made by a pretty quick forcing up of the copper into a ſort of ſhoulder about where the circles of the hours come, and afterwards continuing the riſe more gradually. The bent ſpatula and the ſcratch bruſh are chiefly employed to ſet the coppers into theſe curves, and where the riſe is very quick from the edge, the copper is ſometimes turned up as in ſmall dials, that the enamel may be the better retained in its place.

The quantity of enamel wanting for clock dials renders the grinding it a very laborious and tedious operation; eſpecially as the hard kind only can be uſed with complete certainty. It is true that plates of from ten to twelve inches diameter have been made with glaſs enamel, where particular attention has been given to the *annealing up*, and to the *cooling down*, (phraſes that will be preſently explained,) and where the backing has been of a quality perfectly agreeing with the nature of the glaſs. Of the experiments made in this way, however, the ſucceſs has not always been proportionate to the loſs, and the few enamellers who have clock-furnaces cannot always be induced to repeat them.

The enamel for clock dials is broken down in a ſteel mortar, and afterwards cleanſed and ground in an agate mortar, in a ſimilar way to that prepared for watch plates. Sometimes, where the enamel is of a good quality, the *waſhings* are made uſe of for backing, and no bad conſequence reſults, but this requires conſiderable care in the laying on as well as in properly drying, in order to prevent the ſurface of the back from riſing in bliſters, either entirely or partially. Waſhings is the name given to the almoſt impalpable powder which ariſes in grinding, and floats in the water, intermixed with the duſt and minute hairs which are ſure to fall into the mortar, and which renders it neceſſary that the enamel ſhould be ſeveral times waſhed during the proceſs by pouring off the buoyant matter from time to time, and introducing freſh water, from the tea-pot. Pure ſpring water ought always to be uſed, and a large baſon provided for the reception of the waſhings.

In the beſt and largeſt kinds of work, the waſhings ought never to be uſed, as their great propenſity to bliſter can hardly be counteracted; and when the bliſtering is conſiderable, the plates will aſſuredly *cockle*, or get out of ſhape. The peculiar fineneſs of the waſhings, alſo, occaſions it to be very difficult to lay on as backing in an even manner. Where the enamel in ſubſtance only is uſed, the ſucceſs of the work is rendered more certain; the additional expence therefore is fully balanced by the greater ſecurity.

The general way of putting on the enamel is to lay the copper upon a cloth, twice doubled, and placed upon a die or piece of board, for the conveniency of turning. The backing is then ſpread carefully over it by means of a ſmall ivory or bone ſpoon, and when the whole ſurface is covered, the water is partially dried off by another cloth, and the enamel laid even by a large ſpatula, (ſee SPATULA,) finely poliſhed. Theſe operations are repeated till the back ſurface is ſufficiently evened and dry; when the copper is turned, and the firſt coat laid on and evened in a ſimilar manner. The work is then placed upon a planch for firing, and is next put into the annealing places in the upper part of the furnace, (ſee FURNACE *for Clock-Dials*,) where the humidity is gradually evaporated as the fire draws up. The planches are from a quarter of an inch to three quarters in thickneſs, in proportion to the ſize, and are either made of fine free-ſtone, or of a compoſition of Stourbridge clay, pipe clay, and *old ſtuff*, as the broken muffles, planches, &c. are called, pounded together in an iron mortar, and paſſed through a coarſe ſieve. The face of each planch is either flat or rubbed into a ſimilar curve to that given to the coppers, and before the work is put on to it, a ſlight covering of whiting, dried, is ſifted over it, through a ſmall braſs-wired ſieve: this is done to prevent the enamel from ſticking to the planch when in the act of fuſion.

The muffle is *got up* or rendered hot with ſea-coal, and when ſufficiently vivid, which is known by its near approach to a white heat, the firſt coats are taken from the annealing holes by means of iron prongs, which are ſlid beneath the planches by a ſteady and careful motion, leſt the enamel ſhould be ſhook whilſt in powder; to prevent this, alſo, a farther proviſion is frequently made by means of *irons*, as they are called in the buſineſs, which are placed below the planches, and having a round form, and a convex bottom, are extremely uſeful in moving the work, by admitting the prongs to be readily paſſed below them. The irons are adapted to the ſize of the planches, and are formed out of thin iron plates, and are cut into a circular ſhape; ſome portions of the metal, to render the irons leſs weighty, being wholly removed from between the rim and the centre, which from this circumſtance appear to be connected by croſs bars.

When the firſt coats are properly fired, which can only be determined from practice, they are replaced in the annealing holes, and there left for ſome hours to cool down, all the fire having been firſt raked out from the furnace. The operation of cooling down muſt be effected in a very gradual manner, for were it done too quickly, the plates would crack in different places, through the action of the metal upon the enamel. The particular cauſe of this cracking ſeems to ariſe from the ſurface of the enamel being too ſuddenly fixed by the cold air, to admit of that gradual adjuſtment to the contraction of the metal, which the latter, by retaining the heat longer than the enamel, renders neceſſary. On a ſimilar principle, the annealing up of the ſecond coats muſt be equally progreſſive; for ſhould they be too ſuddenly put into the fire, the metal, by expanding with the heat before the fuſion of the enamel has commenced, would cauſe the enamel to fly through its brittleneſs, and the ſurface would be thereby ſtreaked with cracks.

The enamel for ſecond coats, as in watch plates, muſt be ground finer than for firſt coats, yet not ſo fine as for backing. It is laid on with a ſpoon, and reduced to a ſmooth and equal ſurface by the ſpatula, in the ſame manner as above deſcribed; and the plate being enamelled with the requiſite attention, is fired a ſecond time, and gradually cooled down as before. The next operation is poliſhing.

Clock plates are poliſhed by a ſomewhat different proceſs than watch dials. When perfectly cold they are taken off the planches, and either carefully fixed upon a bed of wet ſand, ſo that not any hollow or vacancy is left below the plate, or imbedded in a ſimilar way with ſand upon wet flannel, twice or thrice doubled. When thus prepared, the ſurface is gradually worn even by means of fine ſilver ſand, paſſed through a ſieve, that the coarſer particles may be prevented from ſcratching the enamel, and poliſhing-ſtones formed of flint pebbles, ground at one end to a regular ſurface. The ſand is uſed with water, and the operation is performed by giving the poliſhing-ſtone a quick circular direction in progreſſive movements over every part of the plate, till the ſurface is evenly reduced, which is known by the gloſſyneſs being wholly worn off: this occupies from half an hour to an hour, or more, according to the ſize and previous evenneſs of the plate. Sometimes the poliſhing is accelerated by uſing pieces of lead or iron, as half-pound weights, for inſtance, in the early ſtage of the proceſs, and afterwards finiſhing with the flint; and that not only to give a ſmooth ſurface to the enamel, but likewiſe to remove the general ſtain or blackneſs which proceeds from the uſe of the lead or iron. When the poliſhing is completed, the plates are well waſhed and bruſhed, and afterwards made perfectly clean by ſome fine enamel being ground over the face of each with a ſmall mull or poliſhing-ſtone for about a quarter or half a minute; the operation being repeated twice or thrice, as may be neceſſary, and the looſe enamel being carefully wiped off with a ſmooth cloth or napkin, after the laſt cleanſing, inſtead of being waſhed away: this is done in order that the ſmall pores which are ſometimes laid open by poliſhing into the ſubſtance of the plate, may be filled up by the minute particles of enamel that eſcape the action of the cloth, but would be removed by the water. Whatever ſpecks or bliſters may be in the plate, are then opened with the diamond, and the holes neatly ſtopped with finely-ground enamel from a quill-point, as in watch-plates; the *ſtoppings up* being ſuffered to lie rather higher than the ſurface, to admit of the reduction in bulk occaſioned by the fuſion. The plates are now again put into the annealing places upon the planches; and the furnace being properly heated, are fired for the third and laſt time, before painting. In this latter firing, great care ſhould be taken that the enamel be not over-fired, which would occaſion a freckled appearance in the plate, when held againſt the light; and if the work is drawn out from the muffle after the fuſion has commenced, and again returned to complete it, the air will be found to have given additional richneſs to the gloſſyneſs of the ſurface. The preciſe time required for firing poliſhed plates can only be known from practice; thoſe on which the fineſt poliſhing-ſand was uſed, and, of courſe, where the ſcratches are leſs deep, wanting leſs heat than when the ſand has been employed in a rougher ſtate. After firing, the finiſhed plates are returned to the annealing-holes, and gradually cooled down for painting on. See Painting *of Clock and Watch Plates.*

In the making of *fluxed plates* for enamel-paintings, ſimilar methods of planiſhing are practiſed to thoſe already detailed; and ſimilar or even increaſed care muſt be taken in deſtroying or regulating the ſpring of the copper. Fluxed plates are commonly either ſquare or oval: in the ſquare ones, about an eighth of an inch, or ſomewhat more, ſhould be cut off each angle of the copper, previous to enamelling, to prevent the danger of breaking them. In preparing them for the flux, every thing is conducted in the ſame way as for clock-dials, till they are poliſhed off, when, inſtead of firing them in their poliſhed ſtate, the flux is laid on as a third coat. In grinding the flux, very particular attention muſt be given to keep it free from dirt; and the grinding muſt be continued till the flux becomes extremely fine, as it will not otherwiſe flow to an even ſurface, when expoſed to the fire, without a more intenſe heat than the ſubſtance will well bear. The flux indeed requires a peculiar delicacy of treatment, and the firing of the fluxed plates muſt be managed with great caution and nicety. The heat which they require in fuſion is much ſtronger than that for enamels only; but the exact point of time for withdrawing them from the furnace muſt be dexterouſly ſeized, leſt the flux ſhould fall into freckles. It is not cuſtomary to poliſh off the flux, as by ſo doing it would be deprived of ſome portion of its brilliant richneſs; yet that perhaps would be in ſome meaſure compenſated for, by the ſuperior evenneſs that would be attained. Fluxed plates muſt be cooled down with great care, as the brittleneſs of the upper coating renders them more liable to crack when too ſuddenly made cool. In fluxing, hard enamel muſt always be uſed; as the flux will not agree with glaſs enamel, but cracks in circles as it grows cold. See Flux.

The greater ductility of gold, and its ſuperior mellowneſs of colour, render it by far the beſt metal that could be employed for the baſis of fluxed plates; though, on account of the expence, it is ſeldom uſed. For naked figures, portraits, or other ſubjects, where much fleſh is exhibited, gold plates ought to be excluſively employed, as their rich hue would ſave conſiderable labour in the painting.

Till the preſent age, fluxed plates were ſeldom made of a larger ſize than four or five inches; but ſince the art of enamel-painting has been carried to ſuch great perfection by Mr. Bone, enamel-painter to the king and the prince of Wales, they have been progreſſively increaſed in extent for his uſe, and are now made of every ſize up to twelve and fourteen inches. The largeſt ever completed meaſures eighteen inches by ſixteen and a half; and Mr. Bone is now employed in painting it from Titian's famous picture of Bacchus and Ariadne, in the collection of lord Kinnaird. See Painting *on Enamel.*

In chuſing enamels for uſe, great experience is neceſſary: indeed the moſt expert practitioner may be deceived, unleſs he make the requiſite trials by aid of the furnace. Some enamels can only be employed alone; others may be uſed for the upper coats, but require a ſtronger kind for the backs; and ſome can be uſed only for backing. Should a new ſort be proffered for uſe, experiment alone is the criterion by which its qualities can be determined. In a ſimilar manner, ſome fluxes will only agree with particular enamels; others muſt be uſed ſeparately; and others again muſt be mixed in grinding, before they can be employed with certainty.

In every branch of enamelling, it is eſſential that the copper, or other metal employed to enamel on, ſhould be of a proper thickneſs. Should the metal be too thick, the plates will always crack, either in their ſecond coats, or in their poliſhed ſtate; and ſhould it be too thin, they would be extremely likely to warp from the too powerful action of the enamel. The due medium can only be aſcertained by practice; for even the different kinds of enamel will require a difference in the thickneſs of the metal.

The proper management of the fire, and the mode by which the muffle is heated, will be explained under the words Furnace and Muffle; it need only be ſtated here, that the time neceſſary to *get up* a clock furnace varies from about an hour and a half to two and three hours, or more, according to the intenſity of the draught, the method of ſtoking, and the quality of the fuel. The work is turned in the muffle by means of ſpring tongs, ſo that each part may have a regular and due heat; and it is returned into the annealing places with the prongs. Should many plates be fired at one time, the labour will be found to be very ſevere, and the heat too powerful; as it carries a flux of blood to the head, and occaſions languor and oppreſſion throughout the whole frame.

Enamelling *Flux*. See Flux.

Enamelling *Furnace*. See Furnace.

Enamelling, *Imitative*. See Japanning.

Enamelling *Muffle*. See Muffle.

Enamelling *Spatula*. See Spatula.

ENARA, in *Geography*, the chief lake of Lapland, in the northern extremity, about 70 Britiſh miles in length by 30 at its greateſt breadth.

ENAREA, a province of Abyſſinia, conquered by the troops of the Negus, at the beginning of the 17th century, ſituated at the S.W. extremity of the empire.

ENARGEA, in *Botany*, from εναργης, *conſpicuous*, or *diſtinguiſhed*, alluding doubtleſs to the ſtriking and elegant appearance of the plant, ſo little to be expected in the dreary country about the Straits of Magellan, of which it is a native. Banks in Gærtn. v. 1. 283. t. 59. f. 3. Schreb. 232. Willd. Sp. Pl. v. 2. 230. Mart. Mill. Dict. v. 2. (Callixine; Juſſ. 41. Lamarck t. 248. f. 2: alſo, Phileſia; Juſſ. 41. Lamarck t. 248. f. 3. Willd. Sp. Pl. v. 2. 231.) Claſs and order, *Hexandria Monogynia*. Nat. Ord. *Sarmentaceæ*, Linn. *Aſparagi*, Juſſ.

Gen. Ch. *Cal.* none. *Cor.* Petals ſix, erect, elliptic-oblong, acute, inferior; three of them exterior; three interior, larger. *Stam.* Filaments ſix, ſhorter than the corolla, equal, awl-ſhaped, dilated at the baſe, ſlightly attached to the bottom of each petal; anthers oblong, verſatile, incumbent. *Piſt.* Germen ſuperior, globoſe; ſtyle the length of the ſtamens, erect, ſwelling, and triangular upwards; ſtigma in three obtuſe lobes. *Peric.* Berry globoſe, of three cells. *Seeds* angular, three or more in each cell.

Eſſ. Ch. Calyx none. Petals ſix, erect; three of them internal. Stigma three-lobed. Berry ſuperior, with three cells and many ſeeds.

1. E. *marginata*. Gærtn. as above. Willd. Sp. Pl. v. 2. 230. Petals nearly equal. Leaves with many ribs.—Our ſpecimens of this pretty little plant were, ſome of them, gathered by Commerſon in the ſtraits of Magellan, and communicated by the celebrated M. de Juſſieu; others by Mr. Archibald Menzies in Staten land near Cape Horn, in Feb. 1787, all of them in bloſſom. Lamarck's figure is a tolerable repreſentation of the whole plant, except the ſtigma, which he erroneouſly draws ſimple and entire. His fruit is copied from Gærtner.—The *roots* are creeping, and throw out cluſters of branched fibres. *Stems* a ſpan high, erect, branched, angular, deſtitute of pubeſcence, as is the whole herb; branches zig-zag, leafy, ſheathed at their baſe. *Leaves* alternate, nearly ſeſſile, upright, about half an inch or more in length, elliptical, acute, entire, ſomewhat revolute, their edges rough with minute ſpines; their underſide marked with three or five ſtrong prominent ribs; the upper even. *Flowers* terminal, ſolitary, drooping, on ſhort ſimple ſtalks. *Petals* white, ribbed; the three outermoſt elliptical; the reſt rather broader and obovate; each of the ſix is ſaid by Gærtner to be marked with two green ſpots below the middle. Commerſon deſcribes three of them only as having a pair of obſolete glands at their baſe. *Berry* the ſize of a pea.

2. E. *buxifolia*. (Phileſia buxifolia; Willd. Sp. Pl. v. 2. 231.) Inner petals thrice as large as the outer. Leaves with numerous tranſverſe veins.—Commerſon alone ſeems to have found this fine ſpecies, in the ſtraits of Magellan. Lamarck's plate, drawn from one of his dried ſpecimens, is a very juſt repreſentation. We have received ſeveral of theſe from Thouin and Juſſieu. The *ſhrub* is two or three feet high, with the aſpect of box, much branched and ſmooth. *Leaves* ſtalked, an inch long, elliptic-oblong, pointed, revolute; green, ſmooth, with a longitudinal furrow above; glaucous, with a central prominent rib, a marginal one at each edge, and numerous tranſverſe veins, beneath: their edges are rough with minute teeth near the point. *Flowers* terminal (not axillary), large and very handſome, apparently reddiſh; their three outer petals elliptical, flat, about half an inch long; the three inner obovate, thrice as long; all veiny. We preſume to unite theſe two plants under one genus, the differences deſcribed in their ſtigmas having no foundation in truth, and there being a ſufficient difference between the outer and inner petals of the firſt, to ſhew that a more ſtriking difference of the ſame kind in the ſecond can only make a ſpecific, not a generic, diſtinction. S.

ENARGIA, Εναργεια, in *Rhetoric*, a figure, which paſſing from the narrative ſtyle, points out, and as it were, ſets the ſubject before the eyes of the audience. Voſſ. Rhet. lib. iii. p. 361.

ENARTHROSIS, in *Anatomy*, is that kind of joint, in which a rounded head of one bone is received into a cup-like hollow of another. See Diarthrosis.

ENBAR, in *Geography*, a town of Aſiatic Turkey, in the Arabian Irak, on the Euphrates; 40 miles weſt of Bagdad.

ENBORNE, a pariſh in the hundred of Kentbury-Eagle, Berkſhire, England, is ſituated 59 miles from London, and contains 46 houſes, and 275 inhabitants. A remarkable and well-known cuſtom is attached to its manors, that if the widow of a copyholder ſhould marry again, or be guilty of incontinency, ſhe forfeits her free-bench, or life-intereſt in her late huſband's copyhold; which is not recoverable but by her ſubmitting to ride into court upon a black ram, repeating ſome ludicrous lines, which end with a petition for her huſband's land. The ſteward of the manor is then obliged to reinſtate her. At every court, the jury ſtill preſent this as one of the ancient cuſtoms of the place. The penalty has not been literally enforced within the memory of man; but it is ſaid, that a pecuniary commutation has been received in lieu of it, which may perhaps have been more readily accepted, from the difficulty of procuring a proper animal for the purpoſe. Lyſon's Magna Britannia, vol. i.

ENCÆNIA, Εγκαινια, a Greek term, ſignifying *reſtauration*, or *renovation*, being compounded of the prepoſition εν, and καινος, *new*.

Encænia is more particularly uſed for the name of a feaſt celebrated by the Jews on the twenty-fifth of the ninth month, in memory of the dedication, or rather purification of the temple, by Judas Maccabæus, after its having been polluted and plundered by Antiochus Epiphanes.

The Jews had alſo two other Encænia, *viz.* the dedication of the temple by Solomon, and that of Zorobabel, after the return from the captivity.

ENCÆNIA is likewiſe applied in the *Fathers*, and *Church-Hiſtory*, to the dedication of Chriſtian churches. See DEDICATION.

Our tranſlators of the Bible do not retain the word Encænia, in St. John, x. 22. where mention is made thereof; in lieu of that, they call it "Feaſt of the Dedication," which is leſs proper. In effect, it is not the feaſt of the dedication, but of the purification or re-conſecration of the temple profaned, that is there ſpoken of.

St. Auguſtine aſſures us, that in his time the uſe of the word Encænia was even transferred to profane matters; and that they called it *Encæniare*, when they put on a new ſuit of clothes.

ENCALYPTA, in *Botany*, from εν, and καλυπτος, *covered* or *veiled*, alluding to the extraordinary ſize of the calyptra or veil, which is a characteriſtic mark of the genus. Extinguiſher-moſs; Schreb. 759. Hedw. Sp. Muſc. 60. Sm. Fl. Brit. 1180. Turn. 17. (Leerſia; Hedw. Fund. v. 2. 88. Bryum; Linn. Gen. 564. Juſſ. 11. Hudſ. 474. Dill. 338.) Claſs and order, *Cryptogamia Muſci*. Nat. Ord. *Muſci*.

Gen. Ch. Male, *Flowers* axillary, compoſed of imbricated ſcales. Female on the ſame plant. *Fl.* terminal, ſeveral abortive. *Capſ.* ſtalked, cylindrical, inclining to ovate, erect, regular. *Fringe* ſimple, of ſixteen linear, upright, thin, paliſh teeth. *Veil* bell-ſhaped, inflated, membranous, much wider than the capſule, erect, often toothed or fringed at the edge.

Eſſ. Ch. Capſule cylindrical. Fringe of ſixteen linear upright teeth. Veil bell-ſhaped, inflated, lax.

This is but a ſmall genus, conſiſting of five ſpecies only in Hedwig's Sp. Muſc. and of four in the Flora Britannica, to which indeed a new one, E. *alpina*, is added in Engl. Bot. t. 1419. The moſt common is E. *vulgaris*. "Veil entire and ſmooth at its margin. Stem nearly ſimple. Leaves lanceolate." Figured in Engl. Bot. t. 558. (*Bryum extinctorium*); and by Dillenius in his t. 45. f. 8. It occurs not unfrequently on ſhady banks, and in the crevices of rocks, and is ſtrikingly diſtinguiſhed by its large and deep veil. E. *ſtreptocarpa*. "Veil contracted and torn at its margin. Stem branched. Leaves oblong. Capſule ſpirally furrowed." Is the largeſt and fineſt ſpecies, long much miſunderſtood by botaniſts. See its figure in Hedw. Sp. Muſc. t. 10. f. 10—15, and Haller's Hiſt. t. 45. f. 3. Dillenius exhibits the leaves and ſtem only, t. 43. f. 71.

Mr. Turner, in his Muſcologiæ Hibernicæ Spicilegium, ſuggeſts an opinion that this genus is not really diſtinct from *Grimmia*, and we confeſs that E. *Davieſii*, Engl. Bot. t. 1281, ſeems not very juſtly referred to it. It is certain that the fringes of ſeveral *Grimmiæ* have the thin pale aſpect ſuppoſed eſſential to *Encalypta*, but their veils are truly thoſe of *Grimmia*.

ENCAMPMENT, in *Military Affairs*, implies the poſition taken for the night, or for any time, of an army, for the purpoſes of exerciſe, or for warfare. It is common in all countries for the regular forces to be called out, at ſtated periods, eſpecially during favourable ſeaſons, from their barracks or quarters, in order to unite for their acting in concert upon a large ſcale, and for their being reviewed by ſome ſuperior officer. Theſe camps are uſually pitched on certain large commons, whereon evolutions may be conveniently performed by ſeveral regiments or brigades, and whoſe ſites are favourable both in regard to ſalubrity, and the eaſy ſupply of water and proviſions. When we ſpeak of encampments in a literal ſenſe, we invariably attach thereto the idea of living under canvas; and ſuch is abſolutely the caſe, when troops are called out for the above purpoſes. But we are not to conclude that in time of war, when on actual ſervice, ſuch takes place on all occaſions: far otherwiſe, for it is a general maxim always to ſpare the camp equipage, as far as may be practicable; and to keep every thing packed, which is not immediately in requiſition: therefore, we uſually ſee regiments, eſpecially of infantry, ſtationed in towns, with lines of pickets in advance, and along their intervals, when the diſtances between ſuch towns may not be great, and the enemy not ſo near at hand as to render ſuch breaks dangerous. Thus, an army of 40,000 men is frequently ſeen to occupy full 20 miles, or even more, in this manner; the different regiments occupying the ſeveral villages along that line, and cloſing up into more compact arrangement, whenever danger may be apprehended. This manner of diſpoſal not only ſaves infinite trouble and delay, reſpecting the camp equipage; but expoſes the army leſs to inclement weather, or to noxious localities; and beſides, facilitates its movements very conſiderably, by allowing the whole to move in ſeparate columns, from one ſtation to another. In this the columns neceſſarily act nearly parallel, much the ſame as in the advance of a battalion by the right or left of companies in open column.

Encampments, by which we mean the mode of laying out the camp into ſtreets and diviſions, are, with ſome trifling variation, formed after the ſame manner in all countries. The general principles are, 1ſt, That no more ground ſhould be occupied than may be abſolutely neceſſary for the drawing up the troops in order of battle: hence, all additions whatever ſhould be made rather in the depth than in the breadth of the camp. This is done to avoid ſuch breaks as could not fail to weaken the line, and to admit the incurſions of the enemy's horſe. It is, however, uſual to allow the interval of about an eighth of their reſpective fronts between battalions of infantry, and of 30 or 40 paces between ſquadrons of cavalry. 2dly, The leaving of paſſages, or ſtreets, throughout, ſo that bodies may move from one part to the other without hindrance, and without being compelled to paſs along the front of the bells of arms. 3dly, That due precaution ſhould be taken for the prevention of diſeaſe, by a judicious arrangement of the regimental and general hoſpitals, as well as by ſecuring the due facility for the removal of filth, and for abundant ventilation; both which can only be effected by due care founded on the precaution of not allowing the camp to be too crowded, either by its ſituation, or the number of perſons contained therein. It is uſual to allow a front of two feet for every file (whether two or three deep) of infantry, and a front of three feet for every file of cavalry: hence camps, wherein the battalions are formed three deep, muſt have their ſtreets full one-half deeper than where the corps are drawn up only two deep. When the ground may permit, the ſtreets are uſually at right angles with the front; each row of tents containing the men of a company, arranged according to their ſeveral ſtations, or numbers, in their companies reſpectively. Suppoſing the whole to be ſtanding at the doors of their reſpective tents, and to be ordered to fall in, they would, by this arrangement, arrive in regular ſucceſſion, either from right to left, or from left to right, at their ſeveral ſtations. The horſes and the tents of a troop of cavalry are arranged in a ſimilar manner. The grenadiers and light infantry are ordinarily encamped in ſingle rows, on the flank; but the battalion companies, in double rows: each two companies thus forming a ſtreet, of which the tent-doors are face to face. This mode certainly looks well, but does not anſwer for all climates. In low latitudes, and in very cold weather, the tent-doors ſhould be pitched from the wind, without regard to appearances. A ſingle row, or one company, occupies nine feet in front; and a double row, or two companies, twenty-one feet; if formed of the old pattern, rectangular tents, which hold only five men each: but if the new bell-tents are uſed, fifteen feet muſt be allowed in front for a ſingle, and thirty feet for a double, row. In the cavalry, a row (or troop) occupies in front as follows:

	Old Tents.		New Tents.
Tent - - - - -	3 yards.	—	5 yards.
From the front pole of the tent to the picket rope -	3 do.	—	3 do.
For the horſe - - - -	6 do.	—	6 do.
For the dung - - - -	2 do.	—	2 do.
Totals - - - -	14 yards.		16 yards.

The breadth of a row in front, whether cavalry or infantry, being multiplied by the number of rows, and the product ſubtracted from the whole extent of the front of a battalion of infantry, or of a ſquadron of cavalry, will leave the ſpace for the ſtreets, which are generally divided thus:

For the infantry,	59½	feet each.
For the cavalry,	30	feet each between the tents.
————	46	feet each between the horſes.

By the foregoing it will be ſeen that the utmoſt order prevails in laying out the tents of the ſoldiery, where the ground will permit. In places abounding with trees, rocks, puddles, &c. it muſt of courſe follow, that the locality of every tent conforms to theſe interruptions: but the main points muſt, nevertheleſs, be ever adverted and conformed to; otherwiſe all thoſe evil conſequences, attendant upon want of management, will inevitably follow. Negligence will admit filth; filth will create diſeaſe; and diſeaſe will produce weakneſs, diſcontent, and deſpair. The following is the diſtribution of the depth of a camp of infantry, or of cavalry, when the ground permits.

Diſtribution of the Depth of a Camp.	Infantry.	Cavalry.
	Yards.	Yards.
From the quarter guard parade to battalion parade - - - - - - -	62	
From this firſt line of parade to the front of the { ſerjeant's tents quarter maſter's tents } - - -	16	
N. B. *Theſe tents open to the front.*		
To the firſt picket of horſes - - - - - - - - - - - -	—	15
Infantry for every tent in depth. ——, old pattern - 9 feet. ——, new pattern - 15 feet. Cavalry, for every horſe - 3 feet.		
N. B. *The infantry privates' tents open to the ſtreet.* *The cavalry ditto to their horſes' heads.*		
Suppoſe infantry 12 tents deep ———- cavalry 60 horſes ditto } old pattern - - - - - - -	36	60
From the laſt tent of infantry, or laſt horſe of cavalry, to the front of the ſubaltern's tent *(openings to the rear)* - - - - - - - - - -	15	12
To the front line of captains *(openings to the front)* - - - - - - -	15	15
To the front of the field officers *(open to the front)* - - - - - - -	10	15
To the colonels - - - - - - - - - - - - -	10	10
To the ſtaff officers - - - - - - - - - - - -	10	14
To the firſt row of batmens' tents - - - - - - - - - -	10	15
To the firſt row of pickets for bat-horſes - - - - - - - - -	2	
To the ſecond row of ditto - - - - - - - - - - -	10	
To the ſecond row of batmen - - - - - - - - - -	2	
To the front of the grand ſutlers' tent - - - - - - - - -	10	
To the centre of the kitchens - - - - - - - - -	15	20
To the front of the petty ſutlers - - - - - - - - - -	15	15
To the rear guard *(opens to the rear)* - - - - - - - - - -	15	15
Total depth required in yards - - - - - - - - -	253	226

The captains and ſubalterns are pitched in the rear of their reſpective companies; the field officers oppoſite the outſide ſtreets of the battalion; the colonels oppoſite the central, or main, ſtreets; the ſtaff officers next to the main ſtreets; the grand ſutlers in the rear of the colonels; and the petty ſuttlers in the rear of the kitchens.

If the ground on which the camp is to be formed will not, owing to a ſwamp in the rear, admit of each troop, or company, being formed in one row perpendicular to the front; the diſtribution of the front of a battalion, or ſquadron, muſt be more contracted than the above; and be laid down as follows. Find how many perpendicular rows will be required, by dividing the number of men in the battalion or ſquadron, by the number the ground will admit of in one row; then the number of rows being multiplied, by the breadth of one in front, will give that part of the front to be occupied by the rows; and the difference between it and the whole front allowed for the battalion, or ſquadron, will be left for the ſtreets; which, if the ſtreets are to be equal, muſt be divided by their number, to find the breadth of each; or is, otherwiſe, eaſily divided into ſtreets of unequal breadths.

When two guns are attached to a battalion, they are poſted on the right in the following order; from the right of the battalion to the centre of the firſt gun, four yards; from this to the ſecond gun, ſix yards. The muzzles of the guns in a line with the ſerjeants' tents. The ſubalterns of artillery, if any, in a line with the ſubalterns of infantry; the rear of the gunners' tents in a line with the rear of the battalion tents.

The park of artillery ſhould always be placed, if practicable, within a ſhort diſtance of water carriage, and have the moſt ready communication with every part of the line. Its form muſt depend on its ſituation. Ten feet are uſually allowed in front for one carriage and its interval, and about fifty yards from the hind wheels of the front row to the fore wheels of the ſecond: this interval ſhould allow ſufficient room for putting the horſes to the carriages, and for a free paſſage along the line. In parks not on immediate ſervice, it is uſual to arrange the guns with their muzzles to the front, but where the guns are likely to be wanted at a ſhort notice, appearances muſt give way to promptneſs, and the gun-carriages muſt be parked with their ſhafts to the front, ready to receive the horſes, or other draught animals.

A quarter-guard is placed in front of the park, and the non-commiſſioned officers' and gunners' tents on the flanks, at about twenty paces diſtant; forty paces to the rear are the ſubaltern officers' tents; at ten more the rear of the captains; and ten more to the front of the commanding officers: the meſs-tent is fifteen paces in rear of the line of officers. At a convenient diſtance, in the rear of the whole, are the horſes, picketted in one or more lines, with the drivers on their flanks. The horſes are ſometimes picketted in lines perpendicular to the front of the park, and on the flanks of the carriages, between the men and the carriages.

An army is ſometimes encamped in two, or even in three, or more lines; according to its numbers, and the nature of the ground. The diſtance between two lines muſt depend entirely on local circumſtances, or on the object in view: ſometimes they are not more than two hundred yards aſunder, and ſometimes full five or ſix hundred; occaſionally they are pitched in reverſe, eſpecially when covering a convoy that has taken poſt between two hills, or rivers, or woods; in ſuch inſtances they are "in reverſe," and, in lieu of rear guards, have a central force to act as a reſerve.

With reſpect to the choice of ground for an encampment, it muſt be recollected that no poſition is tenable, in a military point of view, which does not ſtand exempt from the enfiladeof an enemy. In fact, all commanding grounds ought to be beyond the reach of cannon, ſo that the camp ſhould not be ſubject to moleſtation from ſuch ſituations. Four principal objects demand attention in the choice of a poſition for encampment. 1ſt. The advantages of the ground, as ariſing naturally, in point of defence. 2d. The acceſs to, or the poſſeſſion of, ſupplies for the army. 3d. The particular object to be attained; whether mere ſecurity, the covering of any depot, the cutting off of an enemy's reſources, the communication with other parts, and eſpecially with ſhipping. 4th. The means of retreat if too cloſely preſſed by a ſuperior force.

The front of an encampment, or, as already explained, of a poſition, ſhould be interſected by rivers, ravines, or broken grounds, or any other obſtacles which may prevent the enemy from advancing in order of battle, and oblige him to paſs through defiles: but the front ſhould nevertheleſs be exempt from ſuch obſtacles as might debar the army from moving out of its camp, or advancing when neceſſary. All obſtacles ought to be within reach of the artillery, or the enemy will paſs them unmoleſted. In a flat country, where the ground does not afford commanding ſituations, a poſition is more or leſs eligible according as it may be covered by obſtacles; ſuch as very thick woods, in which there are few roads; large rivulets that cannot be croſſed but by means of bridges; deep and broken ravines; ground much interſected by ditches and hedges; the poſſeſſion of mills, churches, convents, and other buildings that are capable of obſtinate defence, and are within the encampment. A ſituation where the rear is covered by ſwamps has certain advantages, but is attended with this danger, that, in caſe of defeat, retreat muſt be difficult, if at all practicable. The principal obſtacles, if a choice can be made, ought to be thrown upon the flanks, and force the enemy to narrow his front when attacking the encampment; but, if ſuch obſtacles ſhould be of a nature to be eaſily poſſeſſed by him, they will prove peculiarly exceptionable, and ought not to be depended upon, any more than the ſupply of water from ponds, wells, or ſtreams that lie expoſed to his interference. Laſtly, the want of wood, or of water, even though proviſions ſhould be abundant, totally diſqualify a poſition; unleſs, indeed, for a very ſhort occupancy, and rather as a reſting place than an *appui*, or defenſive aid. Theſe deficiencies muſt invariably operate, on large armies eſpecially, ſo as to render ſuch ſituations untenable, whatever advantages they might offer in regard to natural ſtrength, or diſtreſs occaſioned by their occupancy, to the enemy.

ENCANTHIS, a term in *Surgery*, derived from the Greek εν, ſignifying *in*, and κανθος, which implies the *angle of the eye*. By a kind of abuſe of words, which is too common in every language, the Greek writers have applied the name of "encanthis" to a ſmall, roundiſh, unequal, more or leſs conſiderable, ſometimes red, at other times light-coloured tumour, ſituated in the caruncula lachrymalis, which every ſurgeon knows is naturally placed near the angle of the eye.

Profeſſor Scarpa, of Pavia, has ſurpaſſed every author, with whom we are acquainted, in the excellent and intereſting account which he has given of the diſeaſe under conſideration. To him we feel highly indebted for a great deal of the matter, which we are about to inſert. He obſerves, that the incipient encanthis is a ſmall, ſoft, reddiſh, or ſometimes ſlightly livid, excreſcence, which grows from the caruncula lachrymalis, and alſo from the adjacent ſemilunar fold of the tunica conjunctiva. In general, the inveterate encanthis is of very conſiderable ſize, its roots reaching beyond the caruncula lachrymalis and ſemi-lunar fold of the conjunctiva, and extending along the membranous lining of one, or both eye-lids. In conſequence of its being ſituated between the internal commiſſure of the eye-lids, which it hinders from becoming cloſed on the ſide next the noſe, it ſubjects the patient to a great deal of inconvenience, by keeping up a chronic ophthalmy, obſtructing the action of the eye-lids, and, in particular, by rendering the patient incapable of ſhutting his eye. Alſo, partly by compreſſing the orifices of the puncta lachrymalia, and partly by altering their natural direction, the encanthis becomes an impediment to the free paſſage of the tears from the eye into the noſe.

The encanthis, in its early ſtate, has uſually a granulated appearance, like a mulberry; or elſe it is compoſed of little portions reſembling fringe. When the excreſcence has attained a conſiderable ſize, a certain part of it has a granulated appearance, while the remainder looks like a ſmooth, whitiſh, or aſh-coloured ſubſtance, ſtreaked with varicoſe veſſels, and ſometimes extends ſo far over the conjunctiva, covering the ſide of the eye-ball next the noſe, that it reaches to the place where the cornea and ſclerotica meet. When the encanthis has increaſed to this conſiderable pitch, it conſtantly affects, together with the caruncula lachrymalis and ſemi-lunar fold of the conjunctiva, the membranous lining of one, or both eye-lids. In this ſtate, it may be obſerved, that the excreſcence, beſides the roots, which it derives from the caruncula lachrymalis, and conjunctiva, has a firm prominent appendage, or elongation, which extends along the inner ſurface of the upper, or lower eye-lid, in the direction of its edge. In other terms, we may ſtate, that the middle portion, or body (as it were) of the encanthis, near the cornea, divides, in the form of a ſwallow's tail, into two appendages, or elongations, one of which extends along the inſide of the upper eye-lid, covered by the edge of this part, while the other is continued along the inner ſurface of the lower eye-lid, concealed under its margin, and proceeding in the direction from the internal towards the external canthus of the eye.

Scarpa remarks, that the body of the encanthis, or that middle portion of the excreſcence, which reaches from the caruncula lachrymalis and ſemi-lunar fold incluſively, over the conjunctiva of the eye-ball, even to the very edge of the cornea, is ſometimes as prominent as a common nut or a cheſnut. In other inſtances, it is of the ſame ſize, but depreſſed and flattened, as it were, in the middle. However, the body of the excreſcence does not now retain the ſame granulated appearance which it preſented at an earlier period, while one, or both the appendages, extending along the inner ſurface of one, or both eye-lids, ſeem more like a fleſhy, than a granulated ſubſtance.

When the eye-lids are turned out, theſe appendages of the encanthis form a projection forward, and when this is obſervable on both palpebræ, on their being turned out in this manner, the two fleſhy appendages make together a kind of ring, which comes into cloſe contact with the globe of the eye behind. Scarpa informs us, that Fabricius Hildanus was acquainted with this diſeaſe, which he ſucceeded in curing, and which he named *ficus ſcirrhoſus ad majorem oculi canthum*. See Centur. 1. Obſ. 2.

However, Scarpa takes notice, with reſpect to the caſe recorded by Hildanus, that the encanthis had only one appendage, which was ſituated on the inner ſurface, and below the margin, of the upper eye-lid.

Scarpa, in conformity with moſt ſurgical writers, has very accurately explained, that the encanthis, as well as the pterygium, occaſionally puts on a cancerous malignity, which is denoted by the dark-red, or leaden colour of the tumour; by its unuſual degree of hardneſs; by its darting pains, which extend to the forehead, and all over the eye and temples, particularly whenever the excreſcence has been even gently touched; by its tendency to bleed; and, laſtly, by the ulcerations, which occur in ſeveral places, emit a fungous growth, and diſcharge a thin irritating ſanies. Scarpa is of opinion, that this worſt form of the encanthis can only receive palliative treatment, unleſs an attempt at extirpation be made, by removing, together with the diſeaſe, all the parts contained in the orbit, the ſucceſs of which operation he alſo repreſents as exceedingly doubtful.

At the ſame time, that we profeſs the higheſt reſpect for the ſentiments of Scarpa in general, on the ſubject of diſeaſes of the eyes, we cannot ſilently ſubſcribe to his advice, that no endeavour ſhould be made to effect a radical cure of any malignant encanthis, without extirpating all the contents of the orbit. If the diſeaſe were not ſo very extenſive, as to prevent the ſurgeon from making a fair removal of every part of it, without taking away the eye itſelf, what practitioner can doubt, that the latter formidable operation ought to be diſpenſed with. It would be full time enough to have recourſe to this ſevere ſtep, when it had been decidedly evinced, that cutting away the diſeaſed parts alone was inſufficient, and that malignant morbid miſchief ſtill prevailed.

Scarpa informs us, that the benign encanthis, whether of ſmall, or conſiderable ſize, may be cured by exciſion. The ſmall beginning encanthis, whether of a granulated or fringed appearance, and originating from the caruncula lachrymalis and ſemi-lunar fold, or, alſo, from a ſmall portion of the margins of the eye-lids, where they form the internal commiſſure, may be raiſed with a pair of forceps, and be completely cut away cloſely to its baſe with the curved ſciſſars. In order to accompliſh this operation, it is needleſs to follow the plan, which ſome adopt, of introducing a needle and thread through the little excreſcence, with a view of raiſing and detaching it more accurately from the parts, to which it is adherent. This object can be fulfilled with the forceps, without annoying the patient by the punctures, and by drawing a thread through the tumour, for the purpoſe of making a nooſe. However, in taking away ſuch portion of the incipient encanthis, as ariſes from the caruncula lachrymalis, Scarpa very prudently cautions us againſt removing more of the ſubſtance of that body, than the complete eradication of the diſeaſe requires, leſt the loſs of too much ſhould occaſion an irremediable flux of tears from the eye.

When the little excreſcence has been extirpated, the eye ought to be repeatedly waſhed with cold water to get away the blood, and ſhould then be covered with a piece of fine linen and a retentive bandage. About the fifth, ſixth, or ſeventh day, as ſoon as the inflammation, produced by the operation, has quite ſubſided, and ſuppuration from the wound has commenced, Scarpa adviſes us to touch the cut ſurface with a ſmall button of alum, ſcraped into the ſhape of a crayon-pencil, and he alſo recommends a collyrium, containing the zincum vitriolatum and mucilage of quinceſeeds, to be frequently applied to the eye in the courſe of the day. If this plan of treatment ſhould not have the deſired effect of making the wound heal; but, on the contrary, if the cut ſurface of the caruncula lachrymalis and internal angle of the eye ſhould, inſtead of continuing to heal up, put on a fungous appearance, it ſhould be repeatedly touched with the argentum nitratum, care being taken not to apply this cauſtic to the conjunctiva, more particularly, if any part of this membrane ſhould have been wounded. After the deſtruction of the fungous granulations, a collyrium, containing the zincum vitriolatum, will accompliſh the cure, or the practitioner may introduce between the eyeball and internal commiſſure of the eye-lids, three times a day, an ointment compoſed of freſh butter, powdered tutty, and armenian bole. Scarpa alſo acquaints us, that Bidloo ſpeaks much in favour of uſing for the latter purpoſe powdered chalk, either alone, or mixed with calcined alum. See Exercit. Anat. Chir. Decad. 2.

Scarpa informs us, that we may alſo cut away the large inveterate encanthis, either with a flat body, or with one, which projects in the ſhape of a common nut, or cheſnut, and having one, or two fleſhy appendages extending along the lining of one or both the eye-lids. In this inſtance, a ligature cannot be properly made uſe of, becauſe the neck of the tumour is never ſmall enough to allow of being advantageouſly tied. On the contrary, the encanthis, when it is very large, is always extenſively connected with the caruncula lachrymalis, and with the conjunctiva, almoſt as far as where the cornea begins, and it has, moreover, one or two fleſhy appendages, which run along the under ſurface of one or both the eye-lids. For this reaſon, even ſhould the middle part of the encanthis be extirpated with a ligature, ſtill one or both the appendages would ſtand in need of removal, which object could only be accompliſhed by exciſion.

The apprehenſion of the bleeding from the latter operation is quite unfounded, as there are numerous caſes on record, where the operator has cut away a large inveterate encanthis, without any ills ariſing from hemorrhage. Scarpa mentions, that he could relate himſelf ſome caſes which he has met with, in confirmation of the truth of the foregoing ſtatement. This candid writer, however, does not diſſemble, that Pellier records an example, in which a troubleſome degree of bleeding followed the exciſion of an encanthis; but, it is juſtly obſerved, that the particulars of the diſeaſe are undeſcribed, as well as the exact way in which the operation was performed. Had theſe circumſtances been detailed, perhaps they would have explained the reaſon of the unuſual occurrence. Indeed, Pellier himſelf has remarked, "j'ai ſouvent fait cette operation a des excroiſſances de cette nature, et jamais je n' ai èprouvé un pareil accident."

In the caſe of the large inveterate encanthis, referred to above, and in which there was only one appendage continued along the inſide of the upper eye lid, Hildanus, after taking hold of the body of the encanthis with a tentaculum, drawing the tumour towards him, and turning out the upper eye-lid, in order to make the whole of the appendage project forward, detached all this laſt portion from the inſide of the eyelid with a ſmall knife, and afterwards cut away the body of the encanthis from the conjunctiva and caruncula lachrymalis. Scarpa remarks, that as this plan was attended with complete ſucceſs, it ought to be imitated by all practitioners.

However, when the inveterate encanthis, of large ſize, has two appendages, one reaching along the inner ſurface of the upper eye-lid, the other along that of the lower one, Scarpa adviſes the following plan to be adopted. The patient is to be ſeated in a chair, and the upper eye-lid turned out by an aſſiſtant, ſo as to make one of the appendages of the encanthis project forward. This production of the diſeaſe is to be deeply cut into with a ſmall knife, in the direction of the edge of the eye-lid, taken hold of with a pair of forceps, and be completely detached from the inſide of the part, in the longitudinal direction, the diſſection being continued from the external towards the internal angle of the eye, as far as the body of the encanthis. The appendage on the inner ſurface of the lower eye-lid ſhould be ſeparated in the ſame way. Then the middle portion of the encanthis ſhould be lifted up with a pair of forceps, or, (if this cannot be done) with a double hook, and be entirely cut away from the conjunctiva underneath, which covers the eye ball, and from the ſemi-lunar fold, and caruncula lachrymalis. This may be accompliſhed partly by means of a ſmall knife, and partly with the aid of curved ſciſſars. The operator is alſo to cut more or leſs deeply into the caruncula lachrymalis, according as the ſtrength and depth of the roots of the diſeaſe may require; for, it muſt be confeſſed, that, when the encanthis is very large, and of long ſtanding, the ſurgeon cannot always avoid wounding the caruncula lachrymalis ſufficiently to prevent ſome degree of weeping from the eye, after the operation.

The eye ſhould be repeatedly bathed with cold water, and the reſt of the treatment is nearly like that recommended after removing a ſmall incipient encanthis. Scarpa recommends the uſe of collyria of aqua malvæ, and of anodyne and detergent ones, until ſuppuration has fully taken place from the ſurface of the wound. Then mild aſtringents, and the above-mentioned ointment may be uſefully had recourſe to. Scarpa particularly adviſes giving a preference to mild applications, both before and after ſuppuration has taken place, eſpecially when a conſiderable piece of the conjunctiva, covering the white of the eye, has been cut away with the encanthis. See Scarpa Sulle Principali Malattie degli Occhi.

ENCARDION, from καρδια, *heart*, in *Botany*, a name given by the Greeks to what the Latins properly call the mediata in trees, the heart of the wood, or central hard part of it.

ENCATHISMA, from εγκαθημαι, *I ſit in*, in the *Medical Writings of the Ancients*, a term uſed to expreſs a ſort of bath, in which the patient was only to be plunged up to the belly.

ENCAUMA, from εν, and καιω, *to burn*, in *Surgery*, the mark left by a burn; alſo a ſmall abſceſs ariſing from the ſame cauſe. The term is ſometimes applied to a ſuperficial ulceration on the eye

ENCAUSIS, from εν, and καιω, *to burn*, a burn, or the inflammation produced by this ſort of injury; alſo the operation of external heat on the body, as of the ſun, or ſire. In Dr. Cullen's Noſology, the word is ſynonymous with erythema and ambuſtio.

ENCAUSSE, in *Geography*, a ſmall town of France, in the department of the upper Garonne; 12 miles E. of St. Bertrand, remarkable for its ſprings of mineral water.

ENCAUSTIC PAINTING, Εγκαυστικη, from εν, καιω, *inuro*, *I burn in*, is a ſpecies of painting with burnt wax, practiſed by the ancients, and lately revived. Pliny has given the following brief account of the invention and nature of this art: "Ceris pingere ac picturam inurere, quis primus excogitaverit non conſtat; quidam Ariſtidis inventum putant, poſtea conſummatum à Praxitele; ſed aliquanto vetuſtiores encauſticæ picturæ extitere, ut Polygnoti, & Nicanoris, & Arceſilai, Pariorum Lyſippus quoque, Eginæ picturæ ſuæ inſcripſit ἐνέκαυσεν; quod profectò non feciſſet, niſi encauſtica inventa. Pamphilus quoque Appellis præceptor non pinxiſſe tantùm encauſtica, ſed etiam docuiſſe traditur Pauſiam Sycionium, primum in hoc genere nobilem." Lib. xxxv. cap. 11. From this paragraph we learn, that the method of painting in wax, and burning in the picture, was very ancient; nor is it improbable that in former times, when they were unacquainted with dry oils, and tranſparent varniſhes, they ſhould make uſe of this method for preſerving their colours from damps and heats; though ſome imagine, that by *ceris* is meant a compoſition, different from wax, and capable of bearing the fire; and that burning the picture denotes merely enamelling. Pliny in the ſame chapter informs us, that there were anciently two methods of encauſtic painting in uſe: "Encauſto pingendi duo fuiſſe antiquitùs genera conſtat, cerâ & in ebore, ceſtro, *i. e.* viriculo: donec claſſes pingi cæperè. Hoc tertium acceſſit, reſolutis igni ceris, penicillo utendi; quæ pictura in navibus nec ſole, nec ſale, ventiſque corrumpitur." Dr. Parſons maintains, that the *ceſtrum* was a pointed tool uſed in modelling or carving upon ivory or wax; and he ſuppoſes that there is a contraſt between the uſe of the *ceſtrum*, and painting ſhips with a bruſh, and therefore that the term *pingendi* cannot be underſtood to mean the laying on of paint. However, there is a paſſage in Vitruvius, lib. vii. cap. 9. which ſerves to aſcertain the nature of the ancient encauſtic painting. "At ſi quis ſubtilior fuerit, & voluerit expolitionem miniaceam ſuum colorem retinere, &c." *i. e.* if any one is more wary, and would have the poliſhing, or painting, with vermilion hold its colour, when the wall is painted and dry, let him take Carthaginian wax, melted with a little oil, and rub it on the wall with a hair-pencil; and afterwards let him put live coals into a chafing-diſh, and hold it cloſe to the wax; when the wall, by being heated, begins to ſweat, let it be made ſmooth; afterwards let him rub it with wax tapers, and clean linen rags, in the ſame manner as they do the naked marble ſtatues. This the Greeks call *καυσις*. The coat of Carthaginian wax is ſo ſtrong, that it neither ſuffers the moon by night, nor the ſun-beams by day, to deſtroy the colour. From this paſſage we learn the ancient method of painting in wax by inuſtion, more obſcurely expreſſed by Pliny; though Pliny, in another paſſage, expreſsly informs us, that they uſed coloured wax: "Ceræ (he ſays) tinguntur iiſdem his coloribus, quæ inuruntur;" that they employed a pencil to lay on the melted wax; "reſolutis igni ceris, penicillo utendi:" that the picture was fixed by inuſtion, "picturam inurere." And we learn from Vitruvius, that the whole was cleaned and poliſhed with linen rags.

The Punic or Carthaginian wax, the uſe of which is aſcribed to the ancient painters by Varro, Vitruvius, and Pliny, was ſaid to be the beſt, as it exceeded in whiteneſs the Sardinian and Corſican, probably becauſe it was better purified; for the Africans, as we learn from Pliny, were accuſtomed to uſe alkali in order to render this ſubſtance whiter, and alſo to free it, as ſome have ſuppoſed, from all greaſy matter. Wax, however, ſeems to have formed the only ground of wax-painting. The abbé Requeno, who contributed to preſent to the notice of modern painters wax-painting, adds maſtic; but Lorgna converts his wax into ſoap, as Bachelier does with the alkali of Soda. Aſtori adds gum and honey, affirming that thus the wax would be rendered much more yielding and ſofter for the bruſh. Requeno ſeems to aſſign the excluſive poſſeſſion of this art to the Greeks and Romans; but we have reaſon for believing that the knowledge and uſe of encauſtic painting were older than their time, becauſe the Egyptians, who with the Etruſcans were the parents of the greater part of the inventions known among mankind, and from whom the Greeks derived much of their knowledge, were acquainted with and employed encauſtic painting in the ancient ages of their greatneſs and ſplendour. This fact has been deduced from valuable fragments of the bandages and coverings of mummies painted in this manner. A mummy of this kind is mentioned in a treatiſe entitled "Antichita, &c." referred to at the cloſe of this article. No oil-painting, it is ſaid, perhaps only two or three hundred years old, exhibits a white paint that has kept ſo well as that ſeen on the fragment to which we have alluded; and this circumſtance ſufficiently proves the valuable advantage which that method poſſeſſes when compared with the common oil-painting. The wax, inſtead of becoming black by the contact of the atmoſphere, as drying oil does, acquires increaſing whiteneſs, and according to its natural quality, is not decompoſed in the air, and does not ſtrongly attract the oxygen of the calces or metallic aſhes, which are commonly uſed in painting. That beautiful white, which may be obſerved in the Egyptian encauſtic above-mentioned, is, as the author of the treatiſe juſt cited apprehends, nothing elſe but a ſimple earth, and according to his chemical experiments a chalk *(creta,)* which is alſo unalterable. If we conſider this encauſtic fragment, ſays our author, as belonging to the epoch of the firſt violent change, which the religious ſyſtem of the Egyptians experienced, it will be a ſpecimen of painting about 2500 years old; for ſuch is the number of the years that have elapſed ſince Cambyſes overturned the ceremonies and religious worſhip of the Egyptians, not only by the ſword, but by the ſtill more powerful weapons of ridicule. Dead bodies were embalmed there in the time of Herodotus, (ſee EMBALMING); but the cloth in which they were wrapped, or the bandages bound round them, were no longer painted with ſacred characters. The bodies were only incloſed in wooden caſes, which were more or leſs ornamented. If Bochart and Menage be not miſtaken, the name "mummia" is derived from "muim," which ſignifies wax; and one might therefore believe, that the dreſs of embalmed bodies was thus named becauſe wax was employed for painting it; and thence it would follow, that the fragment in queſtion may be claſſed among the oldeſt. Petronius praiſes the freſh appearance which the valuable works of Zeuxis and Apelles had, even in his time; but Cicero, on the other hand, ſpeaks of the paintings of the ancients having ſuffered from blackneſs. The former is ſuppoſed to have ſpoken of wax-painting, and the latter is preſumed to have alluded to paintings in oil. The author, whoſe ſentiments we are now expreſſing, detached 24 grains of the encauſtic painting from the above-mentioned Egyptian fragment; and in his mode of examining it, the mixture of 100th part of a foreign ſubſtance would have been diſcovered with the greateſt certainty: he muſt, he ſays, have perceived the reſin of Requeno, nor could the alkali of Bachelier and Lorgna have eſcaped his notice. But in this Egyptian encauſtic he found nothing except very pure wax, though he varied his analyſis in every known method.

From the words of Vitruvius above cited it appears, that the Romans, who copied the Grecian proceſs, which was borrowed from the Egyptians, mixed the wax with an oil to make it pliable under the bruſh, but no maſtic, alkali, or honey, as ſome have imagined, was employed; what this oil was it is not eaſy to aſcertain. It does not appear that they uſed thoſe fat oils, which are commonly called drying oils, becauſe they could have employed thoſe as we do, without the addition of wax, which would have been altogether ſuperfluous. Fat oils, which do not dry, would not have been proper for that purpoſe, as they would have kept the wax continually in a ſoft ſtate. Our author ſuppoſes, that the Egyptians, in order to uſe wax in their encauſtic painting, muſt have combined it with an ethereal volatile oil, of which no traces ſhould afterwards remain, and that though they might be unacquainted with the art of ſeparating ethereal oils from the many ſubſtances which they contain, they certainly were acquainted with a very volatile thin oil produced by nature, and which in various places iſſues from the earth. This oil was either that called naphtha, which is an exceedingly volatile oil, that entirely flies off and evaporates, without leaving a ſingle trace behind; or the common ſpirit of turpentine, which would very well anſwer the purpoſe. The encauſtum, thus formed, was uſed in the time of the Romans to cover parts, which had been already painted either with water-colours or in freſco; and it was alſo, as we have reaſon to believe, the ſubſtance with which Apelles daubed over his paintings, and which, according to Pliny, made them appear as if covered by a thin plate of talc or tranſparent ſelenite, and gave the colours a wonderful ſoftneſs,

neſs. It might ſtill be employed for preſerving paintings in water-colours, or on plaſter, and ſculptured pieces of marble.

The ancient art of encauſtic painting, after having been long loſt, was reſtored by count Caylus, a member of the Academy of Inſcriptions in France; and the method of painting in wax was announced to the Academy of Painting and Belles Lettres, in the year 1753; though M. Bachelier, the author of a treatiſe "De l'Hiſtoire & du Secret de la Peinture en Cire," had actually painted a picture in wax in 1749; and he was the firſt who communicated to the public the method of performing the operation of inuſtion, which is the principal characteriſtic of the encauſtic painting. The count kept his method a ſecret for ſome time, contenting himſelf with exhibiting a picture at the Louvre in 1754, repreſenting the head of Minerva, painted in the manner of the ancients, which excited the curioſity of the public, and was very much admired. In the interval of ſuſpence, ſeveral attempts were made to recover the ancient method of painting. The firſt ſcheme adopted was that of melting wax and oil of turpentine together, and uſing this compoſition as a vehicle for mixing and laying on the colours. But this method did not explain Pliny's meaning, as the wax is not burnt in this way of managing it. In another attempt, which was much more agreeable to the hiſtorian's deſcription of encauſtic painting, the wax was melted with ſtrong lixivium of ſalt of tartar, and with this the colours were ground. When the picture was finiſhed, it was gradually preſented to the fire, ſo as to melt the wax; which was thus diffuſed through all the particles of the colours, ſo that they were fixed to the ground, and ſecured from the acceſs of air or moiſture. But the method of count Caylus is much more ſimple: the cloth, or wood which he deſigned for the baſis of his picture, is waxed over, by only rubbing it ſimply with a piece of bees' wax; the wood, or cloth, ſtretched on a frame, being held horizontally over, or perpendicularly before a fire, at ſuch a diſtance, that the wax might gradually melt, whilſt it is rubbed on, diffuſe itſelf, penetrate the body, and fill the interſtices of the texture of the cloth, which, when cool, is fit to paint upon; but as water-colours, or thoſe that are mixed up with common water, will not adhere to the wax, the whole picture is to be firſt rubbed over with Spaniſh chalk or white, and then the colours are applied to it; when the picture is dry, it is put near the fire, whereby the wax melts, and abſorbs all the colours.

Mr. J. H. Muntz, in a treatiſe on this ſubject, has propoſed ſeveral improvements in the art of encauſtic painting. When the painting is on cloth, he directs it to be prepared by ſtretching it on a frame, and rubbing one ſide ſeveral times over with a piece of bees'-wax, or virgin's-wax, till it is covered with a coat of wax of conſiderable thickneſs. In fine linen, this is the only operation neceſſary previous to painting; but coarſe cloth muſt be rubbed gently on the unwaxed ſide with a pumice ſtone, to take off all thoſe knots, which would prevent the free and accurate working of the pencil. Then the ſubject is to be painted on the unwaxed ſide with colours prepared, and tempered with water; and when the picture is finiſhed, it muſt be brought near the fire, that the wax may melt and fix the colours. This method, however, can only be applied to cloth or paper, through the ſubſtance of which the wax may paſs; but in wood, ſtone, metals, or plaſter, the former method of count Caylus muſt be obſerved.

Mr. Muntz has alſo diſcovered a method of forming grounds for painting with crayons, and fixing theſe, as well as water colours, employed with the pencil. On the unwaxed ſide of a linen cloth, ſtretched and waxed as before, lay an even and thick coat of the colour proper for the ground: having prepared this colour, by mixing ſome proper pigment with an equal quantity of chalk, and tempering them with water. When the colour is dry, bring the picture to the fire that the wax may melt, paſs through the cloth, and fix the ground. An additional quantity of wax may be applied to the back of the picture, if that which was firſt rubbed on ſhould not be ſufficient for the body of colour; but as this muſt be laid on without heat, the wax ſhould be diſſolved in oil of turpentine, and applied with a bruſh, and the canvas be again expoſed to the fire, that the freſh ſupply of wax may paſs through the cloth, and be abſorbed by the colour; and thus a firm and good body will be formed for working on with the crayons. If cloth and paper are joined together, the cloth muſt be firſt fixed to the ſtraining frame; and then the paper muſt be paſted to it with a compoſition of paſte made with wheaten flour, or ſtarch and water, and about a twelfth part of its weight of common turpentine. The turpentine muſt be added to the paſte when it is almoſt ſufficiently boiled, and the compoſition well ſtirred, and left to ſimmer over the fire for five or ſix minutes; let wax be diſſolved in oil of turpentine to the conſiſtence of a thin paſte; and when the cloth and paper are dry, let them be held near a fire; and with a bruſh lay a coat of the wax and turpentine on both ſides the joined cloth and paper, in ſuch a degree of thickneſs, that both ſurfaces may ſhine throughout without any appearance of dull ſpots. Then expoſe the cloth to the fire or to the ſun; by which means the oil will evaporate, and the wax become ſolid, and be fit to receive any compoſition of colour for a ground, which is to be laid on as above directed in the caſe of cloth without paper.

Almoſt all the colours that are uſed in oil-painting may be alſo applied in the encauſtic method. Mr. Muntz objects, indeed, to brown, light pink, and unburnt *terra di Sienna*; becauſe theſe, on account of their gummy or ſtony texture, will not admit ſuch a coheſion with the wax as will properly fix them; but other colours, which cannot be admitted in oil-painting, as red-lead, red orpiment, cryſtals of verdegris, and red precipitate of mercury, may be uſed here. The crayons uſed in encauſtic painting are the ſame with thoſe uſed in the common way of crayon painting, excepting thoſe that in their compoſitions are too tenacious; and the method of uſing them is the ſame in both caſes.

The encauſtic painting has many peculiar advantages; though the colours have not the natural varniſh or ſhining which they acquire with oil, they have all the ſtrength of paintings in oil, and all the airineſs of water-colours, without partaking of the apparent character or defects of either; they may be looked at in any light and in any ſituation without any falſe glare; the colours are firm, and will bear waſhing; and a picture, after having been ſmoaked, and then expoſed to the dew, becomes as clean as if it had been but juſt painted. It may alſo be re-touched at pleaſure, without any detriment to the colours; for the new colours will unite with the old ones, without ſpots, as is the caſe in common ſize painting; nor is it neceſſary to rub the places to be retouched with oil, as in oil pictures; it is not liable to crack, and eaſily repaired, if it ſhould chance to ſuffer any injury. The duration of this painting is alſo a very material advantage; the colours are not liable to fade and change; no damp can affect them, nor any corroſive ſubſtance injure them; nor can the colour fall off in ſhivers from the canvas. However, notwithſtanding all theſe and other advantages enumerated by the abbé Mazeas, and Mr. Muntz, this art has not yet been much practiſed. Many of theſe properties belong to a much higher ſpecies of encauſtic painting lately diſcovered in England, the colours of which are fixed by a very intenſe heat; nor are the colours, or grounds, on which they are laid, liable to be diſſolved or corroded by any chemical menſtruum, nor, like the glaſſy colours of enamel, to run out of the drawing on the fire. See on this ſubject, Phil. Tranſ. vol. xlix. art. 100. p. 652. art. 101. p. 655. Id. vol. li. art. 8. p. 40. art. 9. p. 53. Muntz's Encauſtic Eloge of Count Caylus, in the Hiſt. de l'Acad. Roy. des Inſcript. & Belles Lettres, vol. xxxiv. Antichita, Vantaggi e Metodo della Pittura Encauſta; Memoria del Ch. Sig. Giov. Fabbroni, &c. Roma, 1797, 4to. Handmaid to the Arts, &c. vol. i. ch. ix. p. 245. 261.

ENCAUSTICE has been ſometimes uſed to denote the art of *enamelling*, which ſee.

ENCAUSTUM Cæruleum, is a name given to powder blue.

Encaustum *ſacrum*, a name given, by many authors, to that fine red colour uſed for illuminating the capital letters in ſome old manuſcripts. Procopius calls it *baphe*, ſome have called it coccus, and ſome cinnabar. It is ſaid that it was made of the purple colour, extracted from the murex, or purple fiſh, with ſome other additions. It is to be obſerved, that however well this colour, when laid on the parchment, or paper, might reſemble the colours of enamel, yet it was as improper to call it encauſtum, which ſignifies a "colour burnt in," as in enamelling it would have been to have called it atramentum, or ink.

ENCEADA da Bela, in *Geography*, a town of Africa, in the kingdom of Adel, on the coaſt of the Indian ſea; 30 miles S. of cape Guardafu.

ENCEINTE, Fr. from *enceindre, to ſurround*, in *Fortification*, the wall or rampart which ſurrounds a place, ſometimes compoſed of baſtions and curtains either faced or lined with brick or ſtone, or only made of earth.

The enceinte is ſometimes only flanked by round or ſquare towers, which is called a Roman wall.

ENCELIA, in *Botany*, Juſſ. 186. Cavanilles Ic. v. 1. 44, t. 61, and v. 3. 6. t. 210, ſee Pallasia.

ENCEPHALI, in *Medicine*, a term employed by ſome writers to ſignify certain worms, ſaid to be generated in the head.

ENCEPHALITES Lapis, in *Natural Hiſtory*, the name given, by authors, to a ſort of coarſe ſtone, ſuppoſed, in ſome degree, to reſemble the human brain. We have, in the foſſile world, many ſtones, named from the parts of animals, which they have, in reality, been formed from, or owed their original to; and theſe are properly enough called by names denoting the things whoſe forms they wear; but it is a very wrong practice, from ſome ſlight external reſemblances, to give ſuch names to things that never can have been ſuppoſed to be ſo entitled to them. No one can be ſo abſurd as to imagine a human brain can be petrified, though a ſtone may accidentally ſomewhat reſemble its form. The perſon poſſeſſed of ſuch an accidental ſpecimen, ſhould have ranked it among the ſtones to which it properly belonged as a ſtone, whether a flint, a pebble, or a nodule, and have named, as an accident only, this form of it; and not have given it a peculiar denomination, as if it were a new ſpecies.

ENCEPHALOCELE, from εγκεφαλος, *the brain*, and κηλη, *a tumour*, in *Surgery*, a hernia of the brain. See Fungus.

ENCEPHALON, from εν, *in*, and κεφαλη, *the head*, in *Anatomy*, ſhould ſignify, according to its etymology, all the parts contained in the head; but it is commonly applied to the brain, as conſiſting of cerebrum, cerebellum, and medulla oblongata, excluſive of the ſurrounding and containing membranes. Hence, Soemmerring's tabula baſeos encephali is a repreſentation of the baſis of the brain. See Brain.

ENCEPPE, in *Heraldry*, denotes chained, or girt round the middle; as is uſual with monkeys, &c.

ENCERIS, in *Pharmacy*, a word uſed by Galen to ſignify ſmall concretions of wax, which formed themſelves in melted plaſters, of which wax was one of the ingredients. As they cooled, the wax cooling firſt, and collecting itſelf into little grumes, ſpoiled the conſiſtence and form of the whole compoſition.

ENCHANTMENT, of *in*, and *canto*, I ſing, denotes certain words and ceremonies uſed by magicians in the practice of their pretended and deluding art; thus called, becauſe the formulæ of their enchantment were generally compoſed in verſe, and deſigned to be ſung. See Charm, Fascination, Magic, Sorcery, and Witchcraft.

ENCHARAXIS from εν, and χαρασσω, *to ſcarify*, in *Surgery*, a ſcarification.

ENCHASING, Inchasing, or Chasing, the art of enriching and beautifying gold, ſilver, and other metal-works, by ſome deſign or figures repreſented thereon, in low relievo. See Sculpture, Relievo, &c.

Chaſing is only practiſed on hollow, thin works; as watch-caſes, cane-heads, tweezer-caſes, or the like. It is performed by punching or driving out the metal to form the figures from within ſide, ſo as to ſtand out prominent from the plane or ſurface of the metal.

In order to this, they have a great number of fine ſteel blocks, or puncheons, of divers ſizes; and the deſign being drawn on the ſurface of the metal, they apply the inſide upon the heads or tips of theſe blocks, directly under the lines or parts of the figures. Then, with a fine hammer, ſtriking on the metal ſuſtained by the block, the metal yields, and the block makes an indenture or cavity on the inſide; correſpondent to which, there is a prominence on the outſide, which is to ſtand for part of the figure.

Thus the workman proceeds to chaſe and finiſh all the parts, by ſucceſſive applications of the block and hammer to the ſeveral parts of the deſign.

And it is ſurpriſing, with what beauty and juſtneſs, by this ſimple piece of mechaniſm, the artiſts in this kind will repreſent foliages, grotеſques, animals, hiſtories, &c.

ENCHEIRESIS, Εγχειρησις, from εν, *in*, and χειρ, *a hand*, in *Anatomy*, denotes manual operation; as diſſection.

ENCHELIS, in *Zoology*, a genus of *Vermes Infuſoria*, deſcribed eſſentially as being inviſible to the naked eye, very ſimple, and cylindrical. Nearly all the ſpecies are found in ſtagnant water.

Species.

Pyrum. Inverſely conic, behind tranſparent. Müll.

Common in ſtagnant waters, where the duck-weed grows. Body obtuſe, and filled with molecules; and when at reſt, appears to have a ſmall tubercle in the middle of the body. This kind is remarkable for the rapidity of its motion.

Spathula. Cylindrical, ſtriated, with a tranſparent ſpatulate tip. Müll.

Leſs frequent than the laſt, and found in waters in which the duck-weed is infuſed. The body is cryſtalline, and the creature moves in an undulate manner.

Papula. Cylindrical, with the tip papillary. Müll.

Found in the water of dunghills. The body is round, protuberant, opake before, and furniſhed with a papillary finger-ſhaped head; pellucid behind, and both ends obtuſe. Its motion is rotatory and oblique.

Fritillus. Cylindrical, truncated anteriorly. Müll. Hermann.

Met with in water in which graſs or hay is infuſed. The body is pellucid, convex, and obtuſe behind; moves backwards and forwards with a wavering agitation in a line.

Ovulum. Cylindrical-ovate, and hyaline. Müll.

Found in the water of dunghills. Very minute and pellucid.

Fusus. Cylindrical, narrow, and truncated at both ends. Müll.

Obſerved only in pure water.

Epistomium. Elongated, cylindrical, with a ſlender ſub-globular tip. Müll.

Inhabits putrid water. The body is round, obtuſe behind, and its ſize minute.

Seminulum. Cylindrical and equal. Müll.

In water kept ſome days. The body twice the length of its breadth, pellucid before, and opake behind. Moves by alternately aſcending and deſcending.

Nebulosa. Oval-cylindrical, with viſible moveable inteſtines. Müll.

Found in waters with cyclidium glaucoma.

Farcimen. Cylindrical, curved, and truncated at both ends. Joblot.

In water kept a few days. Body opake, and in its motion often appears in the ſhape of the letter S.

Viridis. Green, ſub-cylindrical, and obliquely truncated before.

Abundant in water kept ſome weeks. Tail obtuſe, inteſtines obſcure.

ENCHELUS, Εγχελυς, in *Ichthyology*, the name given by Ariſtotle, Appian, and all the Greek writers, to the eel.

ENCHESON, a French word uſed in our *Law-Books* and *Statutes*, ſignifying the occaſion, cauſe, or reaſon, wherefore any thing is done. Stat. 5 Edw. III. cap. 3.

ENCHRI'STA, from εγχριν, *to anoint*, in *Surgery*, liniments with which parts are anointed.

ENCHYMA, of εγχυω, *I pour in*, in the *Medical Writings of the Ancients*, a word uſed in ſeveral ſenſes. Some have made it expreſs only an *infuſion*; others have uſed it for what the modern phyſicians call *plethora ad vaſa*, that is, a fulneſs of the veſſels, ſimply conſidered, as a relative to themſelves; and others have made it the name of certain forms of liquid medicines, to be injected into the ears, into the thorax, or any other part.

ENCHYMOMA, of εγχυμος, from εγχυω, in the *Writings of the Ancient Phyſicians*, a word uſed to expreſs that ſudden effuſion of blood into the cutaneous veſſels, which ariſes from joy, anger, ſhame, or any other violent emotion of the mind, and is what we uſually call bluſhing; which, according to Dr. Hunter, is a nervous affection.

Enchymoma is alſo an afflux of the blood, whereby the external parts are rendered black and blue, as in the ſcurvy, blood-ſhot eyes, &c.

ENCHYMONITES, in *Natural Hiſtory*, the name of a kind of ſtone found in Macedonia, and ſome other places, which was alſo called *pæonites* and *pæanites*: it was ſuppoſed to be of great virtue to aſſiſt women in labour. See Ceanides.

ENCHYMO'SIS, from εγχυω, *to pour into*, in *Surgery*, an extravaſation of blood from the veſſels, attended with black, blue, or livid appearance of the part. See Ecchymósis.

ENCHYSMA, the ſame with clyſter or enema.

ENCHYTA, in the *Medical Writings of the Ancients*, a name given to ſuch medicines as were injected into the eyes, or into any part.

Some alſo have uſed the ſame word to expreſs a ſort of funnel, contrived to convey the fumes of medicines to any part of the body.

ENCKENDORP, in *Geography*, a town of Germany, in the duchy of Holſtein; 6 miles S.E. of Rendſburg.

ENCKHUYSEN, or Enkhuizen, a conſiderable town of Holland, on the Zuyder Zee, in North Holland; 9 miles N.E. of Horn, and 30 miles N.E. of Amſterdam. N. lat. 52° 40'. Its commerce, and particularly its herring-fiſhery, was of great importance in former times; but its harbour is now almoſt entirely choaked up with ſand.

ENCLAVE', in *Heraldry*, is where one thing is let into another, particularly where the jointure is ſquare.

ENCLITICA, of εγκλινω, *I incline*, in the *Greek and Latin Grammar*, certain particles, united ſo cloſely to the preceding word, that they only ſeem to form one word therewith; and the word which ſuſtains them does generally likewiſe bear the accent that governs them, eſpecially when the enclitic is a monoſyllable; as in *dominuſque*, κυριος τε.

There are three enclitic particles in the Latin, *viz. que*, *ne*, and *ve*; but in the Greek many, as του, μου, μοι, με, σου, σοι, ση, πως, πη, τε, γε, φημι, ειμι, ποτε, and others.

ENCLOS, L', in *Biography*, a muſician in Louis XIII.th's band, an eminent performer on the lute and theorbo, or ſingle and double lute.

He was father of the celebrated Ninon, who played on theſe inſtruments as well as himſelf.

He dying in 1630, left her an orphan at 15 years old, beautiful, full of wit and talents, and formed to inſpire the moſt violent paſſion. Nor did ſhe wrap her talents in a napkin, but availed herſelf of all their influence; and even at more than fourſcore, ſhe is ſaid to have awakened love in the learned abbé Gédoin.

It is pretended that cardinal Richelieu had her firſt favours, and that he was the only one to whom ſhe ſurrendered, without conſulting her inclinations.

She was then 17, and it is certain that, ever after that time, ſhe received a penſion of 2000 livres annually, which was long regularly paid.

Ninon gave concerts at her houſe, where perſons of the firſt rank and talents came to admire her performance on the lute and harpſichord. The philoſopher, Huyghens, the famous aſtronomer, likewiſe obſerved Ninon with great attention and accuracy, and even wrote verſes on her, which Voltaire calls *Geometric*.

> "She has inſtruments five, which my brain much diſturb,
> The two firſt are her hands, the next are her eyes;
> But my tongue for the fifth and the beſt I muſt curb,
> Nor its beauties attempt to diſcloſe, if I'm wiſe."

She was ſeldom left by her lovers, but ſhe left them very ſoon; yet ſhe always retained a friendſhip for her old admirers.

She was ſo celebrated, that Chriſtina queen of Sweden made her a viſit in 1654, in a ſmall villa which ſhe had in the neighbourhood of Paris.

Madame de Maintenon was her beſt friend; and Voltaire aſſerts that M. de Villarceau was a lover in common with both, without its occaſioning a quarrel.

He had two children by Ninon. The hiſtory of the eldeſt is known, who at 19 years old became paſſionately enamoured of her; but on making the diſcovery, he blew his brains out. Her ſecond ſon, called Boiſſiere, died at

Rochelle in 1723, commiſſary of marine. She loved ſeriouſly for ſome time the marquis de Sévigné, brother of madame de Grignan; but who never wrote the letters to her, which M. d'Amoure has printed under her name about 40 years ago.

Madame de Maintenon, becoming all powerful, remembered her, and ſent her word that ſhe would take care of her fortune, if ſhe would change her way of living, and think ſeriouſly of religion: Ninon replied, that ſhe neither wanted fortune nor a maſk. Ninon died at Paris, 1705, at the great age of 90.

ENCŒLIA, of εν, *in*, and κοιλια, *belly*, a word uſed by many of the ancient medical writers, to expreſs the viſcera contained in the abdomen, or lower belly.

ENCOLPIUM, or Encolpion, the pectoral croſs of biſhops, abbots, abbeſſes, &c.; being one of the ordinary marks of the dignity of ſuch perſons both in the Latin and the Greek church.

ENCONDRUS, of εν, *in*, and χονδρος, *grain*, in the *Old Greek Writers*, a word uſed to expreſs any thing made up of a great number of ſmall pieces, or flakes, or ſmall grains of any thing. The manna of the ancients was not in large flakes, as we have it at preſent, but it was formed of a vaſt number of ſmall granules, and was therefore called by Dioſcorides, and ſome others of the Greeks, by this name. The word manna alſo ſignified with them the ſame thing; and they not only expreſſed the ſubſtance by it which we at preſent call ſo, but any other thing that was in ſmall flakes, or pieces, was called manna. Thus the manna thuris, ſo much talked of among the old Greeks, was only a collection of thoſe pieces which flew off from frankincenſe in the breaking. See Manna *Libanotis*.

ENCOPE, of εν, and κοπτω, *I cut*, in *Surgery*, an inciſion of any part; as in a gangrene, &c.

ENCOUNTER, in a *Military Senſe*, relates to that kind of deliberate attack, which is totally abſtracted from accidental hoſtility, and may therefore be conſidered in contradiſtinction to the rencontre, which ordinarily implies a fortuitous meeting. Thus we find, "to lead troops to the encounter," is a very common expreſſion; though we occaſionally hear the term miſapplied by perſons who deſcribe the loſſes, &c. ſuſtained in accidental warfare, as having taken place, not in the rencontre, but in the encounter. We ſhould alſo underſtand, that, in the ſtrict ſenſe, (which relates entirely to the arranging of troops oppoſite, that is, *en-contre*, to the enemy,) we ought not to conſider circuitous attacks, and thoſe feints made merely for the purpoſe of diſtracting the enemy's attention, as coming under this definition; and, on the other hand, we conſider not only thoſe who come into actual engagement, perhaps to the point of the bayonet, as is often the caſe in the attacks made by columns of infantry, but the ſupporting diviſions alſo, to be engaged in the actual encounter. Thus we frequently perceive, that the leading regiment of a column is engaged, while the rear regiments bear no ſhare in the conteſt; but if their ſituations be ſuch as to expoſe them to the enemy's fire, they muſt be as much conſidered in the encounter as a veſſel coming to the aid of another, ſo as to cauſe the enemy's ſhip to ſurrender, or to retreat. Hence it has ever been held a rule, that all veſſels in fight, when a capture is made, become entitled to ſhares in the prize; becauſe, on many occaſions, the approach of reinforcements adds to the vigour of one party, while it depreſſes the ſpirits of the other, and influences it to decline further conteſt.

ENCRANIUM, in *Anatomy*, the ſame with cerebellum.

ENCRASICOLUS, in *Ichthyology*, a ſpecies of clupea. See Clupea and Anchovy.

ENCRATITÆ, formed from εγκρατης, *continent*, in *Eccleſiaſtical Hiſtory*, a ſect of ancient heretics, thus called from their making profeſſion of continence, and abſolutely rejecting all uſe of marriage.

The founder of this ſect was Tatian, a diſciple of Juſtin, and one of the moſt learned perſons of all antiquity. After the death of that martyr, he made a ſeparation from the church, and ſoon had his followers; who, beſide the dogma juſt mentioned, borrowed a great many things from Saturninius and Marcion; beſide ſeveral errors, which they adhered to in common with the Gnoſtics and Valentinians.

They abſtained from eating any thing that had life, and denied that Adam was ſaved. They looked on ſuch as drank wine to be great ſinners; and for this reaſon only made uſe of water in celebrating the Euchariſt, as holding, that wine came from the devil. To countenance this tenet, they produced paſſages out of ſcripture, where mention is made of what befel Noah and Lot, when they were drunk.

They only admitted ſuch of the books of the Old Teſtament as they thought good; but in lieu thereof, they owned ſeveral ſpurious and apocryphal writings for canonical and divine. Such were the Acts of St. Andrew, John, and Thomas.

ENCRAULOS, in *Ichthyology*, the name given by Ariſtotle, and many other of the ancient Greeks, to the fiſh which we call the anchovy. See Clupea and Anchovy.

ENCRINITES, in *Natural Hiſtory*, a kind of columnar extraneous or organized foſſil, found in the earth. See Encrinus, Pentacrini, and Entrochi.

ENCRINUS Fossil, is the remains of an animal, ſo called by ſome; by others, this claſs of zoophytic remains is called *encrinites* (Parkinſon's Organic Remains, vol. ii. p. 153.); and by others, denominated *entrochi*, or *pentacrini*. See thoſe articles. See alſo Harenberg's Encrinus S. Lilium Lap. 4to.

Encrinus, a ſpecies of *Pennatula*, in the claſs of zoophyte worms, comprehending the cluſter-polypi of Ellis, and inhabiting the Greenland ſea.—Alſo, the name given by Ellis to the Aſteria, a ſpecies of Iſis, inhabiting the ocean that waſhes the coaſt of Barbadoes.

ENCRIS, in the *Medical Writings of the Ancients*, ſignifies a ſort of cake made of fine flour, mixed with oil, and ſweetened with honey.

ENCROACHMENT *of the Sea*, in *Geography*, ſignifies the ſudden or gradual converſion of dry land into the verge of the ocean. Hiſtory records numerous inſtances of great and devaſtating effects of this kind: ſome occaſioned by the waves of the ſea undermining the cliffs on its ſhore, and carrying away the matter thereof as faſt as they fall, by which the boundaries of the ſea have been conſiderably enlarged in ſome places; and its ravages ſtill continue with increaſing effect in ſome places, as on the chalky ſhores of Kent and Suſſex. Another kind of marine encroachment, highly intereſting to the geologiſt, is evidently taking place, by ſlow degrees, on a conſiderable portion of the flat ſhores of England; and can only be explained by an exceeding ſlow and gradual ſubſidence of the iſland itſelf, or a correſponding riſe of the ocean which bounds it. This is particularly viſible in the fens and marſhes of our coaſt, which are now defended by banks of that magnitude and height, which ſcarcely any effort of the preſent day could at once effect; but which, as in the marſhes embanked from the Thames below London, muſt have been begun centuries ago, when the tide flowed not ſo high by many feet as it does at preſent, and have been gradually raiſed, as the height of the water increaſed. The finding of immenſe fallen woods of trees, of the recent ſpecies, with the marks of human labour on them, and even the very tools by which they were felled, under great thickneſs of peat, the whole of which is now much below the level to which the tide riſes twice each day, are alſo proofs of this general encroachment of the ſea; ſince neither peat nor trees of any kind will grow where the ſalt-water of the ocean even ſaturates, much leſs continually overflows the ground. The mention of various inſtances of ancient and high embankments of marſhes and fens againſt the tide, will be found under our article CANAL, in the diviſions *Thames*, *Ouſe*, *Welland*, &c. See alſo EMBANKMENT.

ENCROACHMENT. See INCROACHMENT, and ACCROCHING.

ENCURECK, in *Natural Hiſtory*, a venomous inſect, found in Perſia, and ſuppoſed by ſome to be a kind of tarantula. It neither ſtings nor bites, but lets fall its venom like a drop of water, which cauſes inſufferable pain in the part for a time; and afterwards ſo profound a ſleep, that we are told nothing can raiſe the patient from it but cruſhing one of thoſe creatures on the part affected. It is nevertheleſs ſaid, that the ſheep eat theſe inſects without damage. Olearius, ap. Boyle, Works abr. vol. i. p. 37. Ibid. p. 38.

ENCYCLOPÆDIA, the circle or chain of arts and ſciences.

The word is compounded of the prepoſition εν, *in*, κυκλος, *circle*, and παιδεια, *ſcience*, *doctrine*, *diſcipline*, *learning*; the root being παις, *child*, *infant*.

The Greeks uſed the term for the knowledge of the ſeven liberal arts, and the poſſeſſion of all the ſciences. *Orbis ille doctrinæ, quem Græci* εγκυκλοπαιδειαν *vocant*, ſays Quintilian. It is ſometimes alſo written κυκλοπαιδεια, *cyclopædia*. Vitruvius, in the preface to his ſixth book, calls it *encyclios diſciplina*. See CYCLOPÆDIA.

ENCYSTED TUMOURS, in *Surgery*, ſwellings, which are formed of a bag, or cyſt, which is filled with matter very various in its conſiſtence and appearance. When the contents of the cyſt reſemble pap, the tumour is named *atheroma*; when they are of the conſiſtence of honey and wax, it is called *meliceris*; when they are fatty, it is termed *ſteatoma*. See theſe words, and eſpecially TUMOURS.

END *for* END, in the *Sea-Language*. When a rope runs all out of the block, ſo that it is unreeved, they ſay it is run out end for end.

The ſame phraſe is applied to a cable that has wholly run out of the ſhip. In general, it denotes the reverſal of the poſition of any object.

END-*on* is applied to a ſhip, which advances to a ſhore, rock, &c. without any apparent poſſibility of preventing her.

ENDE, in *Geography*, one of the ſmaller Molucca iſlands, S. lat. 8° 30'. E. long. 120°.

ENDEAVOUR RIVER, a river on the N. E. coaſt of New Holland, which at its mouth has a ſmall bar harbour, or creek, that runs in a winding channel three or four leagues inland, and having at its head a ſmall brook of freſh water. There is not depth of water for ſhipping above a mile within the bar. This part of the coaſt is ſo barricaded with ſhoals, as to make the harbour difficult of acceſs, the ſafeſt approach to it being from the ſouthward. S. lat 15° 26'. E. long. 215°.

ENDEAVOUR *Straits*, a channel or paſſage, ſo called by Cook, between New Guinea and New Holland, the N.E. entrance of which lies in S. lat. 10' 39'. W. long. 218° 36'. It is formed by the main, or the northern extremity of New Holland, on the S.E., and by a congeries of iſlands, which Cook called "the Prince of Wales's iſlands" to the N.W., which iſlands probably extend quite to New Guinea. The length of this channel from N.E. to S.W. is ten leagues, and it is about five leagues broad, except at the N.E. entrance, where it is ſomewhat leſs than two miles, being contracted by the iſlands which lie there. The depth of water in the ſtrait is from four to nine fathom, with every where good anchorage, except upon the bank, which lies two leagues to the northward of Wallis's iſlands, where, at low water, the depth is only three fathom.

ENDECAGON, or HENDECAGON, in *Geometry*. See HENDECAGON.

ENDECASYLLABUS, or HENDECASYLLABUS. See HENDECASYLLABUS.

ENDECANDRIA, in *Botany*, from ενδεκα, *eleven*, and ανηρ, *a man*, an order of the Linnæan claſs *Monadelphia*, characterized by having eleven ſtamens, whoſe filaments are, as the character of the claſs itſelf requires, united into a tube. It contains only the genus *Brownea*, the number of whoſe ſtamens is different in different ſpecies, and this preciſe number of eleven is ſo unuſual, and apparently unnatural, in flowers where five and ten ſo much predominate, that perhaps the order in queſtion might be, without miſchief, aboliſhed.

ENDECERES, of ενδηκα, *eleven*, in the *Naval Architecture of the Ancients*, a word uſed to expreſs a galley which had eleven ſeries or tires of rowers. Thoſe with two or three tires were very much in uſe among the ancients, and from thoſe to ſuch as had five or ſix tires. Thoſe of nine tires were ſometimes uſed, but it was very ſeldom; and thoſe of eleven, fifteen, and ſo on, were rather for ſtate, than ſervice. We read of them carried ſo high as to contain twenty, thirty, and forty rows of oars. One of this largeſt ſort was built for Philopater, which required four thouſand men.

ENDEIXIS, Ενδειξις, in *Antiquity*, an action brought againſt ſuch as affected any place or thing, of which they were incapable by law. Pott. Archæol. Græc. lib. i. cap. 23. tom. i. p. 125.

ENDELAVE, in *Geography*, a ſmall iſland of Denmark; eight miles N. of Funen.

ENDEMIC, or ENDEMIAL, *Diſeaſes*, from εν, *in*, and δημος, *a nation*, or *people*, are thoſe diſeaſes which occur among the inhabitants of a particular region or place, in conſequence of certain circumſtances belonging to it, and not ariſing from contagion, or any other general cauſe.

Thus agues, or intermittent and remittent fevers, which are occaſioned by the miaſms of marſhy ground, are *endemic* in low countries: the *goitre*, or bronchocele, connected with that peculiar intellectual imbecility, which characterizes the CRETIN, is *endemic* among the Alps, where its origin has been erroneouſly aſcribed to the uſe of ſnow-water: the colic, COLICA *Pictonum*, is *endemic* in the cyder-counties, eſpecially in Devonſhire: the bilious remittent fever, or yellow fever, is *endemic* in the Weſt India iſlands; and ſo forth. In all theſe inſtances, ſome *local* cauſe obviouſly exiſts, which produces the diſeaſe in the reſpective diſtricts; the diſeaſe belongs to the diſtricts, therefore, and affects thoſe who reſide there, but extends no farther. Whereas an *epidemic* diſeaſe is produced, or at leaſt propagated among the people, in conſequence of ſome general cauſe; as contagion, famine, or, perhaps, ſome change in the condition of the atmoſphere at large.

Hence the diſtinction between endemic and epidemic diſeaſes is obviouſly of great importance, for, in both caſes, much more beneficial purpoſes may be accompliſhed in the way of prevention, than in that of cure. But the prevention of diſeaſes depends altogether upon a knowledge of their cauſes, which ſhould therefore be accurately inveſtigated, whenever they prevail extenſively. If a diſeaſe is endemic, *i.e.* originates in ſome local cauſe, (from marſh effluvia, for inſtance;) it may attack the ſame perſon again and again, while he remains in the ſame ſituation; but he infallibly eſcapes it by removing his reſidence; or the inhabitants of the diſtrict may be all defended from its attacks by draining the marſhy ground, whence the miaſmata iſſue. Thus we are told by writers on the diſeaſes of armies, that the diſorders which ariſe from the foul ground of camps, are readily made to diſappear by removing but a few hundred yards from the ſituation which they previouſly occupied. And of the beneficial effects of attention to the local cauſes of endemic diſeaſes, we have a ſtriking example in the changes, which have occurred in London, in reſpect to the diſeaſes of its inhabitants. In the time of Sydenham and Morton, *viz.* in the latter half of the ſeventeenth century, remittent and intermittent fevers were generally prevalent to a great extent, in the autumnal ſeaſon, and were often extremely fatal to the inhabitants of the metropolis; and the bills of mortality ſhew, that formerly the dyſentery, which almoſt conſtantly appears in the ſame places and ſeaſons as the remittent fever, was annually fatal to great numbers. But of late years theſe diſeaſes have almoſt entirely diſappeared; intermittents occurring only occaſionally after wet ſeaſons, in thoſe people who have viſited the fenny counties during the harveſt; and dyſentery ſometimes prevailing, in a mild way, in thoſe ſeaſons only when the heat has been unuſually great. This exemption, which London now enjoys from thoſe endemic diſeaſes, is chiefly to be aſcribed to the improvements that have been made in the pavement, drains, and ſewers, and the attention that is paid to cleaning and ſupplying with water the ſeveral parts of the town. In ſome towns where theſe precautions are neglected, the remittent fever is ſtill found at times to commit great ravages It is probable that the fever, which proved ſo fatal in Philadelphia, in the year 1793, was of this kind, and produced from the cauſes juſt mentioned. (See Ruſh's Obſervations on the Fever of Philad. 1799. Dr. Miller's Report, New York, 1806.)

Some writers confine the term *endemic* to thoſe diſeaſes which are conſtantly preſent in certain diſtricts, at all times and ſeaſons, ſuch as the *goitre* of the Alps; and call thoſe *epidemic*, which are the product of certain ſeaſons, although originating in a local cauſe, as the autumnal intermittent and remittent fevers of fenny and hot countries. See Epidemic.

ENDENA, in *Geography*, a town of Italy, in the Bergamaſco; ſeven miles N. of Bergamo.

ENDENTED, Dented, or *Indented*, in *Heraldry*. See Indented.

Endented is alſo applied to a feſs or pale, and other triangular pieces, when divided alternately between two different colours. Coupé, or endented with or and azure.

ENDER, in *Geography*, a town of Italy, in the Bergamaſco; 12 miles N.E. of Bergamo.—Alſo, a river of Scotland, which runs into the Garry, ſeven miles W. of Blair-Athol, in Perthſhire.

ENDERSTORF, a town of Sileſia, in the principality of Neyſze; 3½ miles, S. of Ziegenhals.—Alſo, a town in the ſame country and principality; 3½ miles S.W. of Grotkau.

ENDESIS, from εν and δεω, *I bind*, a word uſed by Hippocrates to expreſs that part of the foot where the bones of the tibia end, and which is connected by ligaments to the ankle.

ENDEW, in *Falconry*, is ſaid of a hawk that digeſts her meat ſo well, that ſhe not only diſcharges her gorge of it, but even cleanſes her pannel.

ENDIAN, in *Geography*, a town of Perſia in the province of Chuſiſtan; 150 miles S.S.E. of Suſa.

ENDICA, a word uſed by the alchemiſts for the fæces which ſubſide to the bottom of the veſſels in infuſions; to ſome of which they attribute great virtues.

END-Joints, in *Mining*, otherwiſe called *cutters*, in coal-mining, are the ſhorter of the natural joints or upright partings of any meaſure or ſtratum; the longer of theſe joints being called *Backs*, *Slines*, face or lengthway-joints, or partings: for it ſeldom happens in any quarry or work, that the face-joints are not much longer than the end or croſs-joints.

ENDINGEN, in *Geography*, a town of Germany, in Auſtrian Swabia; ſeven miles N.W. of Fribourg.

ENDINGS of Strata, in *Geology*, ſignify the edges of the ſtrata, in their greateſt advance towards the north weſt, or in the direction of their general *riſe*, according to the obſervations of Mr. William Smith and his followers; by whom it has been obſerved, in all the eaſtern parts of England, that the ſtrata *end* ſucceſſively towards the N.W. generally with a fingered or digitated outline, in ſome, in places running out for miles in ridges, beyond the general range of the edge or limit of the ſtratum: the more recent obſervations in Derbyſhire, at Chelmeſton-low, for inſtance, and other projecting points of ſtrata in that *denudated* diſtrict, ſhew, however, the neceſſity of a careful attention to the fingered or projecting points of ſtrata, and to other concurrent circumſtances, before ſuch fingerings alone are admitted as proofs of the ending of a ſtratum, rather than as part of the edge of a denudated tract, on the oppoſite ſide of which the ſame ſtratum is to be found again, either on the ſurface, or abruptly ſunk beneath it by a fault, and upper meaſures occupy that ſurface. See Denudation, and Concentricity *of Strata*.

ENDITEMENT, or Indictment, in *Common Law*. See Indictment.

ENDIVE, in *Gardening*, the common name of an eſculent plant which is well known in garden culture. There are different varieties of it, but that which is perfectly curled, is the moſt uſeful for culinary purpoſes. See Cichorium.

ENDIVIA, in *Botany*, *Cichorium Endivia* of Linnæus, the garden endive. Ambroſini derives the word from *edendo*, eating, becauſe the plant is ſo grateful to the palate. It appears to us rather a corruption of one of its old names Entyba, or Intuba.

ENDIVIA Marina, the *ſea-endive*, in *Natural Hiſtory*, the name of a ſpecies of ſea plant, or marine ſubſtance, deſcribed by count Marſigli. There are two ſpecies of it, the one having broad and jagged leaves, reſembling thoſe of the vine, the other much narrower. This laſt kind grows on ſtones, ſhells, pieces of wood, or any other ſubſtances, accidentally found at the bottom of the ſea. It ſeldom grows in very deep water, and thrives beſt in places where the ſea is calm and quiet. It is of a duſky greeniſh colour, variegated in ſome places with yellow. It exactly reſembles the ſhape of the endive common in our gardens, and its leaves are cut and fringed in the ſame manner;

but they are of ſo tender a ſubſtance, that a ſlight touch deſtroys them ; they are indeed tenderer and more delicate than thoſe of any other known plant, either of the ſea or land. When this ſubſtance is examined by the microſcope, its ſurface is found to be compoſed of a great number of eminences and cavities, or little holes, between and among them ; and when the leaves are cut tranſverſely, there are ſeen a great number of glandules in them. Marſigli, Hiſt. de la Mer, p. 72. See CORALLINES.

ENDLESS ROLLS, and *Screw*. See the Subſtantives.

ENDOCARPON, in *Botany*, from ενδον, *within*, and καρπος, *fruit*, alluding to the receptacle of the ſeeds being deeply imbedded in the ſubſtance of the leaf, or rather frond. Hedw. Crypt. v. 2. 56. t. 20. f. A. Ach. Prod. 140. Meth. 125. (Lichen ; Zoega Iſland. 15. Dicks. Crypt. faſc. 2. 22. With. v. 4. 52. Sm. Engl. Bot. v. 9. 595, &c.) Claſs and order, *Cryptogamia Algæ*. Nat. Ord. *Lichenes*.

Gen. Ch. *Frond* cartilaginous, rigid, rounded, peltate, depreſſed ; naked beneath. *Receptacles* immerſed in the ſubſtance of the frond, globoſe ; their edges a little protuberant ; their concave diſk lodging the *ſeeds* in vertical cells, and at length expanded and diſplayed.

Eſſ. Ch. Receptacles immerſed, globoſe, concave, in which the ſeeds are imbedded.

This genus is, perhaps, more judiciouſly than moſt ſeparated from the great genus or family of *Lichen*, by Hedwig, followed by the accurate Dr. Acharius. The only queſtion is whether *Verrucaria* ought not to be joined with it, as differing not at all in the parts of fructification, though its frond is a cruſt inſtead of a leaf, juſt as his various *Parmeliæ* differ, even more widely, among themſelves. Several ſpecies of *Endocarpon* are figured in Engl. Bot. t. 593—595. 1512. 1698. 1866. 2012, and 2013. They are ſmall roundiſh or angular plants, commonly growing cloſely preſſed to the earth or ſtone, of a grey or olive hue, their fructification appearing like little black dots over the ſurface.

ENDOR, in *Ancient Geography*, a town of Judea, in the half-tribe of Manaſſeh, on this ſide Jordan, according to the book of Joſhua. Euſebius places it four miles S. from mount Tabor, near Naïm, in the way to Scythopolis.

ENDOR, *Witch of*. See WITCH *of Endor*.

ENDORSE, in *Heraldry*, an ordinary, containing the eighth part of a pale.

This, Leigh ſays, is never uſed but when a pale is between two ſuch : though others hold, that an endorſe may be borne between birds, fiſhes, beaſts, &c. Sir J. Ferne adds, that it ſhews the ſame coat has been ſometimes two coats, and afterwards conjoined within one eſcutcheon, for ſome myſtery of arms. He bears azure an endorſe argent.

ENDORSED, ENDOSSE', is where things are borne back to back.

ENDORSEMENT, of *in* and *dorſum*, *back*, is particularly uſed, in *Commerce*, for a writing on the back of a bill of exchange by the proprietor or bearer, either thereby to transfer it to ſome other, or to render it payable to the order of ſome other, or elſe to ſerve for an acquittance or receipt. See EXCHANGE.

The endorſement is only the name of the proprietor, or endorſer. Note, when the endorſement of a bill of exchange is to render it payable to another, it is called an *order*.

To an order it is neceſſary the endorſement be dated; and contain the name of him who paid the value thereof; in which caſe, the bill belongs to the perſon with whoſe name the order is filed, without any other tradition: without theſe conditions, the bill is judged to belong to the perſon who endorſed it. The bearer of a bill of exchange proteſted has a remedy againſt the endorſers for the payment of the re-change of the places where the bill was negociated by their order. In caſe a bill or note is refuſed to be paid, &c. the bearer has a remedy againſt any one of the endorſers, where there are ſeveral. See BILL.

ENDORSING, or INDORSING, in *Law*, implies the writing on the back ſide of a deed, inſtrument, &c. ſomething relating to the matters contained therein.

ENDOSIS, Ενδοσις, of εν and διδωμι, *I give*, in the *Medical Writings of the Ancients*, a word uſed to expreſs a remiſſion of any kind, as when a tumour, inflammation, or hardneſs of any part, becomes leſs violent ; and when the patient becomes eaſier, after the exacerbations in fevers of the continual kind, and after fits of the intermittent.

ENDOWMENT, or INDOWMENT, the giving or aſſigning of a dower to a woman. See DOWER.

The word is alſo uſed figuratively, for the ſetting forth or ſerving a ſufficient portion for a vicar, towards his perpetual maintenance, when the benefice is appropriated ; whence ſuch a vicarage is called a vicarage endowed.

ENDRACHIUM, in *Botany*, Juſſ. 133, ſee THOUINIA. The name is barbarous, corrupted from the Madagaſcar word Endrach, under which it occurs in Lamarck's Encycl. v. 2. 356, who nevertheleſs calls the genus *Humbertia*, following Commerſon. See Lamarck's plates, t. 103. Dr. Smith named it *Thouinia*, and is followed by Schreber, Willdenow, and Martyn.

ENDRAPA, in *Ancient Geography*, a town of Aſia, in Meſopotamia, ſituated on the left bank of the Euphrates.

ENDSCHUTZ, in *Geography*, a town of Germany, in the circle of Upper Saxony, and circle of Neuſtadt ; 4 miles E.N.E of Weyda.

ENDYMATIA, in *Antiquity*, a kind of dance uſed among the Greeks, performed in Arcadia, to the ſound of certain airs compoſed for the flute.

ENEDA, in *Geography*, a town of Switzerland, in the canton of Glaris ; 2 miles E. of Glaris.

ENELIAXIS, Ενηλιαξις, or rather *Enyaliaxis*, Ενυαλιαξις, in *Antiquity*, a feſtival in honour of Enyalius, whom ſome will have to be the ſame with Mars, others only one of his miniſters. Pott. Archæol. Græc. lib. ii. cap. 20. tom. i. p. 394.

ENEMA, of ενιημι, *I put in*, in *Medicine*, denotes a clyſter. See CLYSTER.

ENEMY. See ALIEN.

ENEOREMA, of εναιρεω, *I lift up*, is uſed by ancient medical writers for thoſe parts of the urine which float about in the middle reſembling a cloud, formed, according to Boerhaave, principally of muriatic ſalt. Comm. Inſtit. § 382.

ENEOS, of εν and αυω, *I cry*, a word uſed by the ancient writers in *Medicine*, for a perſon born deaf, or unable to perform the common offices of life, for want of any of the principal organs.

ENERGETICAL BODIES or *Particles*, are ſuch as are eminently active, and which produce manifeſt operations of various natures, according to the various circumſtances and motions of ſuch bodies or particles.

ENERGICI, in *Eccleſiaſtical Hiſtory*, an appellation given to certain diſciples of Calvin and Melancthon, of the ſixteenth century, becauſe they held the Euchariſt was the energy and virtue of Jeſus Chriſt ; not his real body, nor a repreſentation thereof.

ENERGUMENUS, Ενεργουμενος, a term ſometimes uſed by divines and ſchoolmen, to ſignify a perſon poſſeſſed with a devil, or an evil ſpirit.

The word is formed from the Greek, ενεργεισθαι, *to be agitated, worked*, of εν, and εργον, *opus*.

Though Papias ſays, the Energumeni were ſuch as counterfeited the actions of the devil, performing things which ſeemed ſupernatural. The council of Orange debars, or deprives the Energumeni of the functions of the prieſthood. See Dæmoniac.

ENERGY, in *Elocution*, a mode of delivery applicable to particular paſſages of a diſcourſe that are meant to be rendered particularly impreſſive and operative upon the feelings and convictions; like emotion, if not too frequently appealed to, or too extravagantly exerted, it has a great tendency to demonſtrate the ſincerity and real earneſtneſs of the ſpeaker; which is always one of the indiſpenſible requiſites for the conviction of the hearer. In declamation it ſhould be manifeſted alike in the enunciation, the tones of the voice (which ſhould be firm and fervid), and in the geſticulation. It is this quality in the ſpeaker that ſeems to have been deſignated by Demoſthenes as the firſt, ſecond, and third requiſite of an orator. Action (Ενεργεια, the Latin *actio*,) not being confined in ſignification to the mere motion of the limbs, but to the entire and reciprocal exertion of the mental and organic faculties of the ſpeaker, the co-operative energy of thought, language, enunciation, tone, look, geſture, and deportment. "Et actio oratoris pronunciatio ac geſtus, & ipſa adeo adminiſtratio cauſſæ." Cic. in Orat. c. 17. "Oratorical action is pronunciation and geſture; hence the very delivery of the ſubject." "Eſt actio quaſi corporis quædam eloquentia, cum conſtet e voce et motu." Quintil. Q. 3. "Action is, as it were, a certain eloquence of the body, conſiſting in voice and motion." See alſo Geſner's Theſaurus in voc. actio.

Energy, in *Painting* or *Sculpture*, may be divided into two parts, *viz.* energy of thought, and energy of execution.

The former conſiſts in deeply inveſtigating the nature and intereſt of a ſubject, and ſelecting that moſt impreſſive and deciſive moment for repreſentation (and alſo the mode of doing it) which ſhall convey to the imagination of the beholder with the greateſt intereſt, either its hiſtory or its moral.

The latter conſiſts in that ſame active, animated ſpirit, being accompanied by the power of diſplaying the repreſentation of that ſelection, either on marble or on canvas, with force, with freedom, and preciſion; without labouring, at leaſt without leaving the appearance of labour, in endeavouring to obtain its expreſſion.

The compariſon of two artiſts who in their works have each reſpectively exhibited the poſſeſſion of theſe two qualities in the higheſt degree, will beſt illuſtrate our meaning.

Raphael's works are full of energy of thought. Thoſe of Tritoretto of energy of execution.

The former always fixes upon that preciſe moment of time in a ſtory which is moſt favourable for relating it with ſucceſs; and is ſure to intereſt by the force and truth with which he unfolds the circumſtances of it. He ſometimes even, and that with the greateſt propriety, goes farther than the mere relation of the particular ſubject; he accompanies and illuſtrates it by alluſions to antecedent and ſubſequent events connected with it; as in the cartoon of the death of Ananias.

In that picture, ſome of the diſciples on the right of St. Peter are ſtill engaged in diſtributing alms, not yet having obſerved the inſtantaneous puniſhment inflicted by Almighty vengeance on the guilty ſinner; we are thus unaffectedly informed of the object for which the apoſtles are aſſembled, and how they were engaged previouſly to the time of the immediate ſubject of the work, and we are led as ſimply to underſtand ſomewhat of that which followed, by the introduction of the figure of Sapphira; who advances on the oppoſite ſide, intent upon counting the money ſhe may be ſuppoſed propoſing either to give to the fund devoted to charity, or to withhold, that ſhe might gratify her own, and her now dying huſband's avarice; whoſe fate, of which ſhe appears to be altogether unapprized, ſo nearly awaited herſelf, for her deſign of committing the crime for which he was ſo awfully puniſhed.

Thus we ſee, that no part of the intereſt of the ſubject eſcaped the active energy of the mind of Raphael, and many others of his works would as well illuſtrate his great ability in this point of the art; *e. g.* the cartoon of St. Paul preaching at Athens, but in neither of theſe noble works is there much energy of execution: that was the *forte* of Tintoretto.

He ſeldom ſtopped to think correctly and refinedly upon his ſubject. He rarely pourtrays the paſſions with truth in the countenances of his figures, or gives his ſtory intereſt on the mind; except by the aſtoniſhing freedom, force, and fire of his pencil in the execution, where it appears to have moved with the utmoſt rapidity; the canvas trembles under it. His vigour in colour equals the ſkill of his workmanſhip; and theſe united, the obſerver forgets the want of more valuable beauties. The ſkill of the maſter ſtrikes more than the work itſelf. His execution well deſerves the appellation beſtowed upon it by the Carracci, "Il terribile maniera del Tintoretto." It ſtill remains a deſideratum in art to ſee it united with elegance of deſign; with feeling, and truth in thought, and expreſſion.

In ſculpture the author of the Laocoon has effected their union. We may, therefore, hope its ſiſter art may ſometime arrive at an equal degree of perfection. But there are ſo many more points of difficulty to overcome in painting than in ſculpture, that he muſt be almoſt ſuper-human who effects it.

Many will rather wiſh that Michael Angelo had been inſtanced as poſſeſſing energy of thought in preference to Raphael; and juſtly he might have been hailed as a wonderful model of it, as he alſo was to a conſiderable degree in the other acceptation of the word, *viz.* in execution. But his energy is leſs underſtood than that of Raphael; and is of a leſs valuable kind; as it not unfrequently renders his figures enigmatic, and nature is loſt in art. Raphael comes equally with him, home to his ſubject; and can ſcarcely ever be miſunderſtood. Hence, therefore, we think ourſelves juſtified in preſenting the latter to the attention of our readers rather than the former; not as willing to depreciate Michael Angelo; but becauſe we conceive, that while the conſideration of his energetic powers may invigorate the ſtudent, it may divert his mind from truth, and lead him to bombaſt and affectation; which the contemplation of the works of Raphael never can do, unleſs he be of a moſt perverſe ſtamp of nature indeed. If energy of thought may be ſaid to be characterized by thoſe ſtrong workings of the imagination alone, which produce the repreſentation of the moſt extraordinary and powerful actions of the human body, with bold fore-ſhortenings and ſtrong expreſſions; then M. Angelo claims by far the higheſt place, but we do not conceive that to be the beſt criterion for judgment on this point. He who ſees cleareſt, and while he gives it powerfully, moſt juſtly and beautifully illuſtrates his ſubject, muſt ſurely have as fully and warmly conceived the nature of it; as he, who, mixing the extravagance of enthuſiaſm with his energies, permits his mind to run wild upon it; and throws upon his canvas figures which rather confuſe than exemplify, and draw the attention of the obſerver from the ſubject to the painter. This enthuſiaſm, we think, does characterize in a great meaſure the wonderful works of M. Angelo; whilſt Raphael's mind, though full of energy, is pure, and going to the extreme of indulgence in his ſubject, ſtill keeps within its bounds.

ENERVATING, the act of deſtroying the force, uſe, or office of the nerves, either by cutting them, by weakening them with debauchery, or by ſome other violence.

Exceſs of wine, and other ſtrong, hot, ſpirituous liquors, enervate or weaken the nerves. When they would render a horſe uſeleſs, they enervate him, or cut his nerves.

Enervating, is particularly uſed in the *Manege*, for the cutting two tendons on the ſide of a horſe's head, under the eyes, which meet on the tip of the noſe; they thus enervate horſes, to make their heads ſmall and lean.

The word is alſo uſed figuratively. It is no ſmall artifice in diſputing, to be able to enervate and extenuate the allegations of one's antagoniſt. This author has a weak enervate ſtyle. See Nerve.

ENERVATION, a term in the *Ancient Anatomy*, applied to the tendons of the recti, or ſtraight muſcles of the abdomen.

The fibres of the recti of the abdomen do not go from one extreme of the muſcles to the other, but are interſected by ſeveral nervous places, called by the ancients enervations, though they be real tendons.

Their number is not alike in all; ſome having three, others four, &c.

ENERVE, Folium, in *Botany*, a leaf deſtitute of ribs and nerves. See Leaf, and Costatum Folium.

ENFANS Perdus, a French phraſe, uſed in war to ſignify the ſoldiers who march at the head of a body of forces appointed to ſuſtain them, in order to begin an attack, make an aſſault, or force a poſt.

The word literally imports *loſt children*, on account of the imminent danger they are expoſed to.

In Engliſh, they are called the *forlorn*, or *forlorn hope*.

At preſent, the grenadiers uſually begin ſuch attacks.

ENFIELD, William, in *Biography*, was born at Sudbury in the year 1741, and educated for the miniſtry among the Proteſtant diſſenters at the academy at Daventry, where he diſtinguiſhed himſelf by the poliſh of his early compoſitions. He was firſt ſettled as miniſter with the congregation at Benn's garden, Liverpool; this was in the year 1763; and, in 1770, he became reſident tutor and lecturer in the belles-lettres in the academy at Warrington. He ſhortly after qualified himſelf as mathematical tutor, and in that character publiſhed "The Inſtitutes of Natural Philoſophy," in quarto. A new edition of this work was publiſhed after the doctor's death, with conſiderable additions, and an introduction to the modern doctrines and diſcoveries in chemiſtry. It may be reckoned one of the beſt popular introductions to Natural and Experimental philoſophy. During his labours at Warrington, which were highly prized, the univerſity of Edinburgh conferred upon him the title of doctor of laws. In the year 1785, he removed to Norwich, and became paſtor of the congregation of diſſenters in that place. With the duties of this office, he ſucceſsfully employed himſelf in various literary undertakings, among which was the laborious taſk of tranſlating and abridging "Brucker's Hiſtory of Philoſophy," a work to which we have frequent occaſion to refer in the courſe of our own inveſtigations of the learning of ancient times. This abridgment was publiſhed in two vols. 4to. in 1791, and "probably," ſays his friend and biographer, Dr. Aikin, "the tenets of the different ſects of philoſophers were never before diſplayed with ſo much elegance and perſpicuity. It was, indeed, his peculiar talent to expreſs the ideas of other men to the greateſt advantage. His language, chaſte, clear, correct, and free from all affectation, is one of the beſt ſpecimens of that middle ſtyle which is fitted for all topics, and he communicates to his reader all that clearneſs of idea which reigned in his own mind. Theſe qualities, together with the candour and moderation which made part of his very conſtitution, eſpecially fitted him for the office of literary criticiſm, and he was long an aſſociate in one of the moſt reſpectable of the periodical journals." He died November 3d, 1797, in the 57th year of his age, generally beloved and lamented. In every relation of life, the benevolence of a kind heart diſplayed itſelf in the moſt engaging features. He publiſhed "Sermons," "Family Prayers," and "The Preacher's Directory." His compilations, entitled "The Speaker," and "Exerciſes in Elocution," are perhaps the moſt popular works in our language, and they unqueſtionably merit the patronage which they have had, and continue to have. After his death three volumes of his ſermons were publiſhed by ſubſcription, and the numerous friends who patronized this work, will prove the attachment which he had inſpired. Gen. Biog.

Enfield, in *Geography*, a town and pariſh in the hundred of Edmonton, and county of Middleſex, England, is ſituated nine miles from London, and contained, according to the late return to parliament, 926 houſes, inhabited by 5881 perſons.

It is ſtyled in ancient records Enfen, or Infen, from its fenny ſoil, which is now, however, converted into good land, by draining, &c. The pariſh is very extenſive, the town itſelf being but a ſmall part of what bears the name of Enfield. The pariſh church is an ancient ſtructure, and has been recently repaired. Here are a good free ſchool, and two meeting-houſes for diſſenters. Part of an ancient royal palace ſtill remains, where Edward VI. is ſaid to have reſided, and where queen Elizabeth kept her court in the early part of her reign. One of the rooms appears in its original ſtate, with oak pannels, and a richly ornamented ceiling: the chimney-piece is of admirable workmanſhip, and decorated with the arms of England and France quartered. The palace was alienated from the crown by Charles I. and has ever ſince been private property. In 1670 it was taken by Mr. Uvedale, maſter of the grammar-ſchool, who, being attached to botanical ſtudies, planted in the garden a cedar of Libanus, which, in 1793, meaſured twelve feet in girth, three from the ground. The town had formerly a good market, which is fallen into diſuſe. In the ſuburbs are a number of boarding-ſchools, and ſeveral elegant villas. Enfield was heretofore much celebrated for its *Chaſe*, which comprized a large tract of woodland, well ſtocked with deer; but during the civil war it was ſtripped both of game and timber, and let out into ſmall farms: after the reſtoration it was again laid open, woods planted, and filled with deer. In 1779 it was diſafforeſted by act of parliament; parcels were allotted to different pariſhes, and the remainder ſold. A part was bought by Dr. Jebb, who having ſucceſsfully attended the duke of Glouceſter at Trent, the king, on conferring the dignity of baronet on him, gave the name of Trent-place to the villa which he had erected here. South Lodge, alſo on the chaſe, was the favourite retirement of the late earl of Chatham. Eaſt Lodge was the hunting ſeat of Charles I.

In this pariſh, at a place called "Four-tree hill," or Forty-hill, the late Richard Gough, eſq. had a ſeat, where he died, in February 1809. Some account of this eminent topographer and antiquary will be given in a ſubſequent part of this work. Lyſon's Environs of London, vol. ii.

Enfield, a townſhip of America, in Hartford county, Connecticut, on the eaſt bank of Connecticut river, oppoſite to Suffield, and bounded on the north by the Maſſachuſett's line; ſettled in 1681. In 1769 it contained 214 Engliſh families. In the town are two congregational churches, and a meeting-houſe for the ſect called Shakers. The town is pleaſant, and contains 1761 inhabitants; 18 miles N. of Hartford.—Alſo, a townſhip in Grafton county, New Hampſhire, about 11 miles S.E. of Dartmouth college; incorporated in 1761, and containing 1121 inhabitants.

ENFILADE, a French term, ſometimes uſed in Engliſh, ſignifying a ſeries or continuation of ſeveral things, diſpoſed, as it were, in the ſame thread or line; as an enfilade of rooms, of doors, of buildings, &c.

The word is formed of the French verb, *enfiler*, to ſtring a thing, which is compounded of *en*, *in*, and *fil*, of *filum*, thread; *q. d.* a thread or ſtring of any thing.

Enfilade, in *Military Matters*, relates to a certain mode of acting upon the defenders of lines, redoubts, batteries, &c. thereby counteracting the impediments thrown in the way of a direct fire. To explain this, it is neceſſary to obſerve, that defences may be attacked in three modes; *viz.* *direct*, that is, by a reſponſive fire in front, or, at leaſt, ſo little obliqued as to come under the general acceptation of what the French engineers term *fiſhant*, or, plunging: this fire is commonly at right angles with the line of defence to be battered: when the fire is much obliqued, it is ſaid to be *razant*, or grazing. The ſecond mode of attack is by *reverſe*; that is, where the batteries of the beſiegers can be ſo directed as to command the interior of the rampart, and thus render it impoſſible for the defenders to remain at their guns. This mode generally relates to an angle of at leaſt fifteen degrees from the line of the defence in queſtion, but may extend to any angle up to 90°; remarking, however, that the more direct the fire may be in reverſe, the leſs execution will be done, becauſe the ſhot can only ſtrike one particular object. The third mode is by *enfilade*, and is always the moſt deſtructive, eſpecially if the guns of the enfilading battery can be brought to bear at a right angle with the direction of the battery to be enfiladed. When this cannot be effected, it is neceſſary to make a ſmall angle in reverſe, the leſs the better, thereby to throw the ſhots along the interior of the parapets, and to take the whole in flank. Some fortreſſes are unavoidably ſo ſituated as to have one, or perhaps two batteries expoſed to a very diſtant enfilade. Such a defect is of the utmoſt importance, and cannot be radically overcome; for we ſometimes ſee ſome hill, or what is worſe, ſome ſhifting ſand, which cannot poſſibly be either removed or occupied, but which affords both a command, and a lodgment in ſecurity from the fire of the place. Although this is aſſuredly an immenſe drawback on the ſtrength of the works, it is nevertheleſs in ſome ſituations of little moment; for inſtance, where it is neceſſay to retain a ſmall force for the purpoſe only of preventing an enemy from landing at the only acceſſible ſpot upon a long range of coaſt, preſenting in every other part ſuch natural obſtacles as annihilate all apprehenſions of invaſion. In ſuch place the ſurrounding eminences are of no moment; or if they were, muſt rather be conſidered as offering advantages, and the means of rendering the place untenable to the enemy, ſhould they ſucceed in carrying the works.

Speaking generally, however, a fortreſs that can be enfiladed with tolerable ſafety to the beſiegers muſt be untenable; becauſe it is impoſſible to deviſe effectual means for remedying the evil. It is true, we may raiſe large epaulements, or buttreſſes of ſoil, maſonry, &c. for the purpoſe of preventing the enemy's ſhot from ranging along the rampart; but, in moſt inſtances, where enfilades can be made, theſe epaulements would require to be carried to ſuch an immenſe height, as muſt, in a meaſure, deteriorate the other defences; in ſome inſtances rendering them nugatory, or even advantageous to the aſſailants, whenever they may be able to make a lodgment. Beſides, ſuch epaulements are very liable to be deſtroyed by mortar and howitzer batteries, or by mines. This mode of parrying the enfilade has, with much propriety, been of late years deſignated by the French engineers a *defilade*, a term peculiarly expreſſive of the intention of whatever devices may be uſed for the purpoſe of preventing defences from being enfiladed. It muſt not be forgot, that the approaches of beſiegers ſhould be carefully conſtructed; elſe they may be ſubjected to enfilade from ſome of the defences. That evil is, however, eaſily avoided; and if, through ignorance or inadvertence, found to take place, may be inſtantly corrected, as the beſiegers have, on almoſt all occaſions, ample range for alteration, and can adopt a variety of meaſures totally unattainable to thoſe within the fortreſs.

Where a work is carried over a riſing ground, it is generally very difficult to render the interior of the batteries ſafe from either reverſe or enfilade. The beſt mode is to carry them up the aſcent *en eſcalier*, that is, by ſhort levels, each perhaps capable of mounting four or five guns, and every ſuch level being cut off from its neighbour below, by a heavy epaulement, carried up high enough to prevent the beſiegers from trundling their ſhots along within the parapet. The moſt effectual method of cutting off enfilades is to give the rampart ſuch an augmentation of thickneſs as may allow a free paſſage for cannon, &c. along the rear of thoſe in the embraſures, and to fill up the ſpaces between the latter with *traverſes*, carried to at leaſt ten feet in height. Theſe traverſes are nothing more than regular maſſes of ſoil, properly turfed, or perhaps reveted with maſonry, placed at right angles with the parapet, and uniting therewith: their thickneſs ought not to be leſs than ten feet.

We muſt here obſerve, that with few exceptions, the enfilade commonly takes place from the exterior flank of the battery; therefore that quarter ſhould be chiefly attended to. With this view it is found moſt proper to conſtruct each traverſe partly of maſonry, and partly of ſoil well gazoned, (*i. e.* turfed) or, if on emergency, firmly retained by faſcines. Sometimes ſand bags will be found to anſwer for this part, when the reſidue of the thickneſs is completed with good maſonry, at leaſt four feet in ſubſtance. Where cotton, or wool, or raw hides, are procurable, they will be found to make admirable traverſes, if ſuſtained by a firm wall: theſe being placed neareſt to the enfilading quarter, will, by their elaſticity, completely deaden the force of the ſhot, however great their calibres, and cauſe them, if they ſhould reach ſo far, to be weak and inſignificant in their impreſſion upon the interior buttreſs of maſonry. It ſhould ſeem, to perſons unacquainted with the practice of defending places, that, in conſequence of the great reſiſtance offered by ſolid maſonry to cannon-ſhot, which will often bury themſelves full fifteen feet, or more, in ordinary ſoil, the traverſes ſhould be conſtructed of maſonry only: this would, no doubt, preſent great firmneſs in a contracted ſpace; but the inconceivable deſtruction and diſmay occaſioned by the ſplinters knocked off by ſhots that ſtrike upon bricks or ſtones, oppoſes an inſuperable bar to what would otherwiſe prove a moſt valuable mode of conſtruction; ſuch, indeed, as would render many places abſolutely impregnable. This compels us to reſort to ſuch materials as are, in a great meaſure, devoid of ſuch miſchiefs, of which turf is the beſt.

It is generally conſidered, that the enfilade is cut off by placing traverſes at from fifteen to twenty toiſes aſunder; but the latter diſtance, (equal to forty yards,) is certainly too great: it would even be adviſeable to bed the guns between traverſes, as we have above ſhewn, were it not that by ſo doing the battery muſt be weakened, owing to the ſpaces occupied by ſo many buttreſſes. However, neceſſity and, generally ſpeaking, locality, muſt give laws for the conſtruction of ſuch impediments to the enfilades. It muſt be underſtood, that the obnoxious battery may be very powerful; that is, it may not only mount heavy cannon, but may be far more numerous than might at firſt be ſuppoſed. To explain this, it muſt be ſtated that the moſt deſtructive enfilade is that which ranges along the interior of a battery, at about from two to ſix feet within the parapet; ſince in that direction it is ſure to deſtroy not only the defenders, but even the cannon, diſmounting them, and cruſhing the gunners, as well as cauſing a variety of ſplinters to ſcatter among them, from the ſeveral parts of the wood and iron work. Sometimes, indeed, when the ſhots touch upon the cannons themſelves, the former, being of caſt iron, and conſequently liable to ſhiver when forcibly ſtruck, break into numerous pieces, or even fracture the latter, ſo as to render them perfectly unſerviceable.

If ſhots were to be fired at ſuch an elevation as barely to graze the creſt, or ſummit, of the parapet, they would certainly prove moſt deſtructive to the defence flanked by ſuch a forcible fire; but this cannot be effected at ſhort diſtances, ſince, it is evident, the ſhots would, at the moment of touching the creſt of the parapet, be *aſcending*, and that too with ſuch force as could not fail to impel them far over every part of the fortreſs, and thus to prove completely unavailing. This mode of enfilade, therefore, commonly takes place where the cannon is not at leaſt on a level with the creſt of the parapet, ſo as to ſend its ſhot through it with ſufficient force to cut clean through, without being thrown upwards into a new direction, and thus to plunge into the more remote part of the defence. When the enfilade is more diſtantly ſituated, the ſhots may certainly be thrown over the parapet as they are *deſcending* upon their long range; but this is very uncertain, and rarely does much execution; to be ſure, when the ſhots can be correctly thrown, the havoc they create is dreadful.

The uſual mode of enfilading is by ricoçhet, that is, by giving the piece, whether mortar, howitzer, or cannon, ſuch an elevation, and ſuch a charge, as may cauſe the ſhot to bound firſt on the glacis, and then over the rampart into the battery. This, our readers will perceive, is exactly on the principle of "a three-quarter ball" at cricket; which, if it paſſes over the wicket, makes ſeveral low bounds, or, as they are technically termed, "lobs," in proceeding along their courſe, until they come to a ſtate of reſt. So does a cannon-ſhot, after bounding over a rampart, keep lobbing, rather more forcibly indeed than a cricket-ball, along the terre pleine of the rampart. It will not be neceſſary to expatiate on the effects of this dreadful contrivance, they being ſo obvious, and ſo completely ſimilar to what is called "raking fore and aft," in naval warfare.

The moſt powerful ricoçhet takes place at an angle under ten degrees of elevation; fifteen degrees are the utmoſt that are allowed, both becauſe the effect produced is leſs when the elevation is encreaſed, and the gun-carriage is proportionably injured by the direction of the recoil deviating from the horizontal, ſo as to depreſs and ſtrain the hinder parts of the frame work; while, at the ſame time, the wheels are lifted in the fore part, and return to the ground with undue force. When mortars are uſed in ricoçhet firing, they are commonly charged with a number of ſhots, or of ſhells, forming in the whole, what we may term, a round of grape proportioned to the calibre of the piece. In batteries intended ſolely for ricoçhet firing, the embraſures ſhould have their ſuperior ſlope outwards, as ſeen at K in the plate; whereby the enemy could not fire into it ſo eaſily as if the embraſures were made in the uſual way: in fact, they could not diſtinguiſh them, as the whole would be nearly ſolid, much the ſame as a mortar-battery. Where infantry or cavalry are to be fired at in ricoçhet, the pieces muſt not be elevated more than three degrees, otherwiſe their greateſt effect would not be produced. Ships may likewiſe be acted upon by ricoçhet, if the ſhots are cauſed to ſtrike the water at a *depreſſed* (inſtead of an *elevated*) angle of about four degrees, ſo as to touch the ſurface at from two hundred to two hundred and fifty yards from the battery. But this applies only to particular caſes; for if the veſſel be remote, or that any object is to be fired over, the ſame angle of elevation may be uſed, taking care ſo to proportion the charge, that the ſhot may light upon the water at about two hundred yards from the veſſel, if ſhe be large; but if ſmall, the ſhot muſt light nearer to her, in proportion to her want of bulk.

It was neceſſary to ſay thus much of ricoçhet firing, in order to give a complete inſight into the manner of enfilading by means of ſmall charges of powder. The reader will likewiſe perceive that ſeveral guns may enfilade the ſame battery, in exactly the ſame line, merely by cauſing them to be removed farther from the object of attack, the one behind the other, only taking care that the parapet before each be ſufficiently ſubſtantial to prevent accident to the other batteries in its front, and cauſing the more remote to charge higher, in order that their ſhot may be thrown ſufficiently far to make the firſt bound in a proper manner, over the epaulement of the defence to be enfiladed. We ſhould obſerve that the mode of enfilading before-mentioned, namely, by grazing directly over the creſt of the parapet, may be extended to remote works; but unleſs they are manned for action little damage will be done, as the beſieged will rarely fail to *houſe* their cannon, by pointing them towards the enfilading-battery; ſo that they may be far leſs expoſed than when ſtanding in their proper directions.

We ſhall annex to this article, which we have dwelt upon in deference to its importance in military affairs, a few general principles. 1ſt. That the deſcending enfilade is the moſt deſtructive in long ranges. 2dly. That the ricoçhet-enfilade is peculiarly adapted to ſhort diſtances. 3dly. That the angle ſhould, if practicable, be kept under ten degrees of elevation; the greater effect being generally in proportion to the leſs deviation from the horizontal direction. 4thly. That the more direct the fire may be along the line, or defence, to be enfiladed, the greater will be the damage done thereto, provided it be within ſuch a parallel with the parapet as may ſubject both the cannon and the gunners to its range. 5thly. That if any angle is to be made with the line to be enfiladed, a few degrees in reverſe are better than even half their number in advance; becauſe, though the former may not ſtrike any object in its original courſe, the ſhots may, after having grazed againſt the interior of the parapet, *genouillere*, &c. ſtill do conſiderable damage; and, even though they ſhould not either diſmount a cannon, or kill any of the men on the battery, they muſt tear the garon-revetement far more than one of maſonry, which is often put exteriorly, though not within: the latter would turn the ſhots off, in all probability, and cauſe them to have only the effect of a weak fire *razant.* 6thly. It will be neceſſary to aſcertain the thickneſs of the parapet behind which the enfilading ſhots are to trundle: in common fortifications it may ſufficce to compute, as nearly as may be practicable, upon about four toiſes, (or eight yards,) from the extremity of the ſuperior ſlope of the angle; but in places where the parapets are made of maſonry, leſs will commonly be neceſſary, for the purpoſe of ſtriking ſomewhere upon the line of platforms, and of thereby diſmounting the cannon. 7thly. Where howitzers are uſed for the enfilade, the traverſes muſt be very numerous, to prevent the pieces of burſten ſhells from ſpreading to any extent. But, in ſuch caſe, the traverſes will not require ſo much ſolidity, as if oppoſed to heavy ſhots. 8thly. Where a remote battery is to be enfiladed, eſpecially if the enfilade be direct, that is, in a line with the prolongation of ſuch battery, great care muſt be taken to be exact in aſcertaining its diſtance from that part of the defences which may be neareſt to the enfilading party. This may, in general, be done, with preciſion, by means of two long ladders placed face to face, and elevated during the night, ſo as to give a command of the works then in a ſtate of actual oppoſition; when the flaſhes from their cannon will prove a ſufficient guide. This may, however, be done with more preciſion during the day time, though certainly with more danger; but the operation being certain and ſpeedy, compenſates for the riſk. The enfilade on ſuch occaſion muſt not be by ricoçhet, but by deſcent. Thoſe who are in front of the enfiladed battery, or nearly ſo, will ſee the effects of the ſhots, and can, by means of pre-concerted ſignals, give information accordingly to the enfiladers.

The following references to the figures in *Plate* III. *Fortification, fig.* 1, will explain more fully what has been ſaid.

Let A B be the face of a baſtion, whoſe ſaliant or flanked angle, B, is battered in breach from C C. In ſuch caſe, the beſieged muſt make a very ſtrong epaulement from B to P, on the adjoining face, to prevent the ſhots from the enfilading battery at D trundling upon the terre-pleine of the face A B; in aid of this reſiſtance, the traverſes, S, S, S, muſt likewiſe be thrown up. The battery at D being a direct enfilade, that is, in the line of the face A B, is highly deſtructive; while that at E, which is only 15° in reverſe, is far leſs ſo. It is indeed evident, that one cannon at D would be more effectual than two at E; unleſs the ſhots from the latter ſhould be thrown in ſo as to fall upon the neareſt part of the interior of the parapet, as has been already implied: they would then be capable of tearing away the interior of the merlons, and of cauſing great numbers of ſplinters, &c. The battery at F is a direct-enfilade of the face of the remote baſtion H; but its fire muſt not be in ricoçhet, (as that could never reach its object,) but by deſcent. At I, an enfilading battery is ſhewn in profile, the cannon being ſunk, and the embraſure, K, having an inverted ſlope, covering the cannon from the fire of the battery at L. This ſlope being only 10°, admits the ſhots from the cannon to aſcend, by means of a ſmall charge, in a curve meeting the ground at N; thence reaſcending over the face L. (correſponding with B P in the upper figure,) ſo as to light again at O, upon the terre-pleine of the face M, (here ſeen in reverſe, and correſponding with the interior of A B in the upper-figure;) whence it will again riſe, and, if unimpeded, bound on in ſucceſſively diminiſhing curves, until its force be expended. The dotted line, from the cannon I to O, on the baſtion M, ſhews the direct or plunging enfilade by deſcent, which is beſt adapted to cannon of a ſmaller calibre; the force of the ſhot being, in this inſtance, unabated by any bound; as muſt be the caſe in ricoçhet, wherein, by ſtriking at N, the impetus is conſiderably diminiſhed. This diminution will be greater, in proportion as the elevation of the cannon is increaſed. As already ſtated, the enſilade of H from F will be of little moment, unleſs the battery at H be in action; but, as the obliquity of the embraſures may enable the enfiladers at F to act either in ricoçhet, or by deſcent into the reverſe of A C, or even of A B, there might be conſiderable advantage gained by ſuch a poſition. It is proper to ſtate, that this does not appear to be generally practicable; as the diſtance from C, C, (the main breaching-batteries,) to F muſt render the latter rather inſecure, and expoſe it both to the batteries of the place, and to the ſallies of the garriſon: it is therefore given merely as an illuſtration of the terms uſed in the explanation of all that relates to enfilade. When ſhipping, or craft of any deſcription, lie behind a mole, ſo as to be ſecure from the direct fire of any battery, the ricoçhet-enfilade may be adopted, either by elevation, as ſhewn above; or by depreſſion, as from the cannon at P directed downwards to Q; whence the ſhots will bound over the mole R, and fall among the veſſels behind it. This is occaſionally done to deſtroy veſſels in a harbour, or to enfilade ſuch as may be actively employed in any attack; and thus to force them to a change of poſition, rather than ſuffer themſelves to be raked fore and aft with hot balls.

ENFILED, in *Heraldry*, is applied to a ſword, on which is placed the head of a man or beaſt, or any other charge.

ENFRANCHISEMENT, the incorporating any man into a ſociety or body politic. See Freedom and Franchise.

Thus, he that by charter is made denizen of England, is ſaid to be enfranchiſed. The like is underſtood of a perſon made a citizen of London, or other city or corporate town; becauſe he is thereby made partaker of the liberties appertaining to the corporation whereof he is enfranchiſed.

EN FRAPPANT, *Fr.*, in *Muſic*, a term applied, in beating time, to the firſt note of a bar.

ENGADINE, in *Geography*, one of the higheſt vallies of Switzerland, in the canton of the Griſons. It is divided into the Upper and Lower Engadine. St. Martin's bridge on the river Inn ſeparates the Lower Engadine from the Tyrol. The towns of this valley are leſs agreeable than thoſe of the upper one; but the ſoil is uncommonly productive. In ſome places the roads are narrow and rocky, and nature diſplays its wildeſt ſcenes. The river Inn is often compreſſed in a narrow deep channel: there are, however, a few fine plains, where fruits come ſooner to maturity than in the Upper Engadine, from which it is divided by the Pont Alta. The ſituation of the upper valley is much higher; it has very long winters, and the air is generally cold. In the midſt of ſummer, night froſts nip the corn and fruits. The towns are agreeably ſituated, and moſtly handſome, built of free-ſtone, and painted white; even the barns are fine buildings. The river Inn flows ſlowly in a larger bed; there are ſeveral beautiful bridges of a ſingle arch thrown over it. Near the pretty town of Schoulz are fourteen ſprings of mineral water of different qualities. There are ſeveral manufactures, chiefly iron works and founderies, in the Engadine, which give employment to a great number of its inhabitants, and an appearance of chearfulneſs and comfort to their habitations.

ENGAGE, *To*, when applied to *Military* or *Naval Affairs*, means to attack. Perhaps no circumſtance incident to warfare requires more precaution, or indeed more judgment, than that relating to the giving battle to an enemy. The general, or commander of any deſcription, who neglects to provide againſt thoſe checks which ariſe, often when leaſt expected, or for following up any advantage he may gain, eſpecially if it be within the limits of his anticipations, muſt be totally unqualified for ſo reſponſible and ſo important a ſituation. We ſpeak principally of proceedings in the field, where many alterations and much diverſity may be perpetually offering; for we conſider the manner in which battles on the ocean generally proceed, and in which they almoſt invariably terminate, to be ſo pre-eminent as to leave us only the opportunity of deſcribing them, (as we ſhall do under the head of ENGAGEMENT,) and to debar us, unleſs indeed we wiſhed to incur the charge of preſumption, from ſtating when or how ſingle ſhips or fleets ſhould engage the enemy.

In the firſt inſtance, it will be abſolutely neceſſary for the commander of an army to know, with preciſion, the ſtates of health, of diſcipline, of fatigue, of ſupply, and of competency in general, of every corps compoſing his army. He muſt be thoroughly informed as to the condition and numbers of his cattle, of the amount of his proviſions, and of the manner in which the ſeveral corps, the cattle, and the ſupplies, are diſtributed along his line. He muſt have a thorough knowledge of the numbers, the diſpoſition, the ſupplies, and the probable reſources, of the forces oppoſed to him; as well as of the nature of their warfare, their general habits, the ſtrong poſts in their rear, the opportunities they may have of forming ambuſcades, or of retreating to advantage; and eſpecially whether, in caſe of ſucceſs, he may be able to avail himſelf of thoſe invaluable opportunities which the valour and diſcipline of his troops may offer to his acceptance.

However confident a general may be of ſucceſs, he muſt never loſe ſight of the poſſibility of a reverſe: in truth, it is moſt generally found, that where the beſt preparations are made againſt diſaſter, the moſt decided victories are obtained. This is natural, both becauſe the whole of a line feel inſpirited by the reflection, that due proviſion is made for the worſt; and becauſe, where ſuch arrangements are carefully preconcerted, the appropriate remedy is prompt for application, and the enemy are rendered unable to continue in that line of ſucceſſes, which, but for ſuch apt oppoſition to their momentary or local advantages, muſt inevitably be at their command.

Whenever we obſerve that a commander courts the opinions of thoſe whoſe rank and experience may qualify them to offer advice, we may conſider it a moſt fortunate omen. The immortal Nelſon always diſcloſed his plans, and opened his mind fully, to the admirals and captains under his command: he ſolicited the correction of whatever errors might have crept into his projects, and was eagerly anxious that all ſhould have a competent underſtanding of his intentions. This ought ever to be the ſtudy of a commander; elſe, ſhould he fall, or ſhould unforeſeen accidents occur in any part of his line, his ſucceſſor, as well as his ſubordinates, muſt be totally at a loſs either to continue victorious, or to arreſt the progreſs of the enemy.

But perhaps the moſt eſſential point may be for a commander to aſcertain how far his troops are well diſpoſed to the cauſe; whether they proceed to engage with alacrity and zeal; and whether they have an entire confidence in the courage and abilities of their leaders. This part of the ſubject is ſometimes overlooked, until it is too late to be remedied; and the moment of engaging is the moment of treaſon, or of cowardice. It is true, the Britiſh army may claim an exemption from theſe ungovernable miſchiefs; but no commander ſhould be indifferent to matters which are within the ſcope of poſſibility, and which may often be avoided by a little courteſy, or by ſome well directed policy. We ſhould conſider, that in our time the moſt unforeſeen events are daily brought forth; that the opinions of perſons inimical to the welfare of the ſtate are every day promulgated; and that, within theſe very few years, even a field officer of our army endeavoured to miſlead thoſe guards, who are excluſively appointed to protect his majeſty's ſacred and moſt valuable life. Fortunately for Britain,

> “ Such divinity doth hedge our king,
> That Treaſon dared but peep at what it would!”

Therefore we may ever hope that the diſpoſition of our ſoldiery will remain unſhaken; and that we may find them, as they ever have been, bold, active, and obedient in the field, and ready on all occaſions to engage in ſupport of our king, and our conſtitution.

It may be proper to add, that too much ardour to engage may exiſt in an army: this is aſſuredly dangerous. There is a certain eſtabliſhed coolneſs in veteran regiments, reſulting from the preſence of perhaps only a ſmall portion of veterans among them, which is highly conducive to the character and to the proweſs of the corps at large. Such regiments are admirably calculated for reſiſtance; while new levies are generally more ſuited to the charge, and to thoſe tremendous conflicts which ſpeedily terminate the ſtruggle in their quarter. In truth, we are well aſſured from the moſt reſpectable authorities, as well as from the numerous facts which proudly and pre-eminently offer themſelves to our notice, that nothing can reſiſt the attack of our new regiments; while, on the other hand, nothing can ſubdue the firmneſs and patience of our old ones.

ENGAGEMENT, in the *Military Profeſſion*, relates to ſuch conflicts as take place between bodies of armed men, generally regular troops, and eſpecially to that kind of warfare which is carried on between armies of ſome magnitude, in contradiſtinction to thoſe leſs extenſive conteſts, which ordinarily are conſidered as ſkirmiſhes. Engagements may be either partial or general; in the latter caſe, they are commonly attended with marked and decided conſequences; whereas, in the former inſtance, little or no difference may be made in the poſitions of the contending powers. We generally find, that, according to the modern mode of warfare, great ingenuity and cunning are exerted, for the purpoſe of deceiving the adverſary into an opinion of a general attack. This is done with the intention of preventing reinforcements being ſent from any part, the whole being kept in action, while the main attack is made on ſome point, either naturally weak, or by gaining which the fortune of the day may be determined in favour of the aſſailants. This, although it bears the appearance of a general engagement, is in fact but a partial aſſault; the greater portion of the conteſt falling upon a few regiments, which, unleſs properly ſupported, are commonly ſwept away: to ſay the leaſt, they muſt ſuffer very conſiderably.

Previous to engaging the enemy, every attention muſt be paid to ſecuring a retreat, in caſe of a check. This precaution is indiſpenſable in all ordinary inſtances; though, in ſome ſituations, it may be found the beſt policy to deſtroy the means of evaſion, under the intention of convincing the army that it has only the alternatives of victory or death. Thus, when Cæſar landed in Britain, he deſtroyed the fleet which had brought him to our ſhores; a meaſure which, in thoſe times, compelled the invaders to fight to the laſt. They knew they had to contend with an enemy, from whom no quarter was to be expected; therefore, like rebels, they ſtruggled for life; they fought virtually with halters around their necks; and, thus rendered deſperate, contended with ſuch ſavage, ſuch unrelenting fury, as neceſſarily cauſed the engagement to be ſanguinary to an extreme.

Engagements are of two kinds; namely, either in the field, where the oppoſing parties are both diveſted of the protection of fortifications of any deſcription, ſuch as we ordinarily find to take place in open countries; the other conſiſting of that mixed kind of warfare, which compriſes the attack and defence of *abbaties*, the croſſing of rivers in the face of an enemy, and, on many occaſions, the attacks made upon open towns, &c. With reſpect to thoſe engagements which are connected with the ſtorming of lines, or of fortifications of any deſcription, we conſider ſuch to appertain to that protracted ſyſtem included under the head of *ſiege*, which ſee; and the attacks upon ſuch to be, not engagements, but aſſaults.

It is ſcarcely to be credited upon what very ſlight incidents the fate of an engagement may depend! Circumſtances, which, if conſidered in the cabinet, ſhould appear to be akin to impoſſibility, ariſe unexpectedly, and change the face of affairs inſtantaneouſly. Hence, during the moment of conteſt, a commander ſhould be intent on obviating thoſe miſchiefs which muſt reſult from the falling back, or the failure, of any part of his army. He muſt carry in mind, and perhaps might advantageouſly delineate on a card, the great outline of the engagement; ſtudying to chooſe ſuch a poſition as may give him a general view of the field, but moſt eſpecially of ſuch portions as may either appear to him either weak, *ab origine*, or to be hard preſſed by the enemy.

To deſcribe an engagement is next to impoſſible; for though we might perhaps afford ſome general idea of the incidents uſually occurring during a battle, ſuch is the diverſity to be found in the localities, as well as in the ſyſtems of warfare adopted even by perſons in the ſame ſervice, that to enter upon the inveſtigation of the ſubject in all its bearings, and throughout its amplifications, would be to compriſe a volume of no ſmall magnitude. We muſt, therefore, content ourſelves with obſerving, that the ordinary diſpoſition for an engagement, where no particular *point d'appui* is in queſtion, conſiſts of two or more lines, compoſed chiefly of infantry, properly ſupported by artillery of various natures, that is to ſay, of braſs 18 pounders, alſo of 12, 9, 6, and 3 pounders, with a portion of howitzers, commonly of $4\frac{1}{2}$, or $5\frac{3}{4}$ inches diameter in the bore, or eventually up to 8 inches. Theſe are placed in the intervals between the ſeveral regiments, while one or more parks of artillery are arranged in ſuch parts of the ſeveral lines, as may appear to require that powerful aid; or on ſuch commanding ſpots as may enable the artilleriſts to act with greater effect againſt the enemy. See TACTICS, *Military*.

Where the ground may admit, the cavalry often commences the action, by endeavouring to prevent the enemy from forming upon, or taking poſſeſſion of, ſtrong poſitions. The horſe artillery, together with the pieces of lighter conſtruction which can be ſpeedily withdrawn, advance to cannonade; while the infantry may be deploying from column into line, or forming according to the inſtructions of the generals commanding in the ſeveral quarters of the army; to whom the commander in chief previouſly communicates his intentions. During this time, the greateſt order, coolneſs, and promptneſs, are indiſpenſably neceſſary: it is now that ſuperior diſcipline will manifeſt itſelf, and that the real powers of an army will be aſcertained. Let it not, however, be ſuppoſed, that that kind of ſymmetrical order which is the boaſt of our parade martinets, is to be found in the field of battle! Far otherwiſe; in lieu of regular firings by diviſions, each individual loads and diſcharges his piece when, and how he can; in place of a regulated pace conforming to any particular cadence, the advances and retreats are generally too much diveſted of that order, and of that ſyſtematic uniformity, which ſo highly delight the fair ſex when they viſit our ſummer camps, to witneſs the ſplendid array attendant upon parade evolutions. In ſhort, the celebrated ſong in the "Recruiting Serjeant" is the beſt, and moſt pithy deſcription of an engagement we have ever heard, eſpecially that part which relates to the moſt arduous portions of the conteſt.

"But the merrieſt joke of all,
Is when to cloſe attack we fall.
Killing, wounding, maiming, butting,
Daſhing, flaſhing, ſlaying, cutting:
Horſe and foot,
Both go to't;
Blood and thunder!
Then to plunder,
Oh! what a charming thing's a battle!"

A very charming thing, indeed; eſpecially when we conſider that many of the wounded are often murdered by perſons, chiefly women, who follow the ſeveral armies, for the purpoſe of plundering ſuch unfortunate brave men as may be incapable of making reſiſtance. It is, indeed, a well-known fact, that this iniquitous and diſgraceful practice, is more than ever prevalent in many countries, whoſe inhabitants, being at leaſt on a par with thoſe of the moſt enlightened parts of the world, ſhould rather endeavour to ſoften the rigours of war, than to perpetrate the moſt ſavage cruelties on thoſe whoſe misfortune it may be to be diſabled in the courſe of an engagement.

Theſe fluctuations between victory and defeat, which ſometimes alternate for hours together between contending armies, muſt afford the moſt lively intereſt to a ſpectator, and cannot fail to produce the moſt exquiſite ſenſations of joy, or of miſery, in the breaſts of the reſpective commanders. What can afford a greater gratification than the complete ſucceſs of an army? or what can occaſion more pointed chagrin than the evidence of its defeat? Perhaps, of all the men who ever experienced ſuch reverſes, the old king of Pruſſia may be conſidered as the moſt illuſtrious inſtance of fortitude under diſaſter, and of moderation when ſucceſsful. Theſe good qualities, though they may have been coeval with his birth, muſt neceſſarily have been conſiderably enhanced, by that intenſe application the monarch paid to the diſcipline of his army. Hence, we are informed, that no reverſe appeared to him irremediable, and that no victory was conſidered by him to be permanent. Such a man muſt have viewed an engagement under very peculiar impreſſions: he muſt have been moſt ardently intent upon the conſideration of what evolutions would be moſt ſuited to the events paſſing under his notice; while at the ſame moment, his mind muſt have been actively employed in the conſideration of reſources, wherewith he might, according to the modern cant term, "carry on the war." We muſt, however, remark, that the great Frederick rarely had a large army; but that which he had, though comparatively ſmall, was of immenſe ſtrength: every part was ſyſtematically organized under the moſt ſevere code of diſcipline, and under the moſt penetrating obſervation. We have heard old officers ſtate, that the Pruſſian army, under their immortal royal general, performed its evolutions, and preſerved the ſame order, and went through their firings, as regularly while in action as when on their ſeveral parades. We fear this ſingular inſtance of military conſiſtency, is not likely to be again diſplayed by the Pruſſian army at this date; nor, indeed, have we any authority, if paſt events are to guide us, for expecting to ſee, or hear, that they ſhould throughout an engagement diſplay thoſe qualities which, however much we may commiſerate the ſufferings of thoſe individuals whereof it was compoſed, characterized the military eſtabliſhment of that now ill-fated country! We leave to our readers to contemplate what muſt be the feelings of the brave marſhal Mollendorff, who, we believe, is the only ſurviving general now of the many that held commands under that military prince, whoſe exiſtence in theſe times would, no doubt, have given a very different aſpect to the affairs of Europe.

Engagement, in a *Naval Senſe*, denotes a particular or general battle at ſea, or an action of hoſtility between ſingle ſhips, or detachments, or ſquadrons of men of war: the whole economy of which may be arranged under the heads of preparation, action, and repair. The preparation is begun by iſſuing the order to clear the ſhip for action, which is repeated by the boatſwain and his mates at all the hatchways. The hammocks are firſt removed; every ſailor ſtowing his own bedding properly and firmly cording it with a laſhing, or line provided for that purpoſe: as each ſide of the quarter deck and poop is furniſhed with a double network, ſupported by iron cranes fixed immediately above the gunnel or top of the ſhip's ſide; the hammocks, thus corded, are firmly ſtowed by the quarter-maſter between the two parts of the netting, ſo as to form an excellent barrier or ſort of parapet, to prevent the execution of ſmall ſhot on the quarter-deck: the tops, waiſte, and fore-caſtle, are fenced in the ſame manner.

At this time all heavy luggage, ſuch as cheſts, &c. are handed down into the hold, and the ſurgeon, with his mates and aſſiſtants, together with whatever women may be on board, deſcend into a part called the cock-pit; which, being below the level of the water, is conſidered to be tolerably ſecure; various inſtances have, however, been known of ſhots, between wind and water, finding their way to that retirement.

At the ſame time the boatſwain and his mates are employed in ſecuring the ſail-yards, to prevent them from tumbling down when the ſhip is cannonaded, whereby it might be diſabled. The yards are ſecured by ſtrong chains or ropes, beſides thoſe by which they are uſually ſuſpended. The boatſwain alſo provides the neceſſary materials for repairing the rigging; and the carpenter and his crew prepare ſhot-plugs and mauls to cloſe up any breach that may be made near the ſurface of the water, and provide their ironworks neceſſary to refit the chain-pumps. The gunner, with his mates and quarter-gunners, examine the cannon of the different batteries, and provide proper charges, &c. The maſter and his mates attend to the number and trimming of the ſails, &c. The lieutenants viſit the different decks, taking care that all incumbrances are removed, and giving inſtructions to the other officers, that every thing may be ready for the expected engagement at a moment's warning. When the hoſtile ſhips have approached each other to a competent diſtance, the drums beat to arms: the boatſwain and his mates pipe "all hands to quarters!" at every hatch-way. The perſons appointed to manage the great guns immediately repair to their reſpective ſtations; crows, hand-ſpikes, rammers, ſpunges, powder-horns, matches, and train-tackles are placed in order by the ſide of every cannon. The hatches are laid to prevent any one from eſcaping into the lower apartments. The marines are drawn up in rank and file, on the quarter-deck, poop, and forecaſtle. The laſhings of the great guns are let looſe, and the tompions withdrawn: the whole artillery, above and below, is run out at the ports, and levelled to the point-blank range ready for firing. When the neceſſary preparations are finiſhed, the commencement of the action is determined by the mutual diſtance and ſituation of the adverſe ſhips, or by the ſignal from the commander in chief of the fleet or ſquadron. The cannon being levelled in parallel rows, projecting from the ſhip's ſide, the moſt natural order of battle is evidently to range the ſhips a-breaſt of each other, eſpecially if the engagement is general. The moſt convenient diſtance is probably within the point-blank range of a muſket, ſo that all the artillery may do effectual execution. The combat uſually begins by a vigorous cannonade, accompanied with the united efforts of all the ſwivel-guns and ſmall arms. Inſtead of firing platoons, or vollies of cannon at once, the general rule throughout the ſhip on theſe occaſions is to load, ſpunge, and fire the guns with all poſſible expedition, yet without confuſion or precipitation. The captain of each gun is enjoined to fire only when the piece is properly directed to its object. The lieutenants who command the different batteries traverſe the deck, to ſee that the battle is proſecuted with vigour, and to animate the men in their duty. The midſhipmen ſecond theſe injunctions, and give aſſiſtance where it is required at the guns committed to their charge. The gunner takes care that the artillery is ſupplied with powder, and that the cartridges are conveyed along the decks in covered boxes.

During the action, the captain manœuvres his ſhip to the beſt advantage; cauſing the maſter ſo to lay her on the enemies' bows, or quarters, and eſpecially under her ſtern, as may give thoſe favourable reſults attendant upon a ſafe, but annoying, poſition. Should any intervals ariſe, owing to the ſituations of the ſeveral ſhips, it is employed in clearing the decks, in repairing the damaged rigging, and in providing for a renewal of the engagement. If, as very often happens, the enemy make ſail with the view to eſcape, the guns are ſecured, while all hands turn to for the purpoſe of giving chaſe: in this inſtance, the great object is to come up with the flying foe; therefore all theſe ſails which were furled or clued up, with the intention of either having leſs to manage, or to keep them free from danger, are now ſpread to the gale, and every effort is made to regain a poſition within ſuch a diſtance as may cauſe the enemy to ſtrike his flag, and to ſurrender. Should he ſtill perſiſt, the engagement muſt continue, until, being a complete wreck, he may conſider further oppoſition uſeleſs. So ſoon as he has ſtruck, his ſhip is taken poſſeſſion of by a detachment from the victor's crew, and the whole of the ſubdued party are put under hatches in the hold, or, if neceſſary, are otherwiſe ſecured in the bilboes, &c. while a prize maſter, generally a lieutenant, is put on board, for the purpoſe of navigating the prize, according to ſuch orders as he may receive.

It ſometimes happens, that, where an enemy is very determined, it is neceſſary to board; indeed, this not unfrequently occurs, owing to veſſels adventitiouſly coming in contact. Previous to the adoption of this deſperate meaſure, it will be abſolutely neceſſary to conſider well how far it may be likely to ſucceed. If the oppoſing crew be numerous, and eſpecially if abounding in marines, or if there be any number of military on board, much management, activity, and reſolution will be required to carry the point; which is generally effected by laying along the lee waiſt or quarter, or perhaps upon the bow, and, after having grappled, by means of chains, or of ſmall boarding grapnails ſuſpended by chains from the yards, to lower down the boarding platforms, (if there be any,) and thus to ruſh upon the enemy's deck. In ſome inſtances, ſhips have been boarded by entering at the ports, ſtern, or quarter gallery, &c. either of which modes will often ſucceed, where the whole of the oppoſing crew ruſh with too much precipitation, to the upper works, with the intention of reſiſting thoſe who are about to board upon the deck. The bowſprit is frequently reſorted to, as the means of entering an enemy's ſhip: this, being laid over the ſtem, or tafrail, will generally enable the boarders to proceed with ſufficient facility, while the marines are employed in keeping up a ſharp fire, to drive the defenders off the poop. It is, however, a very hazardous concern, and chiefly reſorted to on deſperate occaſions, by privateers, or where, though ſtrong in point of crew, a veſſel may not be of ſufficient force to lie alongſide her opponent. A repulſe in boarding is peculiarly dangerous, and very commonly leads to defeat. It almoſt invariably happens, that, on ſuch occaſions, great numbers of the boarders are deſtroyed; whereby the reſidue of the ſhip's company are conſiderably diſpirited; at leaſt, this is an ordinary reſult among foreigners; Britiſh tars are not ſo eaſily daunted, but may be again, and again, led to the attack.

When the engagement is concluded, they begin the repair. The cannon are ſecured by their breachings and tackles; the ſails that have been rendered unſerviceable, are unbent; and the wounded maſts and yards ſtruck upon the deck, and fiſhed or replaced by others. The ſtanding rigging is knotted, and the running rigging ſpliced wherever this is neceſſary. Proper ſails are bent in the room of thoſe that are become uſeleſs. The carpenter and his crew repair breaches in the ſhip's hull by ſhot-plugs, pieces of plank, and ſheet-lead. The gunner and his aſſiſtants repleniſh the allotted number of charged cartridges, and refit the damaged furniture of the cannon.

When two fleets or ſquadrons are preparing for engagement, it will be the endeavour of the admiral or commander in chief to come to action as ſoon as poſſible. To facilitate the execution of the admiral's orders, the whole fleet is ranged into three ſquadrons; each of which is claſſed into three diviſions, under the command of different officers. Before the action begins, the adverſe fleets are commonly drawn up in two lines parallel to each other, and cloſe-hauled. When the admiral diſplays the ſignal for the line of battle, the ſeveral diviſions ſeparate from the colours in which they were diſpoſed according to the uſual order of ſailing, and every ſhip crowds into its ſtation in the wake of the next a-head, at the diſtance generally of about fifty fathom; which diſtance is regularly obſerved from the van to the rear: though the admiral may ſometimes find it neceſſary to contract or extend his line, according to the length of that of his adverſary; always taking care that his own line be ſecure from being doubled, which might throw his van and rear into confuſion. When the reverſe fleets approach each other, the courſes are commonly hauled up in the brails, and the top-gallant ſails and ſtay-ſails, furled; the frigates, tenders, and fire-ſhips, being hauled upon the wind; lie at ſome diſtance behind the line of battle; and tranſports and ſtore ſhips lie beyond theſe, at a ſtill greater diſtance from the ſcene of action; and if the number of ſhips allows it, a body of reſerve from the different ſquadrons is ſelected to cover the fire-ſhips, &c. and ſtationed oppoſite to the weakeſt parts of the line, ſo that they may readily fall into the line in caſe of neceſſity. Each ſhip forming the line ſhould keep cloſe to its ſtation during the engagement; the aſſault of boarding being ſeldom permitted unleſs in ſingle action: becauſe the regularity of a cloſe line conſtitutes the principal force of the fleet; and the ſkill of the admiral is greatly concerned in keeping his line, notwithſtanding unequal attacks and damage, as complete as poſſible. If he proves victorious, he ſhould proſecute his victory as much as poſſible, by ſeizing, burning, or deſtroying the enemies' ſhips. If he is defeated and reduced to the neceſſity of retreating, he may judge it expedient, for greater ſecurity, to range his fleet into the form of a half-moon, placing himſelf in the centre. The enemies' ſhips that attempt to fall upon his rear will thus be expoſed to the fire of the admiral and his ſeconds, and the eſcape of his own ſhips will be facilitated, whilſt the purſuit of his averſary is retarded. Upon the whole, the real force of ſuperiority of a fleet, conſiſts leſs in the number of veſſels and the vivacity of the action, than in good order, dexterity in working the ſhips, preſence of mind, and ſkilful conduct in the admiral and captains. Falconer's Marine Dict. art. *Engagement*.

There formerly exiſted certain ſuppoſed axioms, in regard to the ſeveral modes of forming in line of battle a-head, or a-breaſt; and much attention was paid to the weather-gage, as well as to other ſuch matters: fleets uſed then to manœuvre for ſeveral days, obviouſly intent upon gaining ſome particular poſition, which was ſuppoſed to be indiſpenſably neceſſary towards a ſucceſsful iſſue. Of late years this has been totally, or at leaſt very generally neglected; for in lieu of fleets, or ſingle ſhips, now dancing minuets for ſuch a purpoſe, we ſee them ranging up with little ceremony, and intent only on getting into action; whatever may be the ſtate of the wind or of the weather. All that a Britiſh commander requires of his maſter, nowadays, is, "Lay me alongſide the enemy;" a few guns more or leſs, or even an extra deck, on the part of the enemy, being diſregarded. It is to this ſpirit, that our ſhores are indebted for ſafety, and our commerce to that wide range afforded by the univerſal command which Britain holds over the ocean. It is with the utmoſt pride and ſatisfaction, we witneſs the glorious exertions of our invincible tars: for ſuch we may fairly deſignate men who, regardleſs of every danger, and urged by the moſt patriotic zeal, bear away the palm when, and wherever the enemy, however ſuperior in guns, or in numbers, give them the opportunity of diſplaying that valour which, though uncontroulable in oppoſing a foe, is rapidly metamorphoſed into humanity, ſo ſoon as the victory may be proclaimed, or that the voice of diſtreſs may be heard! Surely we never can ſufficiently reward thoſe heroes who, as Hudibras ſays, ſtand forward—

> "To fight our battles in our ſteads,
> And have their brains beat out o' their heads;
> Encounter in deſpite of nature,
> And fight at once with fire and water,
> With pirates, rocks, and ſtorms, and ſeas."

A naval engagement is a branch of warfare in which the Britiſh character appears to the utmoſt advantage, and in which we ſtand confeſſedly pre-eminent over the whole univerſe. We derive the more ſatisfaction, from the reflection, that our credit and proweſs are not ephemeral, nor dependant upon any temporary weakneſs on the part of our opponents: we contemplate them as heir-looms, bequeathed to us from a noble and brave anceſtry, whoſe examples have been duly followed, and whoſe reputation has, no doubt, contributed to that zeal, and to that emulation, which pervade every part of the Britiſh navy, and induce our tars to perſevere in their ſtruggles for the preſervation of our rights and liberties as a people; while, at the ſame time, each individual aims to uphold his own character for bravery, ſubordination, and generoſity. See Battle, Boarding, *Line of Battle*, and Signal.

Engagement, in *Engliſh Hiſtory*, was the obligation impoſed by Oliver Cromwell required to be ſigned by every member of the Firſt Parliament in 1654, aſſembled by his authority, after he was declared Protector, *viz.* "I *A. B.* do hereby freely promiſe and engage myſelf to be true and faithful to the Lord Protector, and to the commonwealth of England, Scotland, and Ireland, and ſhall not (according to the tenure of the indenture whereby I am returned to ſerve in this preſent parliament) propoſe or give any conſent to alter the government, as it is ſettled in one ſingle perſon and a parliament." Many, who refuſed to ſign this engagement, were excluded from the houſe.

ENGALLA, in *Zoology*, the Ethiopian hog or African wild boar. See Sus *Æthiopicus.*

ENGALLIM, in *Ancient Geography*, a town of Judea, in the tribe of Benjamin, ſituated on the coaſt of the Dead ſea, where, according to St. Jerom, the river Jordan diſcharged itſelf into that ſea.

ENGAMOS, in *Natural Hiſtory*, the name given by the people of ſome parts of Guinea to a root very common there, and much reſembling our larger ſort of turnips, but not ſo ſweet or juicy. They commonly boil theſe with their battatas, in the ſame kettle with their meat. The latter of theſe roots, which is conſiderably different from our potatoe, gives a fine flavour to the whole, and makes the broth and meat taſte as if roſe-water were added to it. The engamos alſo partakes of the flavour, and in this caſe becomes very agreeable. Phil. Tranſ. N° 108.

ENGANNIM, in *Ancient Geography*, a city in the plain belonging to Judah, Joſh. xv. 34.—Alſo, a city of Iſſachar; given to the Levites of Gerſhon's family. Joſh. xix. 21. xx. 29.

ENGANNO, or Deceit *Iſland*, in *Geography*, an iſland in the Eaſtern ſea, at a ſmall diſtance from the S.W. coaſt of the iſland of Sumatra. S. lat. 5 9′. E. long. 102° 44′.

Ships that paſs the ſtraits of Sunda, in the weſterly monſoon, generally run in ſight of Enganno. This iſland is 6 or 7 leagues in length, and not quite half as broad. It is not high, and can only be diſcerned at the diſtance of 5 leagues. It is covered with trees, and always appears green. For a more particular account of this iſland, ſee Phil. Tranſ. for 1778.

ENGANO, Cape, a cape on the eaſt coaſt of the iſland of St. Domingo. N. lat. 18° 27′. W. long. 68° 52′.

Engano, or Enganno, *Cape*, the N.E. point of the iſland of Luçon, in the Eaſt Indian ſea. N. lat. 17 45′. E. long. 121° 20′.

ENGASTRIMANTES, Εγγαστριμαντεις, in *Antiquity*, called alſo *Engaſtrimythi*, Εγγαστριμυθοι, a deſignation given to ſuch diviners as were poſſeſſed with dæmons, which either lodged or ſpoke within their bodies. Pott. Archæol. Græc. lib. ii. cap. 12. tom. i. p. 301.

ENGASTRIMYTHUS, Εγγαστριμυθος, or *Engaſtrimander*, a perſon who ſpeaks from, or with the belly, without opening his mouth; or, if open, without ſtirring the lips.

Thus called by the Greeks, from εν, γαστηρ, *belly*, and μυθος, *ſpeech*; and by the Latins, *ventriloquus*, *quaſi ex ventre loquens.*

The ancient philoſophers, &c. are divided on the ſubject of the engaſtrimythi: Hippocrates mentions it as a diſeaſe. Others will have it a kind of divination, and aſcribe the origin and firſt diſcipline thereof to one Eurycles, whom nobody knows any thing of. Others attribute it to the operation or poſſeſſion of an evil ſpirit; and others, to art and mechaniſm.

The moſt eminent engaſtrimythi were the Pythians or prieſteſſes of Apollo, who delivered oracles from within, without any action of the mouth or lips.

St. Chryſoſtom and Oecumenius make expreſs mention of a ſort of divine men, called by the Greeks engaſtrimandri, whoſe prophetic bellies pronounced oracles.

M. Schottus, library-keeper to the king of Pruſſia, in a Diſſertation on the Apotheoſis of Homer, maintained that the engaſtrimythi of the ancients were only poets; who, when the prieſteſs could not ſpeak in verſe, ſupplied the defect, by explaining or delivering in verſe what Apollo dictated in the cavity of the baſon, placed on the ſacred tripod.

Leo Allatius has an expreſs treatiſe on the engaſtrimythi. See Ventri-loquists.

ENGEDI, in *Ancient Geography*, *q. d.* the fountain of the goat, called alſo *Hazazon-Tamar*, or the palm-tree city, from the great quantity of palm-trees that ſurrounded it, a city of Paleſtine, in the tribe of Judah (Joſh. xv. 62.), ſituated near the lake of Sodom, 300 furlongs from Jeruſalem, not far from Jericho, and the mouth of the river Jordan. It was in a cave of the wilderneſs of Engedi, that David had an opportunity of killing Saul, and of ſparing his life, then in purſuit of him. 1 Sam. xxiv. 1, 2, 3, &c.

ENGEL. See Anglen and Angles.

ENGELACH, in *Geography*, a town of Germany, in the circle of Lower Saxony, and biſhopric of Hildeſheim; 15 miles S.W. of Alfeld.

ENGELBERG, an extenſive narrow valley of Switzerland, in the canton of Underwalden; its length exceeds twelve miles, and it is hardly ſix miles broad. It was formerly called the Hahnenberg (Cocks' mountain), but when the abbey church was conſecrated, ſome inhabitants pretended they had heard the melodious concerts of the angels in heaven, which made them call it *Engelberg*, (the Angels' mountain). The inhabitants are numerous and remarkable for the innocence of their manners, and for their hoſpitality to ſtrangers.

The abbey of Engelberg is 9 miles S.W. of Altorf. It was founded in the year 1125.

ENGELBRECHTS, a town of Germany, in the archduchy of Auſtria; 95 miles N.N.W. of Bavarian Waidhoven.

ENGELHARTZEL, a town of Germany, in the archduchy of Auſtria; 9 miles E. of Paſſau.

ENGELHAUS, a town of Bohemia, in the circle of Saatz; 2 miles E.S.E. of Carlſbad.

ENGELHOLM, a town of Sweden, in the province of Schonen, or Scania, ſituated at the mouth of a river which runs into the Cattegat, 12 miles from Helſingborg. It is the twentieth town in rank among thoſe which vote in the Swediſh diet. Its name is ſaid to be derived from the Angles, who either firſt came from this neighbourhood, or paſſed over to it from Denmark, and built the place for the conveniency of trade. The latter conjecture is the moſt probable.

ENGELSBERG, a town of Sileſia, in the principality of Appau; 5 miles N.N.W. of Freudenthal.

ENGELSBURG, a ſmall town of Pruſſia, in the diſtrict of Culm, with an ancient caſtle not far from Graudentz.

ENGELSDORF, a town of Bohemia, in the circle of Boleſlaw; 10 miles N.N.E. of Krottau.

ENGELSTEIN, a town of Pruſſia, in the province of Natangen; 48 miles S.E. of Konigſberg.

ENGELSTETTEN, a town of Germany, in the archduchy of Auſtria; 23 miles E. of Vienna.

ENGEN, a town of Germany, in the circle of Swabia, and principality of Stuhlingen: 12 miles N.N.E. of Schaffhauſen, and 20 N.N.W. of Conſtance.

ENGENDERING, or Ingendering, the act of begetting or producing the kind, by way of generation.

The term is likewiſe applied to other productions of nature: thus, meteors are ſaid to be engendered in the middle region of the air. Crude fruits engender worms. The ancients believed, that inſects were engendered of putrefaction.

ENGENTHAL, in *Geography*, a town of Germany, in the circle of Franconia; 13 miles E. of Nuremberg.

ENGER, a town of Germany, in the kingdom of Weſtphalia, and county of Ravenſburg; 3 miles W. of Hervorden.

Enger *Sea*, a lake of Carinthia, 10 miles N.N.W. of Feltkirchen.

ENGERSTORFF, a town of Germany, in the archduchy of Auſtria; 10 miles S.W. of Ziſterſdorf.

ENGETAL, a valley of Switzerland, in the canton of Baſle, remarkable for its abbey, which was ſecularized in 1534, and where a bible was printed at the end of the fifteenth century, with N. Lyra's notes.

ENGGISTEIN, a ſmall town of Switzerland, one mile from Worbe, remarkable for its mineral ſprings, on whoſe account it is much viſited in the ſummer ſeaſon. The water contains a little copper. The accommodations of the place are very good.

ENGHELBRECHT, Cornelius, in *Biography*, a painter, born at Leyden in 1468. Having imitated the works of John Van Eyck, at Bruges, he returned to his own country, and had the honour of being the firſt who taught the Dutch to paint in oil; in which he wrought with very great reputation in his time, as well as in diſtemper; and was then accounted among thoſe moſt deſerving of eſtimation.

He was not quite ſo dry or formal in his manner of deſign as the painters of that period; and he caſt his draperies with more care, and better ſtyle, than they. His moſt admired performance is the repreſentation of the "Lamb" in the Revelation, which he painted for a chapel in the church of St. Peter at Leyden. The compoſition conſiſts of an immenſe crowd of figures, angels, martyrs, doctors, and fathers of the church, &c. and all the "holy hierarchy of heaven," combined together with an immenſe multitude of perſons of all nations. This picture is very ingenious in the painting of the various parts, but it muſt owe its reputation more to the lack of knowledge of the better qualities of art at the time it was painted, than to its own intrinſic worth. This artiſt died in 1533, at 65.

ENGHIEN, or Enguien, in *Geography*, a ſmall town of France, in the department of Jemmappe, chief place of a canton, in the diſtrict of Mons, with a population of 3045 individuals. It is 18 miles S.W. of Bruſſels, and 15 N. of Mons. N. lat. 50° 40′.

The canton contains 10 communes, and 13,674 inhabitants, on a territorial extent of 140 kiliometres. It is from this place that the eldeſt ſons of the princes of Condé in France, the laſt of whom was ſo baſely murdered by the orders of the French emperor Napoleon, derived the title of duke.

ENGIA, an iſland near the coaſt of the Morea, anciently called *Ægina*, which ſee. Engia gives name to a gulf on the S.E. coaſt of European Turkey, formerly denominated *Sinus Saronicus*. See Ægina.

ENGINE, in *Mechanics*, a compound machine, conſiſting of ſeveral ſimple ones, as wheels, ſcrews, levers, or the like, combined together, in order to lift, caſt, or ſuſtain a weight, or produce ſome other conſiderable effect, ſo as to ſave either time or force.

The word is formed of the French *engine;* of the Latin *ingenium*, wit; becauſe of the ingenuity required in the contrivance of engines, to augment the effect of moving powers.

The kinds of engines are innumerable; ſome for war, as the baliſta, catapulta, ſcorpio, aries, &c. others for the arts of peace, as mills, cranes, preſſes, clocks, watches; engines to drive piles, to bore cannon and water-pipes, (ſee Boring), to raiſe water, wheel and water-works; to extinguiſh fire, ſee Fire-*engine*, &c. See Hydrocanisterium. See Steam-*engine*, &c. See alſo Instrument.

Engine *for cutting Wheels*. See Cutting-*Engine*.

Engine *for cutting Fuſees*. See Fusee-*Engine*.

Engine *for ornamenting a Watch-caſe*. See Rows-*Engine*, or Rose-*Engine*.

Engine *for dividing Circles*, *Quadrants*, *Sextants*, and *Octants*. It is not our intention in this place to enter into the hiſtory of the different methods of dividing aſtronomical inſtruments into degrees and their ſub-diviſions, as ſucceſſively practiſed by Tycho Brahe, Hevelius, Dr. Hook, Mr. Abraham Sharp, Olaus Roemer, Mr. Graham, Mr. Jon. Siſſon, Mr. Bird, Mr. Ramſden, and Mr. Troughton, without the aid of an engine; but, as we propoſe to treat the ſubject at ſome length under our article Graduation *of Aſtronomical Inſtruments*, we beg leave to refer the reader to that head for ſuch particulars as relate to the manual operations performed by the beam-compaſs and otherwiſe, which are neceſſary for graduating all circles and other inſtruments, that are too large to be graduated by an engine.

Among all the improvements in chronometers and nautical inſtruments, that owed their origin, during the laſt century, to the munificent encouragement of the honourable Board of Longitude, there is none that has ſo much contributed to the intereſt of navigation, conſidered as a ſcience, as the engine at preſent to be deſcribed; the facility, and at the ſame time the accuracy, with which the meaſuring portion of any nautical inſtrument, however portable, can now be divided by our beſt engines, are truly aſtoniſhing; the fine dividing-ſtrokes, which, in many inſtances, are ſcarcely viſible to, and not legible by the naked eye, when magnified by a ſuitable lens, are perceived to be laid down with ſuch perfect equality, as to relative diſtances, that no one who has not examined the means by which they were effected, can conceive the poſſibility that the expedition, with which the diviſions are made, is equal to the accuracy with which they are meaſured and marked down. In Mr. Smeaton's paper, read to the Royal Society of London, on Nov. 17, 1785, on the "Graduation of Aſtronomical Inſtruments," he mentions an engine, made by Mr. Henry Hindley of York, which indented the edge of any circle in ſuch a way, that a ſcrew with fifteen threads acting at once, would, by means of a micrometer, read off any given number of diviſions, ſo as to anſwer the purpoſe of ſub-dividing the circle. It does not, however, appear that this engine, though it divided the circles of Hindley's equatorial inſtruments, was intended or adapted ſo much for graduating circles as for cutting the teeth of wheels in clock-work. (See Cutting-*Engine*.) The year in which it was ſeen by Mr. Smeaton was 1741, and, conſequently, was in Graham's time, who died in 1751. According to the ſame author, Mr. Ramſden, in conſequence of the reward offered by the Board of Longitude to Mr. Bird, for his method of dividing, in the year 1760, turned his thoughts towards the contrivance of an engine that would divide nautical inſtruments with ſufficient accuracy, without the tediouſneſs of manipulation. Accordingly, conſidering the nature and properties of the endleſs ſcrew, and probably contemplating what Hindley had previouſly done in this way, he completed an engine with an indented plate, or wheel, of thirty inches diameter, which, though it did not completely anſwer his expectations to their full extent, yet was found very uſeful for dividing theodolites and ſuch common inſtruments with great facility. This was effected before the ſpring of 1768, and, in 1774, a much larger and better engine was produced, with an indented plate of 45 inches diameter, which divided a ſextant for Mr. Bird's examination ſo accurately, that the Board of Longitude, ever ready to remunerate any ſucceſsful endeavour to promote the lunar method of determining the longitude at ſea, did not heſitate to confer an handſome reward on the inventor, but on condition that the ſaid engine might be at the ſervice of the public, and that Mr. Ramſden would publiſh an explanation of his method of making and uſing it, which he accordingly did in a quarto pamphlet in the year 1777. The ſum of money given to Mr. Ramſden was 615*l.*, of which 300*l.* was conſidered as a reward for his improvement in the art of dividing inſtruments by means of his engine, and the remaining 315*l.* was paid in conſideration of his making over the property of the ſaid engine to the Commiſſioners of Longitude, for the good of the public. The deſcription which Mr. Ramſden publiſhed, being ſhort and explicit, cannot well be abridged, and the drawings, intended as a guide for other artiſts to work by, are explanatory of all the parts of the engine, as detached from one another; we have therefore given reduced engravings of all the figures, as they were originally arranged, and propoſe to copy the deſcription without any other alteration than what the references to our plates required.

Mr. Ramſden's Engine.—"This engine conſiſts of a large wheel of bell-metal, ſupported on a mahogany ſtand, having three legs, which are ſtrongly connected together by braces, ſo as to make it perfectly ſteady; *fig.* 1. *Plate* VII. of *Engines*, is a perſpective repreſentation of the body thus united. On each leg of the ſtand is placed a conical friction-pulley, whereon the dividing-wheel reſts: to prevent the wheel from ſliding off the friction-pulleys, the bell-metal centre under it turns in a ſocket on the top of the ſtand. The circumference of the wheel is ratched or cut, by a method to be hereafter deſcribed, into 2160 teeth, in which an endleſs ſcrew acts. Six revolutions of the ſcrew will move the wheel a ſpace equal to one degree. Now a circle of braſs being fixed on the ſcrew-arbor, having its circumference divided into 60 parts, each diviſion will anſwer to a motion of the wheel of ten ſeconds; ſix of them will be equal to a minute, &c. Several different arbors of tempered ſteel are truly ground into the ſocket in the centre of the wheel. The upper parts of the arbor, that ſtand above the plane, are turned of various ſizes, to ſuit the centres of different pieces of work to be divided. When any inſtrument is to be divided, the centre of it is very exactly fitted to one of theſe arbors, and the inſtrument is fixed down to the plane of the dividing wheel, by means of ſcrews, which fit into holes made in the radii of the wheel for that purpoſe. The inſtrument being thus fitted on the plane of the wheel, the frame which carries the dividing-point is connected at one end by finger-ſcrews with the frame which carries the endleſs ſcrew; while the other end embraces that part of the ſteel arbor which ſtands above the inſtrument to be divided, by an angular notch in a piece of hardened ſteel; by theſe means both ends of the frame are kept perfectly ſteady and free from ſhake.

The frame carrying the dividing-point, or tracer, is made to ſlide on the frame which carries the endleſs ſcrew to any diſtance from the centre of the wheel, that the radius of the inſtrument to be divided may require, and may be there faſtened by a pair of clamps; and the dividing-point, being connected with the clamps by the double-jointed frame, admits a free and eaſy motion towards or from the centre, for cutting the diviſions without any lateral ſhake. From what has been ſaid it appears, that an inſtrument thus fitted on the dividing-wheel may be moved to any angle by the ſcrew and divided micrometer circle on its arbor, and that this angle may be marked on the limb of the inſtrument with the greateſt exactneſs by the dividing-point, which can only move in a direct line tending to the centre, and is altogether freed from thoſe inconveniences that attend cutting by means of a ſtraight edge. This method of drawing lines will alſo prevent any error that might ariſe from an expanſion or contraction of the metal, during the time of dividing. The ſcrew-frame is fixed on the top of a conical pillar, which turns freely round its axis, and alſo moves freely towards or from the centre of the wheel, ſo that the ſcrew-frame may be entirely guided by the frame which connects it with the centre: by theſe means any eccentricity of the wheel and the arbor would not produce any error in the dividing; and by a particular contrivance, hereafter deſcribed, the ſcrew, when preſſed againſt the teeth of the wheel, always moves parallel to itſelf; ſo that a line joining the centre of the arbor and the dividing-point, continued, will always make equal angles with the ſcrew. The reſt of the parts are repreſented in *Plates* VIII. and IX. of *Engines*, where the figures are numbered in ſucceſſion from 2 to 14 incluſively, which are more eaſily referred to than the figures in the original plates. *Fig.* 2 is a plan of reduced dimenſions, of which *fig.* 3 repreſents a ſection on the line ΠΛ. The large wheel, A, is 45 inches in diameter, and has 10 radii, each ſupported by edge-bars, as ſeen in *fig.* 3. Theſe bars and radii are connected by the circular ring B, 24 inches in diameter, and 3 deep; and, for greater ſtrength, the whole is caſt in one piece in bell-metal. As the whole weight of the wheel, A, reſts on its ring B, the edge-bars are deepeſt where they join it; and from thence their depth diminiſhes, both towards the centre and circumference, as ſeen in the figure. The ſurface of the wheel, A, was worked very even and flat, and its circumference turned true. The ring C, of which a ſection is ſeen in *fig.* 3, made of fine braſs, was fitted very exactly on the circumference of the wheel, and was faſtened thereon with ſcrews, which, after being ſcrewed as tight as poſſible, were well rivetted. The face of a large chuck being turned very true and flat in the lathe, the flattened ſurface, A, of the wheel was faſtened againſt it with hold-faſts; and the two ſurfaces and circumference of the ring C, a hole through the centre, and the plane part round it, together with the lower edge of the ring B, were all turned at the ſame time. D is a piece of hard bell-metal, having the hole that receives the ſteel-arbor made very ſtraight and true. This bell-metal was turned very true on its arbor, and its face, that reſts againſt the wheel, was made very flat, ſo that the ſteel-arbor might ſtand perpendicular to the plane of the wheel: this bell-metal was faſtened to the wheel by ſix ſteel ſcrews. A braſs ſocket, Z, is faſtened on the centre of the mahogany ſtand,

and receives the lower part of the bell-metal piece D, being made to touch the bell-metal in a narrow part near the mouth, to prevent any obliquity of the wheel from bending the arbor: good fitting is by no means neceſſary here, ſince any ſhake in this ſocket will produce no bad effect, as will appear when the cutting-frame is deſcribed. The wheel was then put on its ſtand, the lower edge of the ring, B, reſting on the circumference of the three conical friction-pulleys W, to facilitate its motion round its centre. The axis of one of thoſe pulleys is in a line joining the centre of the wheel and the middle of the endleſs ſcrew, and the other two placed ſo as to be at equal diſtances from each other. F is a block of wood (*fig.* 1.), ſtrongly faſtened to one of the legs of the ſtand; the piece, *g* (*figs.* 1 and 12.), is ſcrewed to the upper ſide of the block, and has half holes, in which the tranſverſe axis, *h*, (*figs.* 1 and 11.) turns; the half holes are kept together by the ſcrews *i*. The lower extremity of the conical pillar, P, (*figs.* 1 and 11.) terminates in a cylindrical ſteel pin *k*, which paſſes through and turns in the tranſverſe axis *h*, and is confined by a cheek and ſcrew. To the upper end of the ſaid conical pillar is faſtened the frame G, (*figs.* 5 and 9.), in which the endleſs ſcrew turns; the pivots of the ſcrew are formed in the manner of two fruſta of cones joined by a cylinder, as repreſented at X, in *fig.* 9. Theſe pivots are confined between half holes, which preſs only on the conical parts, but do not touch the cylindrical parts; the half holes are kept together by ſcrews, *a*, *a*, which may be tightened at any time, to prevent the ſcrew from ſhaking in the frame. On the ſcrew-arbor is a ſmall wheel of braſs, K, having its outſide edge divided into 60 parts, and numbered at every 6th diviſion with 1, 2, &c. to 10. The motion of this wheel is ſhewn by the index, *y*, on the ſcrew-frame G. H repreſents part of the ſtand (*fig.* 1.) having a parallel ſlit in the direction towards the centre of the wheel, large enough to receive the upper part of the conical braſs pillar P, which carries the ſcrew and its frame; and as the reſiſtance, when the wheel is moved by the endleſs ſcrew, is againſt that ſide of the ſlit, H, which is towards the left hand, that ſide of the ſlit is faced with braſs, and the pillar is preſſed againſt it by a ſteel ſpring on the oppoſite ſide: thus is the pillar ſtrongly ſupported laterally, and yet the ſcrew may be eaſily moved from or againſt the circumference of the wheel, and the pillar will turn freely on its axis, to take any direction given it by the frame L, lying over the wheel in *fig.* 1, and ſeen more diſtinctly in *fig.* 13.

At each corner of the piece I, ſeen in *fig.* 1, and alſo detached in *fig.* 8, are as many ſcrews, *n*, of tempered ſteel with poliſhed conical points: two of them turn in conical holes in the ſcrew-frame, near *o*, *fig.* 9; and the points of the other two turn in holes in the piece Q, *fig.* 7: the ſmall end ſcrews, *p*, are of ſteel, which, being tightened, prevent the conical pointed ſcrews from unturning, when the frame is moved. The braſs frame L, *figs.* 1 and 13, ſerves to connect the endleſs ſcrew, its frame, &c. with the centre of the wheel; each arm of this frame is terminated by a ſteel ſcrew, that may be paſſed through any of the holes, *q*, in the piece Q, *fig.* 7, as the thickneſs of the work to be divided on the wheel may require, and are faſtened by the finger-nuts *r*, ſeen in *figs.* 1 and 2. At the other end of this frame is a flat piece of tempered ſteel *b*, wherein is an angular notch; when the endleſs ſcrew is preſſed againſt the teeth of the circumference of the wheel, which may be done by turning the finger-ſcrew S, ſeen in *figs.* 1 and 2, to preſs againſt the ſpring *t*, this notch embraces and preſſes againſt the ſteel-arbor *d*. This end of the frame, too, may be raiſed or depreſſed, by moving the triangular or priſmatic ſlide *u* (*fig.* 14.), which may be fixed at any height by the four ſteel ſcrews *v*. The bottom of this ſlide has a notch *k*, having its plane parallel to the endleſs ſcrew; and by the point of the arbor *d*, reſting in this notch, this end of the frame is prevented from tilting: the ſcrew, S, alſo is kept faſt by the finger-nut *w*, in *fig.* 2.

The teeth on the circumference of the wheel were cut by the following method. Having conſidered what number of teeth on the circumference would be moſt convenient, which in this engine is 2160 or $\overline{360 \times 6}$, I made, ſays Mr. Ramſden, two ſcrews of the ſame dimenſions of tempered ſteel, the interval between the threads of which being ſuch as I knew by calculation would come within the limits of what might be turned off the circumference of the wheel; one of theſe ſcrews, which was intended for ratching or cutting the teeth, was notched acroſs the threads, ſo that the ſcrew, when preſſed againſt the edge of the wheel and turned round, cut in the manner of a ſaw. Then having a ſegment of a circle a little greater than 60°, of about the ſame radius with the wheel, and its circumference made true from a very fine centre, I deſcribed an arch near the edge, and ſet off the chord of 60° on this arch. This ſegment was ſubſtituted for the wheel, and had its edge ratched or indented; and the number of revolutions and parts of the ſcrew head contained within the arch of 60° were counted. The radius was corrected in the proportion of 360 revolutions, which ought to have been in 60°, to the number actually found; and the radius ſo corrected was taken in a pair of beam compaſſes: while the wheel was on the lathe, one foot of the compaſſes was put in the centre, and with the other a circle was deſcribed on the ring; then half the depth of the threads of the ſcrew being taken in the dividers, was ſet from this circle outwards, and another circle was deſcribed cutting this point; a hollow was then turned on the edge of the wheel of the ſame curvature as that of the ſcrew, at the bottom of its threads; the bottom of this hollow was turned to the ſame radius as the outward one of the two circles before-mentioned.

The wheel was now taken off the lathe, and the bell-metal piece D, *fig.* 3, was again ſcrewed to its place, not to be removed any more. From a very exact centre, a circle was deſcribed on the ring C, *fig.* 4, about $\frac{4}{10}$ths of an inch within where the bottom of the teeth would come; this circle was divided with the greateſt poſſible exactneſs, firſt into 5 parts, and each of theſe again into 3; theſe parts were then biſected 4 times; *i. e.* ſuppoſing the whole circumference of the wheel to contain 2160 teeth, a fifth part would be 432, a fifteenth part (or 5 × 3) would be 144, and this laſt number biſected four times would give 72, 36, 18, and 9 reſpectively; but as it was apprehended that ſome inaccuracy would ariſe from quinqueſection and triſection, another circle was deſcribed on the ſame ring, at $\frac{1}{10}$th of an inch within the former circle, and divided by continual biſections into the portions 2160, 1080, 540, 270, 135, $67\frac{1}{2}$, and $33\frac{3}{4}$; and as the fixed wire, to be deſcribed preſently, croſſed both the circles, it was a check on their agreement at every 135 revolutions, and after ratching at every $33\frac{3}{4}$; but as no ſenſible difference was perceived in the two circles, the former was choſen for ratching: and as the coincidence of the fixed wire with an interſection would be more exactly determined than with a dot or diviſion, the interſections in both circles were uſed.

The arms of the frame L, *figs.* 1 and 13, were connected by a thin piece of braſs $\frac{3}{4}$ of an inch broad, having a hole of $\frac{4}{10}$ths of an inch diameter in the middle; acroſs this hole a ſilver wire was fixed exactly in a line to the centre of the wheel; the coincidence of this wire with the interſections was examined by a lens of $\frac{1}{10}$ths of an inch focus, fixed in a tube, that was attached to one of the arms L. Now a handle, or winch, being fixed on the end of the ſcrew-arbor, the diviſion marked 10 on the circle K was ſet to its index, and, by means of a clamp and adjuſting ſcrew for that purpoſe, the interſection marked 1 on the circle C was ſet exactly to coincide with the fixed wire; the ſcrew was then carefully preſſed againſt the circumference of the wheel, by turning the finger-ſcrew S; then, the clamp being removed, the ſcrew was turned by its handle juſt 9 revolutions, till the interſection marked 240, *fig.* 4, came nearly to the wire; the finger-ſcrew S was now turned back, and the dividing ſcrew releaſed from the edge of the wheel, which was here turned back till the interſection marked 2 exactly coincided with the wire; the diviſion 10 on the micrometer circle was then ſet to its index as before, and the ſcrew preſſed againſt the edge of the wheel by the finger-ſcrew S; then, the clamps being removed, the ſcrew was turned a ſecond 9 revolutions, till the interſection marked 1 nearly coincided with the fixed wire; the ſcrew was again releaſed, and the ſame operation was repeated till the teeth were faintly marked all round the circumference of the wheel. The impreſſion was made deeper by thus going three times round; after which the wheel was ratched continually round 300 times in the ſame direction, without diſengaging the ſcrew, when the teeth were found ſufficiently indented. Now, it is evident, that, if the circumference of the wheel were even a whole tooth or ten minutes ſpace greater than the ſcrew would require, this error would, in the firſt inſtance, be reduced to $\frac{1}{240}$th part of a revolution, or two ſeconds and a half; and theſe errors or inequalities of the teeth were equally diſtributed round the wheel at the diſtance of 9 teeth from each other; but, as the ſcrew in ratching had continually hold of ſeveral teeth at the ſame time, and as theſe were conſtantly changing, the above-mentioned inequalities ſoon corrected themſelves, and the teeth were reduced into a perfect equality.

The piece of braſs which carries the wire was now taken away, and the cutting-ſcrew alſo removed, and replaced by the plane one of the ſame dimenſions; on one end of its arbor was put the micrometer circular plate divided into 60, and numbered at every ſix diviſions, as already ſtated; and on the other end was placed a ratchet-wheel of 60 teeth, ſeen in *fig.* 6, which is covered by the hollowed circle *d*, carrying two clicks, that catch upon the oppoſite ſides of the ratchet, when the ſcrew is to be moved forwards. The cylinder S, *figs.* 5 and 9, turns on a ſtrong ſteel arbor F, ſeen in *fig.* 5, which paſſes through, and is firmly ſcrewed to the piece Y; this piece, for greater firmneſs, is attached to the ſcrew frame G by the braces *v*: a ſpiral groove or thread is cut on the outſide of the cylinder S, which ſerves both for holding the ſtring, and alſo for giving motion to the lever J on its centre, *figs.* 9 and 10, by means of a ſteel tooth *n* that works between the threads of the ſpiral. To the lever is attached a ſtrong ſteel pin *m*, *fig.* 10, on which a braſs ſocket *r* turns: this ſocket paſſes through a ſlit in the piece *p*, and may be tightened in any part of the ſlit by the finger-nut *f*: this piece ſerves to regulate a number of revolutions of the ſcrew for each tread of the treadle R, ſeen in *fig.* 1. T, in *fig.* 1, is a braſs box, containing a ſpiral ſpring: a ſtrong gut is faſtened and turned three or four times round the circumference of this box; the gut then paſſes ſeveral times round the cylinder S, *figs.* 1 and 9, and from thence down to the treadle R. Now, when the treadle is preſſed down, the ſtring pulls the cylinder S round its axis, and the clicks laying hold of the teeth on the ratchet, carry the ſcrew round with it, till, by the tooth *n* working in the ſpiral groove, the lever J is brought near the wheel *d*, *fig.* 6, and the cylinder is ſtopped by the ſcrew-head *x*, *fig.* 9, ſtriking on the top of the lever J; at the ſame time the ſpring is wound up by the other end of the gut paſſing round the box T, *fig* 1. Now, when the foot is taken from the treadle, the ſpring in the box unbending itſelf, pulls back the cylinder, the clicks leaving the ratchet and attached ſcrew at reſt till the piece *t* ſtrikes on the end of the piece *p*, *fig.* 10; and the number of revolutions of the ſcrew at each tread is limited by the number of revolutions that the cylinder is allowed to turn back before the ſtop ſtrikes on the piece *p*. When the endleſs ſcrew is moved round its axis with a conſiderable velocity, it will continue that motion a little after the cylinder S is ſtopped; to prevent which angular motion, the angular lever η was made, that when the lever J comes near to ſtop the ſcrew *x*, it, by a ſmall chamfre, preſſes down the piece κ of the angular lever; this brings the other end η of the ſame lever forwards, and ſtops the endleſs ſcrew by the ſteel pin μ ſtriking on its top; the foot of the lever is again raiſed by a ſmall ſpring preſſing on the brace *v*.

Two clamps D, *fig.* 13, connected by the piece *a*, *fig.* 1, ſlide, one on each arm of the frame L, and may be fixed at pleaſure by the four finger-ſcrews ε, which preſs againſt ſteel ſprings, to avoid ſpoiling the arms; the piece *q*, *fig.* 13, is made to turn without ſhake between the two conical pointed ſcrews *f*, *f*, ſet faſt by the finger-nuts N, N. The piece M is made to turn on the piece *q*, by the conical pointed ſcrews reſting in the hollow centres *e*, *e*. As there is frequent occaſion to cut diviſions on inclined planes, for that purpoſe the piece γ, in which the tracer or dividing point is fixed, has a conical axis at each end, which turn in half holes; ſo that when the tracer is ſet to any inclination, it may be fixed there, by tightening the ſteel ſcrews $\beta\beta$."

Subſequently to the time of Mr. Ramſden's dividing engine being conſtructed, Mr. Edward Troughton conſtructed one to anſwer the ſame purpoſe, which it does in the moſt perfect manner; and it was our intention to have deſcribed it alſo in this place, but on application to him for permiſſion to inſpect its parts and manner of operating, we were ſorry to learn that he has pledged himſelf to give an account of it himſelf in another work.

Engine (by Ramſden) *for cutting the Screws of the circular Dividing-Engine.*—We mean not to enter here into the hiſtory of the ſcrew-engine, as it may be, and has been applied to various purpoſes, but to deſcribe the engine made and uſed by Mr. Ramſden for making the individual ſcrews which he uſed for ratching his engine for dividing circles, &c., and for meaſuring the angular diſtance on his circle when ratched. This apparatus, indeed, may be conſidered as an appendage to the other, and therefore ought to be introduced in this place. *Fig.* 1. of *Plate* X. of *Engines*, repreſents this engine as ſeen from one ſide of reduced dimenſions; and *fig.* 2, the ſame as ſeen from above, of the ſame dimenſions. A repreſents a triangular bar of ſteel, to which the triangular holes in the pieces B and C are accurately fitted, and may be fixed on any part of the bar by the ſcrew D. E is a piece of ſteel whereon the ſcrew is intended to be cut, which, after being hardened and tempered, has its pivots turned in the form of two fruſta of cones, as repreſented in the drawings of the dividing-engine. Theſe pivots were very exactly fitted to the half holes F and T, which were kept together by the ſcrews Z. H repreſents a ſcrew of untempered ſteel, having a pivot I, which turns in the hole K. At the other end of the ſcrew is a hollow centre, which receives the hardened conical point of the ſteel pin M. When this point is ſufficiently preſſed againſt the ſcrew, to prevent its ſhaking, the ſteel pin may be fixed by tightening the ſcrews Y. N is a cylindrical nut, moveable on the ſcrew H, which, to prevent any ſhake, may be tightened by the ſcrews O. This nut is connected with the ſaddle-piece P, by means of the intermediate univerſal joint W, through which the arbor of the ſcrew H paſſes. A front view of this piece, with a ſection acroſs the ſcrew-arbor, is repreſented at X, *fig.* 3. This joint is connected with the nut by means of two ſteel ſlips S, which turn on pins between the cheeks T, on the nut N. The other end of theſe ſlips S turn in like manner on pins *a*. One axis of this joint turns in a hole in the cock *b*, which is fixed to the ſaddle-piece, and the other turns in a hole *d*, made for that purpoſe in the ſame piece on which the cock *b* is fixed. By theſe means, when the ſcrew is turned round, the ſaddle-piece will ſlide uniformly along the triangular bar A. K is a ſmall triangular bar of well-tempered ſteel, which ſlides in a groove of the ſame form on the ſaddle-piece P. The point of this bar or cutter is formed to the ſhape of the thread intended to be cut on the endleſs ſcrew. When the cutter is to take proper hold of the intended ſcrew, it may be fixed by tightening the ſcrew *e*, which preſs the two pieces of braſs G upon it. Having meaſured the circumference of the dividing-wheel, it was found to require about one thread in a hundred, coarſer than the guide-ſcrew H. The wheels on the guide-ſcrew arbor H, and that on the ſteel arbor E, on which the ſcrew was to be cut, were proportioned to each other to produce that effect, by giving the wheel L 198 teeth, and the wheel Q 200. Theſe wheels communicated with each other by means of the intermediate wheel R, which alſo ſerved to give the threads on the two ſcrews the ſame direction. The ſaddle-piece P is confined on the bar A by means of the pieces *g*, and may be made to ſlide with a proper degree of tightneſs by the ſcrews *n*.

Engine *for cutting the Screw of Ramſden's Engine for dividing Straight Lines.*—The exactneſs of the ſtraight line engine, as made by Ramſden, depends very much on the correctneſs of the endleſs ſcrew, which requires ſome properties that are not abſolutely neceſſary in the endleſs ſcrew for the *circular engine.* In that, as there are but a few threads of the endleſs ſcrew engaged in the teeth of the wheel, it required only that thoſe threads ſhould have a ſimilar inclination to the axis of the ſcrew all round; but in the ſtraight-line engine, where the whole length of the ſcrew is engaged in the moveable plate, it is neceſſary that the diſtances alſo between the threads ſhould be preciſely the ſame throughout the whole length of the ſcrew: as this is effected in a manner in ſome reſpects different from the mode of cutting the ſcrew we have juſt deſcribed, we ſhall ſubjoin it here, that the reader may take a comparative view of the two methods adopted by that great artiſt Ramſden. In *fig.* 1. of *Plate* XI. of *Engines*, is a plan of the engine for cutting the ſcrew for dividing *ſtraight lines*; and in *fig.* 2, is an elevation of the ſame. The ſection, as given in the original account publiſhed in 1779, does not ſeem to be neceſſary for explaining the engine, and is therefore omitted in our account. A, in *fig.* 1, repreſents a ſtrong circular plate of braſs, having its edge ratched, as deſcribed in our account of the circular dividing-engine; on its centre is firmly fixed the pulley B by four ſcrews, having a groove turned on its cylindrical part, perfectly concentric with the plate A. C, in *fig.* 2, is a ſteel axis two feet long, terminating in a point, whereon it reſts; the upper part of the axis being firmly ſcrewed to the plate A, and turning in the collar D. E repreſents an endleſs ſcrew, *fig.* 1, which being turned on its horizontal axis, moves the circular plate A round its centre: F is a circular divided ſmall plate, or micrometer-head, which may be turned with or without the endleſs ſcrew; and on the other end of this ſcrew-arbor is a large pinion *a*, with levelled teeth on its edge, together with the winch X to turn it by. G, ſeen in both figures, is a triangular bar of ſteel, which paſſes over the circular plate A, and is firmly ſcrewed to the frame of the engine at H, *fig.* 1, and I, *fig.* 2. K is a piece of ſteel forming the arbor of the ſcrew intended to be cut, having a wheel L, on one end acting with the pinion *a* before-mentioned. M and N, *fig.* 1, are two ſtrong pieces of braſs, in which the arbor juſt mentioned turns, and are firmly fixed to the triangular bar G, by means of the ſcrews *n*, *n*, ſeen at I, in *fig.* 2. O, ſeen in both figures, is a piece of braſs that ſlides on the triangular bar G, the two extremities of which are made exactly to fit the bar; it ſlides regularly thereon, and is prevented from riſing by the two ſpring pieces *c*, *c*; near one end of the piece O is an angular groove *q*, *fig.* 1, that holds the tool by which the threads are cut, and is pointed with a diamond, in order to cut the ſteel after it is hardened and tempered: the cock *w* ſerves to faſten the tool, which may be ſet to take proper hold on the ſteel by turning the finger-ſcrew *s*, and is fixed there by the ſcrew *v*.

To make a perfect ſcrew, it is only required to give the point that cuts the threads an uniform motion parallel to itſelf, and alſo to the axis of the intended ſcrew, and that this motion be proportioned to the revolutions of the intended ſcrew as the number of threads may require. To effect this, a piece of thin tempered ſteel *t*, exactly of the ſame thickneſs throughout, is faſtened to the ſlide O at *r*; the other end of the ſpring being faſtened to the pulley B in the groove: now while the circle A, with the pulley, is turned round its centre by turning the endleſs ſcrew to the right hand, the ſpring *t* draws the ſlider O, with the attached cutter *q*, along the triangular bar; at the ſame time the ſteel-arbor K of the ſcrew to be cut revolves by means of the communication of its wheel L with the revolving pinion *a*.

The ſcrew, E, of the circular plate has 20 threads *per* inch, therefore if the number of teeth on the pinion, *a*, be to the number in the wheel L, as the number of teeth on the circular plate, A, is to the number of 20ths of an inch round the circumference of the pulley B, allowing for part of the thickneſs at the ſpring *t*, the ſpaces between each of the threads of the ſcrew to be cut will be alſo 20ths of an inch. The ſize of the pulley, B, was determined thus: the endleſs ſcrew, E, being diſengaged from the circular plate A, the ſlider, O, was drawn back till the end of it came nearly to the piece M; the endleſs ſcrew was again engaged in the plate A; then having two very ſmall dots on the ſlider O, ſet off parallel to one ſide, at exactly five inches diſtance from each other, the ſlider was moved by turning the endleſs ſcrew E, till one of its dots was biſected by a ſmall ſilver wire fixed acroſs a hole made in a thin piece of braſs faſt to the piece N; then O on the micrometer head, F, being put to the index without moving the ſcrew, the pulley was tried and reduced, till juſt 600 revolutions of the endleſs ſcrew, E, brought the ſecond dot to be exactly biſected by the fixed wire. Theſe biſections were examined by a lens of half an inch focus, ſet in a ſmall braſs tube, that was fixed perpendicularly over the wire.

Engine *for dividing ſtraight Lines, by Ramſden.*—When Mr. Ramſden had ſucceeded in dividing ſextants, &c. by his circular dividing engine, and was rewarded by the honourable Board of Longitude, he turned his mind towards

wards the contrivance of an engine that would divide ſtraight lines into any number of aſſignable parts, and that might be uſeful in laying down with extreme accuracy the lines of ſines, tangents, ſecants, &c. on ſectors and plane ſcales. The project was realized, and the account was ordered to be publiſhed by the Board of Longitude, in the year 1779. We do not find, however, that the original model, which we come now to deſcribe, has been found deſirable to copy by ſucceeding mathematical inſtrument makers: more ſimple and leſs expenſive means have been adopted, which are found to anſwer practically as good a purpoſe. A beam-compaſs, aided by proper tables, is quite accurate enough for the niceſt purpoſes of dividing unequal, as well as equal, diviſions by biſection; and a pattern once carefully laid down can be uſed, for transferring the diviſions on the common caſes of inſtruments, with greater facility than the engine itſelf can be worked; and, provided great care be taken to prevent the parallax of the transferring point, the accuracy will be ſufficient for all ordinary uſes. This engine, which profeſſes to divide any line without an error of $\frac{1}{4000}$th of an inch, has its principal parts repreſented in *Plate* XII. of *Engines;* where *fig.* 1, repreſents a plan of the dividing portion, as ſeen from above; *fig.* 2, an elevation of the ſame ſeen acroſs; and *fig.* 3, the under ſide of *fig.* 1, when turned up. The original account contains ſome ſections, which are more uſeful for the workmen as patterns, than for a general deſcription, which may diſpenſe with them altogether. A, in *fig.* 1, is a ſtrong braſs plate, 27 inches long, 4 broad, and $\frac{7}{10}$ths thick; worked exceedingly flat, and of the ſame thickneſs throughout, with its two edges parallel. One of theſe edges is ratched, or cut into teeth, of which there are juſt 20 in an inch, and is moved by an endleſs ſcrew, containing juſt 20 threads in an inch, which actuates the teeth. (See ENGINE *for cutting the Screw of Ramſden's ſtraight-line Engine.*) Each revolution of the endleſs ſcrew round its axis will move the plate $\frac{1}{100}$ths of an inch along an iron frame, hereafter to be deſcribed. A micrometer head is fixed at one end of the ſcrew arbor, divided into 50 diviſions, which, by means of a vernier ſubdividing into 5 parts, meaſures $\frac{2}{10000}$ths of an inch along the frame. Any rule or other inſtrument may be faſtened on this plate, and may have a line drawn on it divided by a point or tracer, fixed in a proper frame, whereby it has a rectilinear motion without any lateral ſhake. When lines are to be divided by diviſions not commenſurable with Engliſh inches, which conſtitute the ſcale, the line to be ſo divided may be laid down, not parallel to the plate A, but obliquely, ſo as to make an angle with it, or become the hypothenuſe line of a right-angled triangle; which line, by calculation, ſhall be to the baſe as the denomination of meaſure, when longer, is to the Engliſh inch; that is, as the ſecant is to the radius of the triangle, provided the tracer draws lines at right angles to the ſide of the plate; but if the traced lines be at right angles to the line to be divided, then the diviſions on that line will be ſhorter than they would be on a parallel line of the plate, and in the proportion of the co-ſine of the angle of inclination to radius. In order to adjuſt the inclination of a ruler laid on the plate A, two sectoral portions of a circle are laid down on one of its ends, with an extent from the point J, near the fixing ſcrews on the edge of this plate. The outer ſector is divided into proper degrees, and is numbered from 1 to 9, which degrees are ſubdivided into 6, or 10 minutes ſpaces; but the inner ſector is divided into the proportion of the coſines to radius 10,000, and its diviſions are numbered 10, 20, 30, &c. to 140. The uſe of this contrivance will be beſt underſtood by an example: for inſtance, if a line of $9\frac{999}{1000}$ were to be divided into the ſame number of diviſions, and in the ſame manner as if it were 10 inches long exactly; put the ruler to be divided to the cutting frame, hereafter deſcribed, and turn the handle, T, that moves the apparatus, till the ſame edge of the ruler cuts the central point J, and the firſt diviſion from the O of the inner ſector; then ſcrew the ruler faſt to the plate A, and when it has moved ten inches in its own direction, the whole length of the diviſions on the line divided will be only $9\frac{999}{1000}$ inches, though the divided ſpaces will be reſpectively equal among themſelves. It is not neceſſary for us to particularize the precautions taken, in making all the ſpaces of the teeth ratched equal to each other, during the act of ratching, which was done with a notched ſcrew: this was done by means of points previouſly made and examined, with a wire at every 16 revolutions of the ſcrew, till the teeth were a little indented to guide the ſcrew along the whole line by continual revolutions, as was the caſe in the circular dividing inſtrument, more particularly deſcribed, becauſe found more particularly uſeful. B, in *fig.* 1, is a ſtrong iron frame, 43 inches long, having two edges, *a* and *b*, riſing half an inch above its ſurface; theſe two edges are made very ſtraight, and are in the ſame plane; the inſide of the edge *a* is alſo made as ſtraight as poſſible. The plate, A, ſlides on the two edges of the iron frame; beneath it are two ſprings, *c*, *c*, ſeen in *fig.* 3, each faſtened at the extreme ends to the plate A, by the ſcrews, *s*, *s*; at the other end of each ſpring is a roller, *e*, of tempered ſteel, turning on an axis in theſe ſprings; there is alſo a third roller, *d*, of tempered ſteel, let into the iron frame, not ſeen, near where the threads of the endleſs ſcrew act; this roller has a long axis, ſo ſituated that it may be raiſed or depreſſed as occaſion may require, to bear the weight of the plate A, and rule or inſtrument placed on it. C, in *figs.* 1 and 2, is the endleſs ſcrew of tempered ſteel, with pivots of two fruſta of inverted cones, ſimilar to thoſe deſcribed in the engine for dividing circles, &c. which turn in adjuſtable half holes in braſs cocks ſcrewed to the iron frame. G, G, in *fig.* 3, are two ſmall ſteel frames turning on centres, *k*, faſtened to the underſide of the plate A, and equidiſtant from the edge of it; in each frame is a roller, *y*, of tempered ſteel, turning very concentric with their pivots, and exactly of the ſame diameter. The two ſmall frames are connected together by the long braſs bar E, which turns on a ſtud in each frame, and which preſerves its paralleliſm, on the principle of a common parallel ruler. This apparatus ſerves to preſs the edge of the plate, A, with a motion parallel to itſelf againſt the threads of the endleſs ſcrew. On the end of the plate, A, is a ſpring of tempered ſteel, acting as a bent lever. The ſpring end of this lever has a ketch which paſſes under the head of the ſtud *l*, that is on the end of the connecting piece E. While the other end of the lever is preſſed gradually down towards the plate A, by turning the finger-ſcrew F, the connecting piece, E, is drawn forward, ſo that the ſteel rollers, borne by the ſprings T, in *fig.* 3, preſſing againſt the edge, *a*, of the iron frame, in *fig.* 1, may force the ſide of the plate againſt the endleſs ſcrew.

Beſides the micrometer head, already named, the arbor of the dividing ſcrew, which has its threads ſimilar to thoſe of the notched ratching ſcrew, has at its oppoſite end two ſets of ratched wheels; one ſet for turning the ſcrew, and the other ſet for ſtopping it at the proper times. Theſe ſets are each compoſed of three wheels, of which one has 32 teeth, another 48, and the third 50, which afford the means of ſubdividing the inch into ſpaces of different denominations; thoſe wheels uſed in ſtopping the ſcrew are ratched, with the teeth pointing in a contrary direction to thoſe of the wheels for putting it in motion. I repreſents a cylinder of braſs, having on one end two ſteel rings, *a* and *b*, with their contiguous edges cut into ratched teeth, in contrary directions, ſo as to fit each other as ſeen in the figure; on one of theſe rings is an index, and the other has its teeth numbered 10, 20, &c. up to 50; the other end of the cylinder is made hollow, and contains one of the ſets of ratched wheels, already named. There are two ſlits oppoſite each other, pierced through the hollow part of the cylinder W; in each of which ſlits is a click turning on an axis, and preſſed into the teeth of the ratched wheel by a ſmall ſpring.; theſe clicks may be moved along their axis, ſo as to catch in any one of the three ratched wheels, and may be faſtened at that place by a ſmall tightening ſcrew *s*. The cylinder I, with the clicks, &c. turns on a ſteel axis, attached to the piece K, in a line with the axis of the endleſs ſcrew. Motion is given to this cylinder round its axis by a piece of catgut, which hath one end faſtened to the ratched ring *b*; and the other end, after paſſing four or five times round the cylinder, is faſtened to a treadle, and, on preſſing the treadle down, the clicks, *s*, catch in the teeth of one of the ratched wheels; by which contrivance the cylinder I, together with the endleſs ſcrew, is turned round its axis, and its motion carries the plate, A, along the iron frame, and at the ſame time winds up the ſpiral ſpring *u*; but on releaſing the treadle, the ſaid ſpring unbends itſelf, the clicks quit the ratched wheel, and leave the endleſs ſcrew at reſt, whilſt the cylinder, I, turns in an oppoſite direction, and raiſes the treadle to its former ſituation. V, in *fig.* 2, is a ſmall ſquare bar of ſteel, having both its extremities cylindrical; theſe cylinders move in holes lined with hardened ſteel, one in the piece D, and the other in the piece K. This bar carries three different pieces, which are of tempered ſteel; the middle one, *t*, is made to lie in the interval between the threads of the ſcrew cut on the cylinder, and paſſes nearly half round its circumference: it is kept in the threads by a ſpring, *e*, that preſſes on a piece, *q*, ſcrewed to the iron frame; this piece being attached to the bar, V, by a ſcrew, turning the cylinder, I, on its axis, will give a longitudinal motion to the bar V. The upper end of the piece *f*, *fig.* 2, is formed into a hook, and may be ſet to catch in the teeth of any of the ratchet wheels, and then be faſtened to the bar, V, by a ſcrew *i*; towards the other end of the bar is a piece *j*, which ſerves to ſtop the cylinder in turning back, ſo as to limit the number of revolutions and parts of a revolution required, and is faſtened to any required place on the bar, V, by the finger-ſcrew *s*.

When the engine is uſed, the treadle is preſſed down, and the catgut turns the cylinder I; in the mean time, the piece, *t*, moves along the thread till a ſtud, *r*, on the cylinder, ſtriking on the top of the curved piece *t*, bends the ſpring *e*, until that piece reſts on the piece *q*; by bending this ſpring, the ſquare bar is turned a little on its axis, and pulls the hook, *f*, into the teeth on the ratched wheel R: then the treadle being releaſed, the ſpiral ſpring turns back the cylinder till the piece, *j*, is brought under the ſtop on the ratchet ring *b*. The parts of a revolution are regulated by ſetting the number required on the ratchet ring, *b*, to the index on the fixed ring *a*; each of the teeth anſwers to the motion of $\frac{1}{1500}$th of an inch of the plate A; and the number of revolutions, each of which moves the plate, A, $\frac{5}{10}$ths of an inch, is regulated by ſetting the piece, *j*, on the bar. I, in *fig.* 1, repreſents the ſteel frame in which the tracer is fixed; this frame turns between the conical points of two ſcrews, *n*, *n*, of tempered ſteel, which are ſcrewed in the frame Q, *fig.* 2; there are alſo two ſimilar ſcrews in the ſame frame Q, at *m*, *m*; the points of theſe ſcrews, which are alſo of tempered ſteel, turn in conical holes in the piece P; by means of this parallel motion, the tracing point, by which the dividing lines are cut, will always deſcribe the ſame line without any lateral bending; the tracer is put on the hole in the axis *b*, *fig.* 1, and is fixed there by the four tightening ſcrews, *f*, that preſs the holding piece, *c*, againſt the flattened part of the axis of motion. This ſmall axis, which has its pivots formed of double cones, turns between half holes, and may be fixed when the tracer is ſet to any required inclination, by tightening the ſcrews of preſſure, *s*, *s*, *s*, *s*. Beſides theſe parts of the engine, there is a braſs ruler made as an appendage for ſetting the line to be divided in its true ſituation, but is not neceſſary to be particularly deſcribed: this ruler may be ſet parallel to the edge of the plate A, or to any angle of inclination, by turning the handle T, which moves the piece P, with the cutting frame and ruler, on the centre *x*; and the required poſition may be rendered permanent by tightening the capſtan ſcrew *p*.

ENGINE-*Shaft*, in *Mining*, is generally applied to the ſhaft or well wherein the pumps are erected for freeing a mine of its water; but in diſtricts where the mines are relieved of water by ſoughs, as in the mountainous part of Derbyſhire, it is common to find the ſhafts at which they draw ore by a horſe-gin, called the engine-ſhaft, and the gin itſelf an engine.

ENGINE *to draw Fuzes*, in *Gunnery*, conſiſts of a wheel with a handle to it, to raiſe a certain weight, and to let it fall upon the driver, by which the ſtrokes become more equal.

ENGINE *to draw Fuzes* has a ſcrew fixed upon a three-legged ſtand, the bottom of which has a ring to place it upon the ſhell; and at the end of the ſcrew is fixed a hand-ſcrew, by means of a collar, which, being ſcrewed on the fuze, by turning the upper ſcrew, draws out or raiſes the fuze.

ENGINEER, or INGINEER, in its general ſenſe, is applied to a contriver or maker of any kind of uſeful engines or machines.

In its more proper ſenſe, it denotes an officer in an army or fortified place, whoſe buſineſs it is to contrive and inſpect attacks, defences, works, &c. The term engineer is ſaid to be of modern date, and to have been firſt uſed in the year 1650, when one Cap. Thomas Rudd had the title of chief engineer to the king. In 1634 an engineer was called camp-maſter general, and ſometimes engine-maſter, being always ſubordinate to the maſter of the ordnance.

An engineer ſhould be an able and expert mathematician, particularly verſed in military architecture and gunnery; being often ſent to view and examine the places intended to be attacked; to chooſe out and ſhew the general the weakeſt place; to draw the trenches, aſſign the places of arms, galleries, lodgments on the counterſcarp and half-moons; conduct the works, ſaps, mines, &c. and appoint the workmen their nightly taſk; he is alſo to make the lines of contravallation; with the redoubts, &c.

Under the eſtabliſhment of the office of his majeſty's ordnance in England, the corps of *royal engineers* conſiſts of one colonel in chief, one colonel in ſecond, three colonels commandant, ſix colonels, 12 lieutenant-colonels, 27 captains, 28 ſecond-captains, 55 firſt-lieutenants, 28 ſecond-lieutenants, an inſpector-general of fortifications, his deputy brigade-major, adjutant, and quarter-maſter.

The eſtabliſhment of the corps of *invalid engineers* comprehends a colonel, lieutenant-colonel, captain, captain-lieutenant and captain, firſt-lieutenant and ſecond-lieutenant.

The corps of *royal engineers* in Ireland conſiſts of a director, colonel, lieutenant-colonel, major, captain, captain-lieutenant, and captain, and two firſt-lieutenants. See Ordnance.

Engineers, *Civil*, a denomination which compriſes an order or profeſſion of perſons highly reſpectable for their talents and ſcientific attainments, and eminently uſeful under this appellation, as the canals, docks, harbours, light houſes, &c. amply and honourably teſtify. This order of artiſts is ſaid to have commenced in this country about the year 1760, at which period the advancement of the arts and ſciences was ſingularly rapid. In 1771, Mr. Smeaton, ſo well known in this department of ſcience, projected and eſtabliſhed an aſſociation, or ſociety of engineers. During an interval of 20 years, the number of members of this ſociety increaſed to 65, of whom 15 were real engineers, and the reſidue being compoſed either of amateurs, or of ingenious workmen and artificers. In May 1792 this ſociety was diſſolved in conſequence of an unpleaſant circumſtance, which had interrupted its harmony; but a renewal of it, under a better form, was ſoon intended, though not accompliſhed during the life-time of Mr. Smeaton. His death happened in October 1792, and the firſt meeting of the new inſtitution, entitled "The Society of Civil Engineers," was held on April 15, 1793, by Mr. Jeſſop, Mr. Mylne, Mr. Rennie, and Mr. Whitworth. According to the new conſtitution of the ſociety, it is divided into three claſſes. The firſt claſs, as ordinary members, conſiſts of real engineers. The ſecond claſs, as honorary members, is compoſed of men of ſcience, and gentlemen of rank and fortune, who have attended to the ſubject of civil engineering. The third claſs, as honorary members alſo, conſiſts of artiſts, whoſe profeſſions and employments are connected with what is called civil engineering. The meetings are held at the Crown and Anchor, in the Strand, every other Friday, during the ſeſſion of parliament. See Reports of the late Mr. John Smeaton, F.R.S. &c. vol. i. 4to. 1797.

ENGISO'MA, from εγγιζω, *to draw near*, in *Surgery*, an inſtrument formerly uſed by ſurgeons in caſes of fractures of the ſkull. Hence, the word has been applied to ſuch fractures of the cranium as are attended with a depreſſion of the bone in the middle, ſo as to produce preſſure on the membranes of the brain.

ENGLAND, in *Geography*. The ſouthern, moſt opulent, and moſt important part of Britain, has been diſtinguiſhed among European nations, ever ſince the days of venerable Bede, by the appellation of "Anglia," or England; which has been generally aſcribed to the Angles, who conquered and took poſſeſſion of a conſiderable part of the country. (See Anglen, Angles, and *Cimbric* Chersonesus.) England is bounded on the eaſt by the German ocean; on the ſouth by the Engliſh channel; on the weſt by St. George's channel; on the north by the Cheviot hills, by the river Tweed, and an imaginary line extending ſouth-weſt to the Frith of Solway. The extent of England and Wales is eſtimated at 49,450 ſquare miles, and if we allow the population to be 9,500,000, the number of inhabitants to a ſquare mile will be 192. The original population of England is involved in obſcurity; but as far as it can be traced by any authentic records of hiſtory, it ſeems to have conſiſted of a tribe of Celtæ (ſee Celts), denominated Gael or Southern Celts, and diſtinguiſhed by the Welſh under the appellation of "Guydels," who migrated hither from the neareſt ſhores of France and Flanders. Theſe ſouthern Celts were compelled to evacuate the country, and to retire to Ireland, by another tribe, compoſed of the Cimbri of the north, whence the modern Welſh derive their origin and name of Cymru. The Cimbri, or Northern Celts, were diſplaced by the Scythians, or Goths, who, at a period long preceding the Chriſtian era, ſettled in that part of Gaul which is neareſt to Great Britain, and acquired the provincial denomination of Belgæ. (See Belgæ.) We learn from Cæſar (lib. v. c. 10.) that the primitive inhabitants were driven into the interior parts of the country by Belgic colonies, which occupied the regions on the ſouth-eaſt, probably about three centuries before the Chriſtian era. Theſe Belgæ ſeem to have conſtituted the chief anceſtors of the Engliſh nation; but during a ſubjection of four centuries to the Roman power, after Britain was rendered a Roman province by the talents and virtue of Agricola, (ſee Agricola,) they loſt their primitive valour, and were unable to contend with their fierce invaders from Scotland and Ireland. In theſe circumſtances the continent ſupplied them either by accident or at their own requeſt, with new emigrants. The Jutes arrived in the year 449, and about the year 460 founded the kingdom of Kent. The Saxons firſt appeared in 477, and the kingdom of the South Saxons commenced about this period. The Weſt Saxons arrived in the year 495, and the Eaſt Saxons in the year 527. The Angles, who gave their name to the country, were led by the valiant Ida to Bernicia, in the year 547. The Eaſt Angles took poſſeſſion of Norfolk in 575; and the coaſts on the ſouth and eaſt were over-run by them. Hence they ſoon penetrated into the interior of the country, and in 585 founded the kingdom of Mercia, which was the laſt of the heptarchy. (See Heptarchy and Saxons.) The kingdom of Northumberland exiſted under its peculiar ſovereign, the laſt of whom was Eric, till the year 950; and the three counties of modern Northumberland, Cumberland, and Weſtmoreland, were regarded at that period, when Domeſday-book was compiled, as part of Scotland. Bernicia (which ſee) extended at one period to the Frith of Forth; but in the later Saxon times the boundaries of England on the north fell conſiderably within the preſent extent. On the weſt the Welſh were reſtricted by Offa's dyke, (ſee Dyke,) which extended from the river Wye, through the counties of Hereford and Radnor, into that of Montgomery, where it entered North Wales. It afterwards paſſes by Chirk-caſtle to the river Dee, and terminates in the pariſh of Mold. During the Norman period, the northern limits of England were extended to their preſent circuit. Cumberland and Weſtmoreland were wreſted from the Scots, and the provinces north of the Humber were completely incorporated. The dominion of the Danes commenced in the year 1016; but returned to the Saxon line in the year 1042. On the death of Edward the Confeſſor, the conqueſt, as it is called, under William the Norman, took place in 1066. (See Conquest.) For a farther account of the hiſtory of England, ſee Britain, and the ſequel of this article.

The antiquities of England are diſtributed by Mr. Pinkerton (Geog. vol. i.) into ſix claſſes, *viz.* thoſe belonging to the primitive Celtic inhabitants; thoſe of the Belgic colonies; thoſe of the Romans; thoſe of the Saxons; relics of the Danes; and Norman monuments. It is not eaſy, ſays our author, to diſcriminate the remains of the earlieſt inhabitants from thoſe of the Druidic period, which he ſuppoſes to have originated with the Phœnician factories, eſtabliſhed in wooden fortreſſes on the coaſt, which was the uſual practice of commercial nations, when trading with a ſavage or barbarous race. The tenets of Druidiſm correſpond, as he conceives, with the little that is known of Phœnician mythology, in the diffuſion of which the miſſionaries of theſe refined people might be not a little zealous. However this be, the ancient authors, from whom we derive our only authentic information concerning the Druids, minutely deſcribe their religious rites; but they are altogether ſilent concerning any monuments of ſtone being uſed among them. On the contrary, they mention gloomy groves, and ſpreading oaks, as the only ſcenes of the Druidic ceremonies. (See Druids.) Nevertheleſs, our learned antiquarian, Borlaſe, refers to the claſs of Druidic monuments ſuch as follow, *viz.* ſingle ſtones erect; rock idols and pierced ſtones; rocking-ſtones uſed as ordeals; ſepulchres of two, three, or more ſtones; circular temples, or rather circles of erect ſtones; rock-baſons, ſuppoſed to have been uſed in the expiations of the Druids; and caves, uſed as places of retreat in time of war. But Mr. Pinkerton obſerving, that moſt of theſe relics may be found in Germany, (where no Druids exiſted,) and Scandinavia, thinks it hazardous to pronounce whether they be Gothic or Celtic. It is moſt probable, he imagines, that the earlieſt inhabitants, like others who exiſt in the infancy of ſociety, made uſe of wood, not ſtone, in their religious, as well as in their domeſtic ſtructures. He thinks it moſt reaſonable to refer monuments of this kind to a more advanced ſtage of ſociety, when the Belgic colonies introduced agriculture, and had made ſomewhat farther progreſs in the rude arts of barbariſm. See Barrow and Cromlech, Stone-henge, &c.

The Roman relics are amphitheatres, caſtles, ways, or roads, pavements, hypocauſts, walls, inſcriptions, altars, &c. &c. which are deſcribed under theſe articles reſpectively; to theſe we might add coins, gems, weapons, ornaments, and the like. The Saxon antiquities in England are chiefly edifices, ſacred or ſecular, caſtles, vaults, ſhrines, illuminated manuſcripts, &c. The relics of the Danes are caſtles, ſtones with Runic inſcriptions, and camps, which were conſtructed in a circular form, like thoſe of the Belgæ and Saxons, while thoſe of the Roman armies are diſtinguiſhed by their ſquare form. The Norman monuments are reputed to commence after the conqueſt, and to extend to the 14th century, when that which is called the rich Gothic began to appear. This latter was ſupplanted, in the 16th century, by the mixed, which in its turn yielded to the Grecian. The Norman ſtyle in general far exceeds the Saxon in the ſize of the edifices, and the decorations of the parts. The churches became more extenſive and lofty; and though the windows retain the circular arch, they are larger and more diverſified, the circular doors are feſtooned with more freedom and elegance; and uncouth animals begin to yield to wreaths of leaves and flowers. The ſolitary keep, or tower, of the Saxon caſtle, is ſurrounded with a double wall, incloſing courts and dwellings of large extent, defended by turrets and double ditches, with a ſeparate watch-tower, called the Barbican. Among others the cathedrals of Durham and Wincheſter may be mentioned as venerable monuments of Anglo-Norman architecture; and the caſtles are numerous and well-known. What is called the Gothic, or pointed arch, is generally ſuppoſed to have firſt appeared in the 13th century; and in the next it became univerſal in religious edifices. The windows diffuſed to great breadth and loftineſs, and divided into branching interſtices, enriched with painted glaſs, the cluſtering pillars of exceſſive height, ſpreading into various fret-work on the roof, conſtitute, with decorations of ſmaller note, what is called the rich Gothic ſtyle, viſible in the chapel of King's college at Cambridge, and many other grand ſpecimens in this kingdom. The ſpire correſponds with the interior; and begins, about the 13th century, to riſe boldly from the ancient tower, and diminiſhes from the ſight in a gradation of pinnacles and ornaments. See Gothic.

England is now diſtributed into 40 ſhires or counties. See County and Shire.

		Population.	Chief Towns.
Six Northern Counties.	Northumberland,	157,101	Newcaſtle.
	Cumberland,	117,230	Carliſle.
	Durham, —	160,361	Durham.
	Yorkſhire,	563,953	York.
	Weſtmorland,	41,617	Appleby.
	Lancaſhire,	672,731	Lancaſter.
Four bordering on Wales.	Cheſhire,	191,751	Cheſter.
	Shropſhire,	167,639	Shrewſbury.
	Herefordſhire,	81,191	Hereford.
	Monmouthſhire,	45,582	Monmouth.
Twelve Midland.	Nottinghamſhire,	140,350	Nottingham.
	Derbyſhire,	161,142	Derby.
	Staffordſhire,	239,153	Stafford.
	Leiceſterſhire,	130,081	Leiceſter.
	Rutlandſhire,	16,356	Okeham.
	Northamptonſhire,	131,757	Northampton
	Warwickſhire,	208,190	Warwick.
	Worceſterſhire,	139,333	Worceſter.
	Glouceſterſhire,	250,809	Glouceſter.
	Oxfordſhire,	109,620	Oxford.
	Buckinghamſhire,	107,444	Ayleſbury.
	Bedfordſhire,	63,393	Bedford.
Eight Eaſtern.	Lincolnſhire,	208,557	Lincoln.
	Huntingdonſhire,	37,568	Huntingdon.
	Cambridgeſhire,	89,346	Cambridge.
	Norfolk,	273,371	Norwich.
	Suffolk,	210,431	Ipſwich.
	Eſſex,	226,437	Chelmsford.
	Hertfordſhire,	97,577	Hertford.
	Middleſex, (capital excluded,)	535,329	London.
Three Southern.	Surry,	269,043	Guilford.
	Kent,	307,624	Maidſtone.
	Suſſex,	159,311	Lewes.
Four Southern.	Berkſhire,	109,215	Reading.
	Wiltſhire,	185,107	Saliſbury.
	Hampſhire,	219,656	Wincheſter.
	Dorſetſhire,	115,319	Dorcheſter.
Three Southern.	Somerſeſhire,	273,750	Taunton.
	Devonſhire,	343,001	Exeter.
	Cornwall,	188,269	Launceſton.

For a more particular account of each county, ſee the ſeparate articles.

It is hardly neceſſary to mention, that London is the capital of England, or in this place to enumerate its principal towns, which are deſcribed under their ſeveral appellations. Canterbury and York are the ſees of archbiſhops: Oxford and Cambridge are univerſities. The principal rivers of England are the Thames, the Severn, the Humber, the Merſey, &c. which ſee reſpectively. For an account of our inland navigation, ſee Canal; and for our bridges, ſee Bridge. The mountains, with their productions, will occur under that article. For the climate, ſee Britain; and of the ſoil, and agriculture, &c. an account will be found under the name and deſcription of each county; and under the appropriate terms of cattle, dog, hog, horſe, ſheep, goats, &c. and wheat, rye, barley, oats, apples and cyder, pears and perry. Our foreſts (ſee Forest) anciently abounded in ſtags and rein-deer, as the cultivated lands now do with ſheep and cattle. The principal wild animals, wolves and bears having been totally deſtroyed, are the fox, wild-cat, badger, fitchet, martin, otter, ſquirrel, &c. Among our birds of prey may be reckoned the black eagle, and many kinds of hawks. Our ſmalleſt bird is the gold-creſted wren, and our largeſt the buſtard. Our poultry ſeem to have been originally derived from Aſia; our peacocks from India; our pheaſants from Colchis; the guinea fowl from Africa; and our turkeys from America. One of the moſt ſingular of our water-fowl is the long-legged plover, and the moſt uſeful is the mallard or wild duck, chiefly abounding in the fens of Lincolnſhire. The reptiles of England are the coriaceous tortoiſe, frogs, toads, and ſeveral kinds of lizards; among our ſerpents are the viper, which alone is venomous, the ringed ſnake and the blind worm, all of which, together with other ſpecies, are enumerated and deſcribed in their proper places. Our edible ſea-fiſh are very numerous; among which we may reckon the turbot, dorie, ſeal, cod, plaiſe, ſmelt, mullet, &c. Herrings and mackarel extend to moſt parts of the kingdom; but pilchards are reſtricted to the coaſts of Cornwall. The whale ſeldom appears on the Engliſh coaſt, nor the dolphin; but the porpoiſe is not uncommon. Our principal river fiſh comprehend the ſalmon and trout. The lobſter is found on moſt of the rocky coaſts, particularly of Scarborough. The craw-fiſh, muſcle and oyſters, are abundant. The flora of Britain contains as great a variety of genera and ſpecies as any other country of equal extent; and thoſe that are moſt worthy of notice, on account either of their variety or utility, or other peculiar circumſtances attending them, are enumerated and deſcribed under their proper heads. Our native fruits are few, but others have been introduced and our own improved, ſo that plumbs, cherries, peaches, nectarines, apricots, figs, grapes, &c. are by the ſkill and care of the Engliſh gardeners raiſed in the greateſt plenty and variety. The oak and beech are natives of England: the elm is probably an exotic; but there are few plants in any part of the known world, which have not been introduced into our plantations, nurſeries, green-houſes, and hot-houſes.

The conſtitution of England is a limited monarchy counterpoiſed by two ſenates, one of hereditary peers, the other of repreſentatives choſen by the people. (See CONSTITUTION, CROWN, KING, COMMONS, PEERS, PARLIAMENT.) For an account of the judicature of England, we refer to the articles JUDGE, JURY, COURT, CIRCUIT, JUSTICE, SHERIFF, &c. The eſtabliſhed religion of England is that of the reformed church under the adminiſtration of the king, as ſupreme head, archbiſhops, biſhops, deans, archdeacons, rectors, vicars, curates, &c. See each of theſe titles. See alſo CHURCH, CLERGY, CONVOCATION, *Eccleſiaſtical* COURTS, &c. Beſides thoſe who are members of the eſtabliſhed church, England abounds with diſſidents or diſſenters of various deſcriptions. See theſe terms, and alſo INDEPENDENTS, PRESBYTERIANS, BAPTISTS, QUAKERS, METHODISTS, PAPISTS, &c. For the army and navy of England; its manufactures and commerce; its land and revenue; its population; and various other particulars; ſee BRITAIN, and the appropriate articles in this work.

ENGLAND, *hiſtory of.* The principal events belonging to the hiſtory of our country will be found under the names of the ſeveral kings who have reigned over it. To the articles attached to thoſe names we might refer generally for a compreſſed detail of all the changes and revolutions to which England has, at its ſeveral periods, been ſubject; but in conformity to the plan ſketched out in the article BRITAIN, we muſt in this place give a very brief outline of the hiſtory of England, from the Norman conqueſt to the acceſſion of James I.; and likewiſe the hiſtory from that period to the preſent times. After the conqueſt, our hiſtory is repreſented in ſo clear a light, as leaves little either obſcure or uncertain. The only difficulty we ſhall find will be in condenſing into a ſmall ſpace the leading facts that are not immediately connected with the lives of the ſovereigns.

The Saxon monarchy (ſee SAXONS) had continued for more than ſix hundred years: during which, as we ſhall hereafter ſee, they enforced many of their own laws and cuſtoms, though they readily adopted others congenial to the country; and which were derived, as well from the Romans, as the ancient Britons, and which they found in the iſland upon their invaſion of it. The habits and manners of this race were melted down and amalgamated with thoſe of Norman inſtitutions. Every thing was changed; the laws in ſome reſpects were improved, but there was ſtill little taſte for literature and ſcience. From this period, however, we are to date the commencement of certain inſtitutions which, though they required centuries to ripen into maturity, have nevertheleſs given this country a ſuperiority over every other in the civilized world. The variety of diſpoſitions of ſeveral foreign countries being imported into our iſland, at length blended into one national character, celebrated for its courage, its love of freedom, and its pride.

Immediately after the victory of Haſtings, the conqueror marched towards London, carrying before him a ſtandard which had been bleſſed by the pope; and to this the clergy, as is uſual, haſtily reſorted. The biſhops and magiſtrates came out to meet him, and offered him the crown, which he had won by his intrigues and valour. They ſtipulated terms to which he readily acceded, being deſirous of a ſovereignty by the free choice of the people rather than as claimed by the power of the ſword. Though he knew himſelf to be their conqueror, he deſired to be thought their lawful king. William felt that he had power to enforce obedience, but affecting the voice of the people, they imputed his elevation to their own generoſity; and when they felt themſelves oppreſſed or aggrieved, did not ſcruple to reſiſt his power by open revolt and inſurrection. The Engliſh hated the Normans, and were jealous of the power which they ſuſtained in the new government; they envied the wealth which went to enrich thoſe who were truly denominated adventurers in a foreign land, and which was raiſed by loading the natives with heavy taxes, that in thoſe times were with difficulty ſuſtained. At length William ſaw he muſt act with energy if he meant to reign, and from this time he ſeems to have regarded England rather as a conqueſt, than a juſtly acquired dominion. He deprived the biſhops of all judgment in civil cauſes, a right which they had aſſumed during the Saxon ſucceſſion. He reſtrained the clergy to the exerciſe of their eccleſiaſtical power, and he endeavoured to aboliſh trials by ordeal and camp fight. See CAMP-*fight*, and ORDEAL.

We do not intend to recount the acts of the kings of England in this article, but ſhall rather give a general ſketch of the changes and revolutions in the conſtitution, government, manners, &c. of England. The changes introduced by the Norman conqueſt were not very material to the intereſts of the people. Thoſe who occupied the loweſt ranks, ſtill continued in a ſtate of ſlavery; and their numbers were rather increaſed than diminiſhed. The conquerors treated their ſlaves with ſo much ſeverity, that a contemporary writer declined to give a deſcription of it, leſt its inhuman cruelty ſhould appear incredible to poſterity. As the children of ſlaves were alſo ſlaves, this order of the people would have increaſed exceedingly, if many of them had not from time to time obtained their freedom, either by fidelity, or uncommon acts of diligence. In ſome caſes the clergy had the power of granting freedom to ſlaves, and ſometimes the office was performed voluntarily by penitents, who hoped thereby to obtain the pardon of their ſins. The middle ranks in ſociety, that filled up the interval between the freedmen and the barons, were compoſed of different bodies of men, from whom, in proceſs of time, the yeomanry and many of the gentry of England are deſcended. The inhabitants of towns and cities were generally of this middle rank. The barons were a numerous, opulent, and powerful body of men, and comprehended all the conſiderable proprietors of land in England. The acceſſion of the Normans produced many important changes in the political circumſtances of the people—in the tenures by which they held their lands—the ſervices to which they were ſubjected—the magiſtrates by whom they were governed—the courts in which they were judged,—and the laws they were obliged to obey. Theſe changes were chiefly owing to the eſtabliſhment of the *feudal ſyſtem* (which ſee) of police and government in England, by William, in the ſame ſtate of maturity to which it had then attained in his dominions on the continent.

As the moſt important changes in the Engliſh conſtitution were made either in the reign of John, by the limitation of the ſeverities of that ſyſtem, it will not be neceſſary to dwell on the intermediate reigns. The ſucceſſion of the crown of England, after the death of Edward the Confeſſor, became ſo unſettled, that it ſeemed to be the object of ambition to every bold invader, who poſſeſſed the ſlighteſt pretence, together with power and courage, to ſeize the glittering prize. The ſecond William, Henry, and Stephen, are regarded as uſurpers, and did, at the time, reign with a diſputed title. This was a fortunate circumſtance to the natives and their poſterity, as it contributed not a little to raiſe them from that inſignificancy into which they had been depreſſed, to the preſervation of what was left, and to the reſtoration of what had been loſt of their ancient liberties. For the Norman barons, having eſtates both in Normandy and England, were anxious that the ducal and royal crown ſhould reſt on the ſame head, that they might enjoy their eſtates in both countries. Many of theſe barons therefore favoured the pretenſions of Robert duke of Normandy, eldeſt ſon of William I., to the crown of England. This obliged his opponents William and Henry to have recourſe to the native Engliſh, who were ſtill formidable by their numbers, after all the loſſes which they had ſuſtained. Hence they felt their own importance in the ſcale of being, and obtained for themſelves certain rights and immunities which their ſovereigns were ill diſpoſed to grant of their own free will. Henry I. granted them a charter, which proved a model on which the famous charter of liberties in the reign of John was formed. He alſo promulgated a ſyſtem of laws conſiſting chiefly of thoſe of Edward the Confeſſor. Stephen, as his title to the throne was more diſputed, was more liberal of his promiſes; but as he was leſs diſpoſed to perform what he had bound himſelf to do, his whole reign was a ſcene of contention and civil war. At this period the civil law was brought into England from Rome, but not without conſiderable oppoſition on the part of the people, who were ſo much enraged againſt it, that whenever they met with a copy of the Roman law, they deſtroyed it with every mark of indignation. Henry II. conciliated the affections of his ſubjects by granting them a charter, confirming that of his grandfather Henry I. To this prince, whoſe reign was protracted to a great length, the country was indebted for many improvements in the law, as well in its adminiſtration, as in the forms and practice of the courts. At this period the clergy, who were ſcreened from puniſhment on account of their profeſſion, committed every ſpecies of crime, which led (A. D. 1164,) to the enactment of the celebrated conſtitutions which had the effect of reducing the clergy to the rank of ſubjects. Still, however, juſtice was not always adminiſtered in thoſe ancient times with wiſdom and impartiality, partly owing to the ignorance of the judges, and partly to the prevalence of faction among the ſuitors of the courts. Nor was it an eaſy matter to procure relief from an iniquitous ſentence pronounced by a baron or ſheriff, on account of the great diſtance and unſettled ſtate of the king's court, which conſtantly attended his perſon. To remedy this inconvenience Henry II. with the advice of a great council of his prelates, earls and barons, at Northampton, A.D. 1176, divided the whole kingdom into ſix circuits, and appointed three judges to hold courts in each of theſe, by a commiſſion from the king, impowering them to hear and determine all cauſes not exceeding the value of one half of a knight's fee, unleſs the matter was of ſuch importance or difficulty as to require the judgment of the king's court in the royal preſence. Theſe itinerant juſtices took an oath to adminiſter juſtice to all perſons with impartiality. They had alſo authority to judge in all criminal cauſes and pleas of the crown, and to tranſact a variety of other affairs for the public good. Under the reign of Richard, beſides laws relating to the voyage of his fleet to the Holy Land, and thoſe connected with commerce, were others of an excellent nature, in which he attempted to eſtabliſh an uniformity of weights and meaſures over the whole kingdom, a thing greatly wanted, but which has not even yet been accompliſhed. The changes introduced by John have been recited under the article CONSTITUTION. The barons, who procured the famous charter, have been viewed as acting in two capacities, 1, as military vaſſals of the crown: 2, as ſubjects of the kingdom. They conſulted their own intereſt in the firſt capacity, by the limitations of the rigours of the feudal tenures which they procured, and in which all who held lands by military ſervices ſhared with them. They conſulted their intereſt in the ſecond capacity, by the amendments which they procured in the general police of the kingdom, in which all their fellow ſubjects were partakers. Theſe amendments tended to remove or alleviate the ſeveral grievances of which the people in general complained; of theſe, the greateſt and moſt important was, that the mere will and command of the ſovereign were ſubſtituted in the place of law, and men were ſeized, impriſoned, ſtripped of their eſtates, outlawed, baniſhed, and even deſtroyed, without the form of trial. Next to the ſubſtitution of arbitrary will in place of law, was the king's perſonal interference in law-ſuits depending before his courts, in order to interrupt or pervert the regular courſe of juſtice. Theſe flagrant outrages at length wrought their own cure, and thoſe who had tyrannized over the people were obliged to ſubmit to their power.

The common, as well as the ſtatute law of England, received conſiderable improvements in the reign of Henry III.; but his ſucceſſor Edward I. was, as a general and legiſlator, equalled by few of the kings of England, and ſurpaſſed by none. He was ſatisfied with a moderate degree of power, and only laboured to render himſelf terrible to his enemies. The Engliſh, now incorporated with their fierce Norman conquerors, were no longer the tame conſenting people they formerly appeared, but were always prepared to reaſon with that authority which could not eaſily be reſiſted. This ſpirit of oppoſition was tinctured with cruelty: regardleſs of their own lives, the people did not ſeem very ſolicitous about the lives of others. Penal laws began to aſſume more rigour: in the times of William the Conqueror, it was a law, that no man ſhould be puniſhed with death; in the reign of Edward, that law was entirely laid aſide, and ſeveral crimes were rendered capital. But what gave permanence to the reputation of this monarch, was the degree of power the people began to aſſume during this period. The clergy and barons he regarded as rivals; and to weaken their force, he gave authority to the commons: a law was enacted, by which no tax could be levied without their conſent. On account of the many wiſe laws made in this reign, the monarch has been ſtyled the Engliſh Juſtinian. Some of theſe ſtatutes reſpected the church, and were intended to ſet bounds to the power of the pope, the riches of the clergy, and the encroachments of the ſpiritual courts. Others were calculated for explaining, confirming, and enlarging the liberties which had been granted by the great charter. According to ſir Matthew Hale, "the model of the common law, eſpecially in relation to the adminiſtration of common juſtice between party and party, as it was rectified by this king, ſo in a great meaſure it has continued the ſame in all ſucceeding ages to this day; ſo that the mark or epocha we are to take for the true ſtating of the law of England, what it is, is to be conſidered, ſtated, and eſtimated, from what it was when this king left it. Before his time it was in a great meaſure rude and unpoliſhed, in compariſon of what it was thus poliſhed and ordered by him, ſo hath it ſtood hitherto, without any great or conſiderable alteration." Edward made great efforts to reduce the whole iſland of Britain into one kingdom, governed by the ſame ſovereign, and ſubject to the ſame laws; and with reſpect to Wales, he completely ſucceeded ſo as to introduce into it many of the Engliſh laws, cuſtoms, courts, and magiſtrates. His efforts to unite Scotland with England finally failed, and they ſerved only to kindle a moſt violent and implacable animoſity between the people of theſe two kingdoms, which gradually rendered their manners, laws, and cuſtoms more diſſimilar than they had been in more ancient and amicable times. In the following reign, the Scots gained a complete victory over the greateſt army ever ſent into their country: but Edward III., the next in order of ſucceſſion, conteſted, with Philip de Valois, his right to the kingdom of France. He therefore made an expedition into that country, and in the celebrated battles of Creſſy and Poictiers, entirely deſtroyed the French army, and carried the monarch captive to England. See EDWARD III.

This wiſe prince never neglected to conſult his parliament in affairs of moment. There are ſtill extant his writs of ſummons to no fewer than ſeventy parliaments and great councils. The diſtinction between theſe aſſemblies was this; when he deſired only the advice and aſſiſtance of his great barons who ſtill poſſeſſed the greateſt part of the power and property of the kingdom, he called the great council, conſiſting of all the great men, both of the clergy and laity, who held of the crown by barony, and were entitled to a particular ſummons. When he ſtood in need of the counſel and aid of all his ſubjects, he called a full parliament, which conſiſted not only of the barons ſpiritual and temporal, but alſo of the repreſentatives of the inferior clergy,—of the ſmaller barons, or freeholders,—and of the citizens and burgeſſes of the kingdom; and thoſe repreſentatives of the clergy and laity, below the rank of barons, were called the ſpiritual and temporal commons.

Richard II. came to the crown a minor, and by his heroiſm in cruſhing the rebellion of Wat Tyler excited conſiderable expectation, which was completely diſappointed by all the ſubſequent acts of his life. He ſubmitted himſelf to evil counſellors, who took poſſeſſion of his mind, and by their advice he ſacrificed his beſt and ableſt friends, and endeavoured to render himſelf deſpotic. But he was overpowered, ſubdued, and obliged to reſign his crown in favour of his couſin Henry duke of Lancaſter; and this was the commencement of thoſe conteſts between the houſes of York and Lancaſter, which for ſeveral years after deluged the kingdom with blood, and which nevertheleſs contributed in no ſmall degree to give ſtrength and conſiſtency to the conſtitution. In the reign of Richard, Wickliffe began the great work of reformation. The depoſed monarch was murdered with a pole-ax in Pontefract caſtle in the 34th year of his age, having reigned 22 years. His ſucceſſor, Henry IV. ſurnamed Bolingbroke, had to contend with much internal trouble, and had ſo little claim to the ſovereignty which he aſſumed, that conſpiracies were ſpeedily formed againſt him; theſe, however, were quelled and the leaders of them were executed. "If," ſays a good writer, "we compare the times at this period of our hiſtory with thoſe of king John, or thoſe of ſome reigns before him, we ſhall find a great change with reſpect to the inſurgent barons. In the former period they made frequent inſurrections, were often taken in open rebellion, and as frequently pardoned: but in this period they were ſeldom taken without ſuffering the utmoſt rigour of the law. This plainly ſhews how much the power of the barons was ſunk in the courſe of a couple of centuries. This revolution of power is, notwithſtanding, natural and obvious: as the people began to ſhare the government with the nobles, the king was fixed upon as a third perſon to ſecure the balance, and both were contented to make him great from a jealouſy of each other. Noblemen were therefore now executed, not as petty monarchs, but offending ſubjects, and none but kings were conſidered as exempt from penal laws."

In this reign the ſuppreſſion of one rebellion ſeemed only to make way for another more formidable than the former, and more extenſive in its conſequences. The calamities of this period were not, however, confined to internal factions excited by diſcontented barons: the country was threatened with foreign invaſions, and the clergy added not a little to the diſturbance of the public peace. Ever ſince Wickliffe had publiſhed his opinions, his doctrine had been gaining ground, and the clergy were in dread of its prevailing to the excluſion of their ſyſtem and to the ruin of their emoluments. Henry joined the clergy, conſidering that they might be made a powerful engine in eſtabliſhing his uſurped throne, and he recommended the parliament to the care of the church. At firſt the houſe of commons ſeemed reluctant in drawing the ſword of perſecution; they had not, however, vigour ſufficient to oppoſe the power of the court and the clamours of the prieſts, but became inſtruments in their hands for the perpetration of much miſchief. An act was paſſed for burning obſtinate heretics; and William Sawfre, a follower of Wickliffe, was, by virtue of the king's writ, delivered to the mayor of London, and burned alive. This was the firſt martyr in England, on account of religion; but the fires, being once lighted, were not ſuffered to be extinguiſhed. The clergy, under a maſk of hypocriſy, and pretending a regard to truth, took every means that cruelty could ſuggeſt of eſtabliſhing that degree of temporal power, which they had poſſeſſed three centuries before. They ſucceeded, but with this ſtriking difference, that, as in the times of the Saxon heptarchy, their power was founded in the love of the people, in the preſent caſe it had its origin in, and was wholly maintained by, their fears. By theſe means, Henry ſurmounted all his troubles, and the kingdom enjoyed tranquillity. Towards the cloſe of life he determined to embark upon an expedition to Jeruſalem, as well to expiate, as he imagined, the ſins of former years, as to induce his maker to protract the term of his life. His increaſing infirmities prevented him from executing his plan; and in his 46th year he reſigned, by death, his crown to his ſon Henry V. During this reign, if allowance be made for the rancour of the prieſts, to whom the king was too ſubſervient, the government may be ſaid to have aſſumed a form and liberty; the diſtinction between the nobility and the people was rendered leſs conſiderable, and the magiſtrates were leſs arbitrary and leſs venal.

Henry V. was the great hero of his age, and the courage which he had manifeſted from his earlieſt years laid claim to the eſteem and affection of the people over whom he was deſtined to reign. At this period, courage in the great was regarded as almoſt the only virtue: courage and ſuperſtition then made up the whole ſyſtem of human duty. The clergy, notwithſtanding their revenues, paid very little attention to the morals of the people, and were, if poſſible, leſs ſolicitous about their own character: the vices in which they openly indulged, and the paſſions to which they gave free reins, drew upon them a juſt degree of contempt; of which they avenged themſelves, by having recourſe to the engine of perſecution. In this they were encouraged by the king, who, by not oppoſing, may be regarded as a participator of their crimes. One of the early acts of this reign was an attempt to ſuppreſs the doctrines of Wickliffe; and John Oldcaſtle, baron Cobham, was the principal ſufferer in their defence. This excellent man was doomed to bear the moſt excruciating torments: he was hung up by the middle with a chain, and by a ſlow fire literally roaſted alive. The deed was ſcarcely perpetrated when the king, probably diſguſted with the cruelty that had been perpetrated by his ſanction and authority, reſolved to take advantage of the troubles exiſting in France to make a conqueſt of that country. Thither he led a very large army, with which he defeated and almoſt wholly deſtroyed one ſix times larger than his own: he immediately advanced into the heart of the country, making himſelf maſter of many towns. At length he married Catherine, daughter of the French king, and acquired thereby the adminiſtration of affairs in that kingdom, during the life of his father-in-law, fully expecting to be appointed his ſucceſſor. But his death, in the year 1422, fruſtrated his own and the nation's hopes. His ſon, an infant, was afterwards declared king of France and England; but, poſſeſſing none of his father's heroiſm, he ſoon loſt in France all that Henry V. had acquired. The triumphs in France produced ſcarcely any advantages at home. As the Engliſh grew more warlike, they became more brutal; and in their eagerneſs after foreign poſſeſſions, they neglected the cultivation and improvement of thoſe at home. The language became more barbarous. Chaucer and others, about a century before, ſeemed to have drawn it from obſcurity, and enriched it with new terms and combinations; but at this period it relapſed into its former groſſneſs.

The reign of Henry VI. witneſſed much bloodſhed, owing to the rival families of York and Lancaſter. Theſe calamities did not ſubſide till the reign of Henry VII., who was himſelf of the houſe of Lancaſter, and married the daughter of Edward IV. of the houſe of York, when an end was put to the diſſenſions between the different factions of the white and red roſe. In the famous battle that fixed Edward IV. on the throne of England, it is ſaid that 40,000 men were left dead in the field. In this dreadful conteſt, each party, as it happened to be victorious, called in the executioner to complete the bloody tragedy begun in the field. In the reign of Henry VI. the art of printing was firſt practiſed in England by William Caxton. He tranſlated ſome French works, which he printed; and, by his new art, gave currency and celebrity to the tranſlations of others. The prieſts at this period poſſeſſed no ſmall ſhare of erudition, as is evident from ſome Latin productions ſtill extant; but learning was ſeparated from the purpoſes of common life, and though not neglected by the clergy, yet it deſcended no lower, the people at large not conſidering it as any concern of theirs.

The wars in which Edward IV. engaged were long and bloody; and, upon a ſuſpenſion of arms at home, he proclaimed war with France, which he knew would gratify his ſubjects, who have been, at almoſt every period of their hiſtory, more fond of ſplendid than uſeful acquiſitions. To proſecute this ſcheme, he ſent to his ally, the duke of Burgundy, a reinforcement of 8000 men; and ſoon after followed himſelf, at the head of a very numerous army. The French king was alarmed at this formidable invaſion, and feeling that he was unable to contend with his antagoniſt, he had recourſe to treaty; and for a ſtipulated ſum, Edward agreed to lead back his forces to England. Towards the cloſe of life he indulged the hope of invading France again: his parliament conſented, and in that aſſembly of the nation the project was unanimouſly declared to be juſt and neceſſary. The people ſeemed pleaſed with the proſpect, and great preparations were made for the expedition, when, fortunately for the intereſts of humanity, Edward died after a reign of little more than 22 years.

Edward V. ſucceeded, as we have ſeen, (ſee Edward,) to the kingdom in name, but not in fact: for, long before he was capable of acting for himſelf, he was depoſed and murdered at the inſtigation of his uncle, the duke of Glouceſter, who ſecured to himſelf the crown under the title of Richard III. The infamy of this prince's character has been fully deſcribed by every hiſtorian of authority. As he obtained the government by treachery and murder, ſo he loſt his life in ſupport of what he had unlawfully gained. At the battle of Boſworth Richard had to contend with Henry, earl of Richmond, who was not only completely victorious, but was proclaimed king by the unanimous voice of the army, on the very ſpot in which the cruel Richard was ſlain. By the death of this king, the Plantagenet race, which had been in poſſeſſion of the throne more than 300 years, became extinct. With him alſo terminated the conteſts between the houſes of York and Lancaſter, in which, in the courſe of about 30 years, an hundred thouſand lives were loſt either in battle or by the hands of the executioner. Theſe diſſenſions had reduced the kingdom to a ſtate of almoſt ſavage barbarity: laws, arts, and commerce were entirely neglected; every thing laudable gave place to the practice of arms. The people had attained no ideas of pacific government, nor could they applaud or juſtify thoſe who cultivated it. In their wars, it is recorded to their credit, that the women, however formidable and active, were exempted from capital puniſhment, unleſs accuſed of the undefined and undefinable crime of witchcraft. The clergy were diſtinct from the laity in cuſtoms, conſtitutions, and learning: they were governed by the common law, which was delivered to them by the traditions of their anceſtors. As a body, they did not intereſt themſelves in the civil polity; and were not diſpleaſed to ſee the laity, whom they did not deign to regard as fellow-ſubjects, but rivals for power, weakening themſelves by continual conteſts: the laity, on the other hand, regarded the clergy with blind veneration, which leſſened their reſpect and attachment to the monarch on the throne. There was little virtue among individuals of the nation, and the government was ſubject to diſorders of the moſt fatal kind, which perpetually produced all the horrors of civil war.

With the reign of Henry VII. we commence a new era in the hiſtory of our country. Under his ſway we behold one of the greateſt revolutions that was ever effected by the prudence and perſeverance of one great prince: a nation of tumult reduced to civil ſubordination; a haughty ariſtocracy humbled; wiſe laws enacted; commerce reſtored; and the arts of peace cultivated and encouraged by a people, to whom before, war only was delightful. The whole government put on a new form, and Henry was one of the moſt uſeful monarchs that ever held the ſceptre of theſe kingdoms.

The firſt care of Henry was to unite the intereſts of the houſes of Lancaſter and York, by marrying Elizabeth, the daughter of Edward IV. His reign began very auſpiciouſly by a ſtrict obedience to the laws, which he ever after enforced with firmneſs and dignity. Before his reign it had been uſual to take away the lives of thoſe attainted of treaſon; but Henry thought it ſufficient, in moſt caſes, to deprive thoſe taken in arms of their fortune and eſtates, which he applied to his own uſe. By theſe means he deprived his enemies of the power of injuring him; and he was enabled, by new acceſſions of wealth, to perform many acts of liberality. He is ſaid to have releaſed all priſoners for debt in his dominions, whoſe debts did not amount to forty ſhillings, and paid the creditors their whole demand from his own coffers. He has been accuſed of avarice, but it is doubtful whether his conduct in this reſpect does not rather merit the applauſe of uſeful economy. His government was diſturbed by attempts at ſetting on the throne Lambert Simnel, as earl of Warwick; and afterwards by a ſimilar attempt with regard to Perkin Warbeck. In the year 1499 he freed himſelf from theſe conſpiracies, by the conviction and execution of Perkin and the feigned earl of Warwick. After this, the reign of Henry was truly reſpectable: his government was formidable to his own ſubjects, and claimed the reſpect of rival potentates. He paid much attention to the wants of the lower claſſes, and was anxious to depreſs in the ſcale of power the nobility and clergy. From theſe moſt of the calamities of former reigns had reſulted; and on that account he contrived means to leſſen their authority in the ſtate. He allowed the nobility, by a law paſſed in his reign, to alienate their eſtates; and he diminiſhed, as far as he was able, the privileges claimed by the clergy as their right. He was, at the ſame time, a friend to the people, who in former periods were the ſure victims of powerful ambition and revenge. They, in all caſes, were the ſufferers, on whatever ſide they fought, if they had the misfortune to loſe the victory. To remedy this, in a great degree, Henry procured the paſſing of an act, by which it was eſtabliſhed that no perſon ſhould be impeached or attainted for aſſiſting the king for the time being. This wiſe ſtatute ſerved to repreſs the deſire of civil war, as multitudes would naturally take arms in defence of that ſide on which they were ſure of loſing nothing by defeat, and their numbers would intimidate inſurgents. But the greateſt efforts of this king were directed to promote trade and commerce, which naturally introduced a ſpirit of liberty among the people, and diſengaged them from their dependence on the nobility. Before this era, the towns owed their original to ſome ſtrong caſtle in the neighbourhood, where the great lord generally reſided, maintaining at his expence a very large retinue, who, as dependents on his bounty, were on all occaſions bound to vindicate his cauſe. The number of theſe drew together, in or near the ſame place, artificers, victuallers, and ſhop-keepers, to furniſh the lord and his attendants with the neceſſaries of which they ſtood in need. It was the wiſe policy of Henry to bring the towns from ſuch a neighbourhood, by inviting the inhabitants to a more commercial ſituation. He attempted to teach them frugality and the payment of debts; the life of induſtry, by his own example; and never omitted to include the rights and principles of commerce, in all his treaties with foreign princes.

At this period the continent, as well as the Britiſh iſles, ſeemed to be making great advances to improvement. The ſovereigns of Sweden, France, and Spain, were the encouragers and protectors of the riſing arts. The Portugueſe had ſailed round the Cape of Good Hope, and Columbus had juſt made the diſcovery of a new world. Henry was deſirous of following the example ſet him, and granted to certain enterprizing merchants to go in queſt of new countries. By theſe and ſimilar exertions the king ſaw his country civilized, the people pay their taxes without inſurrection; the nobility learning a juſt ſubordination, the laws alone ſuffered to inflict puniſhment, towns begun to ſeparate from the caſtles of the nobility; commerce every day increaſed, and the ſpirit of faction was in a great meaſure extinguiſhed. He was at peace with all the world, and having iſſued a general pardon to his own ſubjects, he had reaſon to expect the happineſs to which wiſe meaſures and true patriotiſm are juſtly entitled; when, at the age of 52, he died of the gout in his ſtomach. In ſome reſpects he has been regarded as the ſecond Alfred, a title to which he has a good claim, on account of the great changes which he introduced in his kingdom;—changes which had the moſt favourable tendency to effect the improvement and happineſs of his ſubjects.

Henry VIII., the ſon to the late king, aſſumed the reins of power under the moſt fortunate auſpices. He found himſelf in poſſeſſion of a peaceable and flouriſhing kingdom; prudent miniſters, who knew the wants of the people, and were ready to provide for them; and a well-ſtored treaſury. The young king, however, made but an ill uſe of the bounties of providence, with which he was ſo abundantly ſurrounded. He had been diligently inſtructed in all the learning of the times; but his ſtock of knowledge ſerved only to inflame his pride, and not to control his vicious affections. The love of his ſubjects was teſtified by an adulation, which produced the moſt miſchievous effects. His vaſt wealth, inſtead of relieving his ſubjects, or of increaſing the national honour, only contributed to ſupply his debaucheries, or gratify the rapacity of the miniſters of his pleaſure. The acts of his life will come more properly under the article devoted to his name. In this place it will be ſufficient to obſerve, that he was perpetually falling from one extreme to another, and agitated by contrary paſſions; it became doubtful to his ſubjects in what manner they ſhould act, or what they ſhould believe, ſo as to obtain his approbation. His conduct as a king was marked with the moſt atrocious acts of tyranny; he expected every one to ſubmit to his will, however frequently that will was changed: yet his reign is memorable on account of the great revolution that was achieved in it by the celebrated Luther, for a full account of which we refer to the article Luther. At firſt the king wrote againſt the doctrines avowed by the former; and for his ability and learning, obtained from the pope the title of "Defender of the Faith," a title which has been continued to his ſucceſſors to the preſent time. He afterwards revolted from the Roman church, and required that his ſubjects ſhould acknowledge him, and him only as head of the church of England. The parliament, entirely dependent on the king, ſided with him in his views of ſeparating from the church of Rome, and readily complied with his other meaſures to ſtrengthen the reformation. Henry, who was an artful politician, knowing that his parliament was devoted to his will, made uſe of the opportunity to render himſelf abſolute. He accordingly oppoſed the parliament againſt the monks, and obtained their ſuppreſſion. While parliament was buſy in ſuppreſſing the religious houſes, moſt of which were houſes of infamy, the king was deviſing methods of deſtroying the power of the ſuppreſſors. This was the origin of the unlimited power which he now aſſumed: he had a moſt complying parliament, ready to ſanction not only what he did, which in many inſtances were deeds of the darkeſt hue, but likewiſe what he intended to do. He was not wanting to ſtrengthen his own power, and claimed the ſame obedience to his proclamation as to the acts of the whole legiſlature. No king of England, as will be ſeen hereafter, lived ſo much the terror of his people. Some perſons wielding a ſceptre have been tyrants, from the frequent revolt of their ſubjects; ſome, from being miſled by favourites; and ſome, from a ſpirit of party: but Henry VIII. was cruel, from a diſpoſition which ſeemed prone to inflict miſery on all about him; he was a ſavage in government, in religion, and in his own family: yet ſuch are the inſcrutable diſpenſations of heaven, that while the harmleſs Henry VI. was dethroned, impriſoned, and aſſaſſinated, the preſent tyrant was permitted to die a peaceable and natural death, if we except the ſufferings which a guilty conſcience cannot fail to inflict. Fortunately perhaps for the people, Henry contrived to diſſipate all thoſe treaſures of which his tyranny plundered his ſubjects: he died poor, and tranſmitted the crown to his ſon and ſucceſſor as dependent on the people for their ſupplies in parliament as at any former period. The wanton profuſion of princes is always hurtful to themſelves; but in many inſtances it has been beneficial to their ſubjects, by preventing greater evils. If Henry VIII. had been more frugal, he would probably have been more dangerous.

The character of Edward VI. has, under his own name, been deſcribed. He died at too early an age to act for himſelf; but during his ſhort reign, the principles of the reformation were encouraged; people were allowed to uſe or diſuſe the practice of confeſſion, as they thought fit; images were taken from the churches, prieſts were allowed to marry, the maſs was aboliſhed, and a liturgy was drawn up, which, with very few alterations, has been continued to the preſent times. Such important changes could not be effected without danger: inſurrections were excited in many parts of the kingdom, which were without much difficulty ſuppreſſed, though many were the victims of the unhappy conteſts.

The reign of queen Mary was marked with cruelty and bloodſhed. She reſtored the Roman Catholic religion, and without heſitation burnt, or otherwiſe deſtroyed, all who fearleſsly oppoſed her will, and the will of her infamous miniſters, Bonner and Gardiner. The reign of this ſovereign was fortunately ſhort; yet, in ſomewhat leſs than four years, five eminent and conſcientious prelates, twenty-one miniſters, and more than eight hundred ſubjects of lower rank in life, were conſigned to the flames for maintaining what they believed to be truth: beſides theſe, we have no accurate account of the numbers who died in priſon, by more lingering and more cruel deaths than even the flames of Smithfield could inflict; nor has it been recorded how many, through fear of death, ſacrificed a good conſcience, and thereby endured for the remainder of their lives ſufferings a thouſand times worſe than the death which a tyrant is enabled to order.

Elizabeth, whoſe character and government have been delineated in the laſt volume, reſtored the principles of the reformation, and advanced the kingdom to the higheſt pitch of ſplendour. She had been nurtured in the ſchool of adverſity, and drew from it leſſons of the higheſt importance to her future conduct. While ſecluded from the buſy world in a loneſome priſon, ſhe was employed in the improvement of her mind, and in deviſing methods of reforming the church, ſo ſoon as providence ſhould make way for her government; and one of her earlieſt acts as ſovereign was to eſtabliſh the reformed religion. The people readily ſeconded her deſigns: they perceived the ill uſe which the papiſts had made of their power in the laſt reign; and they were willing to ſuppoſe that the ſavage acts, which had been committed by Mary and her biſhops, were the neceſſary conſequences of the faith which they eſpouſed, and in behalf of which they effected their cruel purpoſes. Elizabeth ſoon aſſembled her parliament, the reformation was finiſhed, and that form of religion was eſtabliſhed which is now deemed the religion of the country. The clergy, in general, ſubſcribed to the new forms: of nearly ten thouſand who were in poſſeſſion of benefices of different degrees of rank and value, ſcarcely more than an hundred choſe to quit the emoluments of their office, rather than abandon the principles to which they had adhered in the laſt reign. "Thus," ſays an hiſtorian, "England changed its belief four times ſince the acceſſion of Henry VIII." Strange that a people, who are ſo reſolute, ſhould be guilty of ſo much inconſiſtency! that the ſame people, who this day publicly burn heretics, ſhould the next not only think them guiltleſs, but conform to their opinions. Elizabeth, though firmly fixed on her throne, had enemies in almoſt all the neighbouring potentates; who endeavoured by every means in their power to excite diſcontent among her own Catholic ſubjects. In this ſituation, ſhe could only rely upon the reſources which proceeded from the affection of her ſubjects, and the wiſdom of her adminiſtration. Her governing maxim was unqueſtionably founded in wiſdom; it conſiſted in acquiring the eſteem and affection of her people. She was an economiſt of the nation's money, and ſparing in her rewards to her favourites. She diſtributed rewards and puniſhments with impartiality; knew when to flatter and when to upbraid; could diſſemble ſubmiſſion and preſerve her prerogatives; ſhe ſtudied the people ſhe was to govern, and not unfrequently flattered their follies in order to ſecure their hearts.

The errors of this ſovereign, and the acts of cruelty to which ſhe gave her ſanction, have been deſcribed in her own life, or in that of archbiſhop Cranmer, or will be found hereafter in the article Mary queen of Scots, or in other parts of this work of minor conſideration; but it muſt be obſerved here, that whatever puniſhments or cruelties were exerciſed in this reign, they moſtly fell upon the great, and in no inſtance were the people more happy internally, or more formidable abroad, than during this period. It will, however, be readily admitted, that it was not owing entirely to the queen that the nation was ſo completely proſperous at this period; the people, as if ſpontaneouſly, began to exert their native powers, and every art, and every genius put forth all their vigour. The Engliſh could not boaſt of new or ſplendid acquiſitions: their influence in foreign courts was extremely limited, but commerce grew up and flouriſhed. The people began to feel the effects of their own exertions, and to underſtand in what conſiſted the independency of a great nation; and England became at once laborious, enterprizing, powerful, and in a degree poliſhed and polite. The ſucceſsful voyages of the Spaniards and Portugueſe excited their emulation: they fitted out ſeveral expeditions with a view of diſcovering a northern paſſage to China, and, though diſappointed in their firſt and principal object, their voyages were not wholly fruitleſs. Our countrymen, Cavendiſh and ſir Francis Drake, circumnavigated the globe, and diſcovered in the proſecution of their voyages a ſkill and proweſs very ſuperior to the moſt experienced navigators of thoſe nations who led the way in nautical diſcovery. Sir Walter Raleigh, without any aſſiſtance from government, colonized New England; and theſe expeditions at length formed one of the moſt powerful marines of Europe, which in a very ſhort time was enabled to oppoſe the fleet of Spain. (See Armada.) The ſuperiority obtained by the Engliſh at ſea, at this period, gave them a ſort of naval ſovereignty which they have ever ſince inviolably preſerved, and which, we truſt, they will very long maintain, notwithſtanding the boaſtful language of the preſent emperor of France. If, for wiſe purpoſes, he muſt ſubject the continent to his power and controul, we truſt that our own iſlands will, by union among the people, be freed from the tyranny which he has for many years been exerciſing among other nations, which have evidently been ſacrificed by their own want of unanimity, and by the miſmanagement of their ſovereigns.

In the reign of Elizabeth, external commerce was not more cultivated than internal manufactures. Flemiſh manufacturers, who had been perſecuted at home, fled to England for an aſylum, which they found, and for which they made ample amends by the arts which they introduced, and the induſtry which was excited by their example, and by the wealth which their labours acquired. In polite arts and in literature the Engliſh excelled all other nations. The reign of Elizabeth has by ſome writers been denominated the Auguſtan age of literature. The diſputes cauſed by the reformation of religion had retarded the progreſs of our language among the powerful, but they excited a ſpirit of enquiry among the middling and lower orders of ſociety. The people began to read, and being allowed to peruſe the bible in their own language, their morals, and perhaps their taſte, rapidly improved. The reformers, who had fled from the perſecutions of Mary, returned to promulgate their doctrines at home, and by a reſidence abroad their language was corrupted by foreign idioms and barbarous phraſes. Theſe archbiſhop Parker ſet himſelf aſſiduouſly to reform, as well by his own excellent example as by precept. He corrected the Engliſh tranſlation of the bible, and printed it with royal magnificence. His own ſtyle poſſeſſed all the eloquence of the times; it was manly and conciſe, but wanted ſmoothneſs.

Such were the leading improvements in Elizabeth's reign; and, ſays a good writer, "if we look through hiſtory and conſider the riſe of kingdoms, we ſhall not find, in all its volumes, ſuch an inſtance of a nation becoming wiſe, powerful, and happy in ſo ſhort a time. The ſource of our felicity may be traced to the reign of Henry VII., and though the ſtream was interrupted by intervening tyrannies, yet, before the end of Elizabeth's life, who was his grand-daughter, the people became the moſt poliſhed and the moſt happy people upon earth. Liberty, it is true, as yet continued to fluctuate: Elizabeth knew her own power, and often ſtretched it to the very limits of deſpotiſm; but when commerce was introduced, liberty neceſſarily entered in its train; for there never was a nation completely commercial, and at the ſame time perfectly deſpotic."

On the death of Elizabeth James VI. of Scotland ſucceeded to the throne of England, with the univerſal approbation of all orders of the ſtate. Elizabeth bequeathed him her crown almoſt with her laſt breath; he was the neareſt in the order of ſucceſſion, and he had all the ſanction which parliament could confer. He began his reign by a laudable attempt to unite both kingdoms into one, which he effected without much difficulty, and from that period the two kingdoms have been governed by one ſovereign. James, though uſed to arbitrary power, ſet himſelf to ſtudy the Engliſh laws, by the authority of which he reſolved to govern. Whether he did not comprehend their full import, or that his habits were too much fixed to ſubmit to the neceſſary changes which his new ſituation required, it would be uſeleſs to enquire; but it is certain that his whole reign was marked with diſputes between him and his parliament. The king was ever attempting to keep the royal ſplendour unſullied; the other aiming at leſſening the dangerous part of the prerogative: the one labouring to preſerve the laws and inſtitutions of former reigns; the other as ſtedfaſt in aſſerting the inherent privileges of mankind. When the parliament refuſed a ſubſidy, the king was deſirous of availing himſelf of the precedents ſet by other monarchs, by extorting a benevolence. The houſe of commons felt their conſequence as the protectors of the people, and remonſtrated againſt every act of arbitrary power, as incompatible with their rights and privileges. Theſe attempts of the crown, and the reſiſtance of the people, continued through the whole reign, and firſt gave riſe to that ſpirit of party which has ever ſubſiſted in England, the one ſide declaring for the king's prerogative, the other for the rights and liberties of the ſubject.

James exhibited much moderation with regard to thoſe who did not think on religious ſubjects as he was accuſtomed to think, and who did not conform to the eſtabliſhed forms of church diſcipline, wiſely judging that men ſhould be puniſhed for evil actions, and not for erroneous opinions. The conſpirators againſt his government, as will be ſeen in his life, were ſeverely puniſhed; but he cultivated the arts of peace, and obtained as a juſt reward the general good will of the nation. It has been aſcribed to this monarch that the Engliſh have attained to a noble freedom of thought, and the dignity of juſtifying their opinions. James neither cultivated nor underſtood foreign negociations or alliances. His reign was marked with none of the ſplendours of triumph, nor with new conqueſts and acquired dominions; but the arts were ſilently advancing in improvement: reaſon was extending her influence, and deſcrying a thouſand errors in religion and government that had been rivetted by long preſcription. The people began to think for themſelves, to eſtimate their rights and conſequence: the reformation had introduced a ſpirit of liberty, even at the time that the conſtitution and the laws were built upon arbitrary power. "James," ſays the hiſtorian, "taught them, by his own example, to argue upon theſe topics: he vindicated the divine right of kings againſt the natural privileges of the people: the ſubject began in the controverſy, and it was ſoon diſcovered that the monarch's was the weakeſt ſide of the queſtion."

Charles I. aſcended the throne in the year 1625, and was extremely popular, as well on account of his own virtues and addreſs, as in reſpect to the fortunate circumſtances in which he was placed. The country was in a peaceable and flouriſhing ſtate: his title to the crown was undiſputed, and he had formed an alliance with one of the moſt powerful monarchs that ever reigned in France, whoſe ſiſter he had married. The pleaſing proſpect was of ſhort continuance; the people had learned to reaſon: they felt their own power, and it was determined in parliament to oppoſe the ancient claims of the crown. Charles had been taught to conſider the royal privileges as ſacred pledges, which it was his duty to defend: his father had implanted the doctrines of hereditary and indefeaſible right early in his mind. James contemplated theſe doctrines in theory, but it was ſoon the fate of Charles to aſſert and defend them by action. He miſtook the genius of the people he had to govern; they had imbibed the principles of liberty; but he wiſhed to act by maxims and precedents that had their origin in times of ignorance and ſlavery. The late king had been forced into breach with Spain, and Charles gave early indications of a deſpotic temper, which rendered the parliament remiſs in furniſhing him with money for carrying on the war. In a ſhort time his favourite Buckingham perſuaded him to take the part of the French Hugonots, in their quarrel with the crown. They were ill ſupported, and the proteſtant intereſt received an irrecoverable blow in France. The blame was attributed by the people and parliament to Buckingham, who was aſſaſſinated by Felton. This the king laid ſeriouſly to heart, though it did not deter him from his arbitrary proceedings. For ſeveral years Charles reigned without aſſembling a parliament, during which he did as he pleaſed, promulgating laws, and impoſing taxes on his ſubjects to the great mortification of thoſe who felt for their liberties as men and Engliſhmen. He laid arbitrary impoſitions upon trade, which many reſiſted: he levied monies upon monopolies of ſalt, ſoap, and other neceſſaries of life. His government became every day more unpopular, and Burton and Prynne wrote againſt the proceedings of the court. They were proſecuted for their writings in the ſtar-chamber in a very arbitrary and cruel manner, and puniſhed with ſo much ſeverity as excited an almoſt univerſal indignation againſt the authors of their ſufferings. The king next made uſe of Laud and Strafford as inſtruments in carrying on his deſpotic meaſures. Theſe he was in a ſhort time obliged to abandon to an ignominous death on the ſcaffold. Charles, in the early part of his reign, had paſſed the petition of rights into a law, which was intended by parliament for the future ſecurity of the liberty of the ſubject, by which it was enacted "that no man hereafter ſhould be compelled to make any gift, loan, benevolence, tax, &c. without common conſent of parliament." This principle he perpetually violated till at length a civil war broke out. Notwithſtanding the many acts of tyranny and oppreſſion, of which the king and his miniſters had been guilty, yet multitudes ſided with the court and joined the ſtandard of Charles. Many of the nobility and gentry were attached to the crown, and conſidered their own honours as connected with it, and no inconſiderable part of the landed intereſt joined the king. The parliament claimed for themſelves the executive power, and were favoured by moſt of the trading towns and corporations; but its great reſource lay in London. The firſt battle was fought at Edge-hill, in Warwickſhire, in which the royaliſts were ſo far triumphant that parliament was obliged to invite the aſſiſtance of the Scots, who entered England with 20,000 horſe and foot. From this period war was carried on with various ſucceſs, till at length the king was overpowered, reduced, impriſoned, tried, and finally beheaded. The character of this prince will be found under the article CHARLES I. With the death of the king, the miſeries of civil war terminated, and the parliament, which was triumphant, had now no enemy to fear, except thoſe very troops which hitherto had been inſtruments in their hands, in achieving their deſigns. At firſt they hoped to diſband the troops; but Cromwell, who was the rival power in the ſtate, had other projects to accompliſh. He had already rendered the army in a great meaſure independent of the parliament; and now formed a council of officers, and another of common ſoldiers, called agitators, who were appointed to enquire into the grievances of the military, and lay them before parliament. As the commons, from neceſſity, granted their requeſts, the army roſe in their demands, till at length the parliament enjoyed but the ſhadow of authority. It, however, paſſed an act, making it high treaſon to acknowledge Charles Stewart, ſon of the deceaſed king, as ſucceſſor to the throne. They likewiſe voted the houſe of lords uſeleſs and dangerous, and paſſed an act for the abolition of all kingly power. A great ſeal was made, on one ſide of which were engraved the arms of England and Ireland, and on the reverſe was repreſented the houſe of commons ſitting, with the motto, "The firſt year of freedom, by God's bleſſing reſtored 1648." No meaſure was omitted that could probably eſtabliſh the power of the uſurper, and exclude for ever the kingly power in England. Much was done for retrieving the glory of England at ſea. Cromwell and Ireton excited the jealouſy of the republicans, who contrived firſt to employ them in the reduction of Ireland, and afterwards againſt the Scots, who had acknowledged and received Charles II. as their king. Almoſt immediately, by the moſt unparalleled exertions, a fleet was produced ſuperior to any that had ever been ſeen in Europe. An act of navigation was paſſed, and war was declared againſt the Dutch, who were till then regarded as invincible at ſea. Cromwell, from his ſucceſſes in Scotland, found little difficulty in obtaining the honour of being declared commander in chief of the Engliſh army. Admiral Blake, and other naval commanders, carried the terror of the Engliſh name by ſea to all quarters of the globe, and Cromwell, having little employment, began to think how he might eſtabliſh his own authority paramount to that of the ſtate. On the 20th of April 1653, at the head of 300 muſqueteers, he diſſolved the parliament, opprobriouſly driving the members, about one hundred in number, out of their houſe. He next annihilated the council of ſtate, with which the executive power was lodged, and transferred the adminiſtration of government to about 140 perſons, whom he ſummoned to Whitehall on the 4th of July 1653. After this he was declared lord protector; which, however, did not comport with his ambitious views; he was deſirous of the name, as well as the power of king, to which he could never arrive; and in September 1658, he died after an uſurpation of nearly five years. See CROMWELL.

From Charles's death in 1648, to the deceaſe of Cromwell in 1658, England was unqueſtionably improved equally in riches and power; beſides the introduction of the navigation act, which was eſtabliſhed in the reign of Charles II. and which has been regarded as the palladium of Engliſh trade; monopolies of all kinds were aboliſhed, and liberty of conſcience to all ſects was granted, which was highly advantageous to the population and manufactures of the country. Under Cromwell, the arts, ſciences, and literature were not much encouraged, yet he did many things worthy of praiſe; and as his genius and capacity led him to the choice of fit perſons for the ſeveral parts of adminiſtration, ſo he paid ſome regard to men of learning, and particularly to thoſe entruſted with the care of youth at the univerſities. Richard, his ſucceſſor, poſſeſſed none of the talents for buſineſs, nor indeed any activity of diſpoſition, for which his late brother was ſo celebrated, and was in a very ſhort time driven, without reſiſtance, into that obſcurity for which his temper was better adapted, than for the buſineſs of government. The reſignation of his power made way for

Charles II. who returned to the throne of his father by the general concurrence of the people; this was in the year 1660, and for ſome time he ſeemed deſirous of promoting the people's happineſs, though he did not forget to avenge himſelf on the enemies of the late king; the bodies of Cromwell, Ireton, and Bradſhaw were taken from the tomb, and treated with every indignity. Of thoſe who ſat in judgment on Charles I. ſome were dead, others had left the country, and ſome the reigning prince thought deſerving of mercy, but ten were devoted to almoſt immediate deſtruction. Theſe bore their ſufferings with the conſtancy of martyrs dying in a good cauſe, thanking heaven in the extreme of their torments, that they were allowed to be witneſſes of the truth. It was now to be feared that the tide of loyalty would bear away in its courſe all the former mounds of freedom. Parliament ſeemed to concur in all the deſigns of the court, and even to anticipate its wiſhes; but the monarch was by no means attentive to thoſe who had followed him in his misfortunes; his pleaſures and his flatteries engroſſed all his cares, and exhauſted his finances, ſo that he had nothing left, and, apparently, no wiſh to pay the debt of gratitude. From thoſe who would willingly have expoſtulated with him on his miſconduct, he fled, and endeavoured to forget every kind of ſerious buſineſs in ſcenes of mirth, riot, and debauchery. By his own example, he undermined the principles of religion, and the nation, prone to extremes, exhibited every ſpecies of licentiouſneſs, which was practiſed in the moſt diſſolute court that ever exiſted in England. Charles II. though without a pretence to religion, permitted the perſecution of ſectaries, which excited among thoſe, who were objects of it, a plan for a general inſurrection. The plot was diſcovered, and the conſpirators were taken and executed. This circumſtance afforded a pretext for continuing the parliament then ſitting; and repealing the act for triennial parliaments, as being dangerous in times of commotion. This parliament was ſo completely ſubſervient to the will of the king, that he might, with activity, have become abſolute. They confirmed the infamous doctrine of paſſive obedience by a ſolemn act, and aſſigned the king a revenue of twelve hundred thouſand pounds, a ſum which none of his predeceſſors had ever poſſeſſed; nevertheleſs his prodigality rendered him indigent, and inſtead of deſiring an aſcendancy over his parliament, he was content to be a perpetual dependent on their bounty. His prodigality and libertiniſm ſoon alienated the affections of his ſubjects, which in the ſhort period of two years were changed to a contempt of his perſon and adminiſtration. The war, in which he engaged with the Dutch, was unattended with any brilliant ſucceſs, and the enemy's attempting to ſail up the river Thames excited clamours againſt the government. The people began to compare the preſent ſtate of things with the meaſures and adminiſtration of Cromwell; in the one caſe they enjoyed ſecurity at home, and claimed the higheſt reſpect from ſurrounding nations; in the other every principle, private and public, was forced to give way to the paſſions of the ſovereign, which he was determined to gratify at any expence. Uniformity in religion became the popular cry, and, in 1673, the teſt act was paſſed, obliging every perſon in or under government, not only to take the oaths of allegiance and ſupremacy, but receive the ſacrament of the Lord's-ſupper in ſome pariſh church, before competent witneſſes, and ſubſcribe a declaration renouncing the doctrine of tranſubſtantiation. This was levelled againſt the duke of York, the king's brother, who was an avowed papiſt, and whom the parliament wiſhed to exclude from the throne. The fears and diſcontents of the nation were vented without reſtraint, which gave great offence to the court. A great degree of ſeverity was exerciſed againſt the nonconformiſts to epiſcopacy, and every means taken that was likely to repreſs the riſing ſpirit of the country. It was known or violently ſuſpected that Charles was a penſioner on the court of France, his parliament in 1677, addreſſed him to make war upon that country, which he refuſed. The people became exaſperated againſt almoſt all public meaſures; the king was alarmed with the proſpect of a civil war, and made conſiderable conceſſions to avoid the odium which his paſt conduct had juſtly incurred. Many of the leading members of parliament had however determined on ſuch a change as ſhould exclude the duke of York from the crown. To forward this the famous plot of Titus Oates was contrived, which charged the papiſts with a deſign of murdering the king, and of introducing popery by means of the Jeſuits, as the eſtabliſhed religion of the country. Several reſpectable perſons were tried and convicted, principally on the evidence of Oates, who was unworthy of credit. A bill was brought into parliament to exclude the duke from the throne, which was paſſed in the commons, but was thrown out in the houſe of lords. A plot was now invented on the other ſide, in which the principal proteſtants were accuſed of an endeavour to deſtroy the king. For this, on the evidence of lord Howard, a man of infamous character, lord Ruſſel, who had been zealous in his oppoſition to the popiſh ſucceſſion, Algernon Sidney, and other diſtinguiſhed characters, were tried and executed. The terror which the meaſure carried with it intimidated the beſt friends to their country; it ſilenced the oppoſition of the city of London and other corporations, and the duke of York triumphed in the victory which had been obtained by perjury. From this period the reign of Charles was as abſolute as that of any monarch in Chriſtendom, but the ſpirit of freedom, which the people had imbibed, ſtruggled hard againſt the ſpirit of obedience, which the clergy attempted to inculcate. Another civil war threatened the nation ſtill more dreadful than the former, as the forces were more equally divided; but fortunately for the peace of the country, the king was ſuddenly ſeized with an apoplectic fit, and died in the fifty-fourth year of his age.

Though England, during the reign of the ſecond Charles, was agitated by contending intereſts, yet commerce continued to increaſe; its good effects had been duly appreciated, and multitudes were ready to turn their wealth and induſtry into this courſe. Many new manufactures were introduced, and many old ones brought to perfection. When France, by ſhameful and wicked policy, baniſhed her beſt ſubjects, the proteſtants, England opened her arms to receive them, and with them ſhe received large acceſſions of national wealth. To the afflictions and exile of this monarch we are indebted for many of our beſt vegetables which were introduced by his followers from the continent. Science and literature made rapid progreſs during this reign: Newton and Tillotſon; Burnet and Shaftſbury; Butler and Dryden flouriſhed at this period: the Royal Society was inſtituted, and from this time our countrymen took the lead in every uſeful ſcience, and they have maintained their ſuperiority to the preſent hour. Nor muſt it be forgotten, that if Charles was the firſt of our monarchs who claimed the protection of ſtanding forces, yet to him and his brother we are indebted for ſome very important improvements in the art of ſhip-building, an art which has given us a preponderating balance among the nations of the world, and which, we truſt, will, in the hands of an over-ruling providence, preſerve us from that overwhelming ruin in which almoſt all the empires of the continent are involved.

The oppoſition, which during the late reign had ſhaken the throne, vaniſhed almoſt entirely at the acceſſion of James II. The affection of the people ſeemed to know no bounds when the king, as it were, ſpontaneouſly made a declaration in favour of the church of England. That church, to flatter the prejudices of the preſent and late monarchs, had authoritatively from the pulpit and preſs pronounced all reſiſtance to a reigning ſovereign unlawful: a doctrine which, however pleaſing it might be to the feelings of the king, proved fatal to his peace, and, in the event, drove him from the kingdom. The army and people ſupported him in cruſhing an ill-concerted rebellion of the duke of Monmouth, who pretended to be the lawful ſon and heir of Charles II., and had aſſumed the title of king. The duke was taken and was beheaded; and ſome hundreds of his adherents loſt their lives likewiſe by the inſtrumentality of judge Jeffries and colonel Kirke, names that have been deſervedly handed down to poſterity with every infamy that can attach to human nature. James, with ſuch aſſiſtance, determined to try how far the church of England would agree in the practical aſſertion of the doctrine of non-reſiſtance. He was ſet upon introducing popery as the eſtabliſhed religion of the country. He laid pretenſions to a power of diſpenſing with the known laws; he inſtituted an illegal eccleſiaſtical court, and openly received and admitted into his privy council the pope's emiſſaries, and gave them more reſpect than was due to the miniſters of a ſovereign prince. He ſent an embaſſy to Rome, and received, at his court, the pope's nuncio, and, to crown all, his encroachments upon the civil and religious liberties of his people were carried beyond all bounds, even to the diſguſt of Roman catholics themſelves; and the pope was too good a politician not to know that the courſe taken by James muſt eventually ruin the cauſe which he profeſſed to advocate. The church of England took the alarm, when the king had ordered a declaration to be read, by which every reſtraint on popery was removed. Seven biſhops refuſed to comply with their ſovereign's order, and preſented a petition to excuſe their refuſal. They were cited before the council to anſwer for their conduct, and adhering to their reſolution, were committed to the Tower, proſecuted by the attorney-general for ſedition, tried, and gloriouſly acquitted. The joy of the people, on this occaſion, was inexpreſſible: the city and the country ſeemed at once to catch the ſhouts of exultation. James heard the intelligence with ſullen ſilence, and evident indignation, while he was at dinner in his camp. From the church he turned to his army, who proved equally hoſtile to his views. Oppoſition, however, ſerved only to increaſe his zeal, till at length ſome of the principal people in the country reſolved to apply for relief to William, prince of Orange, who was at once the nephew and ſon-in-law of James II. William, who was an able politician, and ambitious of wearing the crown of England, readily liſtened to the propoſals made him, embarked in their cauſe, and landed a large army almoſt before his deſigns were ſuſpected by the court of James, who, in a few days deſerted their old maſter, and ſought protection from the new. The old king was now deeply convinced of his errors, and would gladly have retracted his meaſures, but it was too late: he found himſelf abandoned by his army and fleet, and learnt, with apparent conſternation and horror, that the prince of Denmark and his favourite daughter Anne had gone over to the prince of Orange. On this intelligence he is ſaid to have wept bitterly, exclaiming, “God help me, my own children have forſaken me.” He now hung over the precipice of deſtruction, invaded by one ſon-in-law, abandoned by another, hated by his ſubjects, and held in utter deteſtation by the friends and relations of thoſe who had ſuffered by his cruelty. He aſſembled the few noblemen who ſtill adhered to his cauſe, and demanded their advice and aſſiſtance. Addreſſing himſelf to the earl of Bedford, father to lord Ruſſel, who had been beheaded at the inſtigation of James in the preceding reign, “My lord,” ſaid the dejected monarch, “you are an honeſt man, have great credit, and can do me ſignal ſervice.” “Alas! ſir,” replied the earl, “I am old, and very feeble, and can afford you but little ſervice, but *I once had* a ſon that could have aſſiſted you in this extremity, but he is no more.” James was ſo ſtruck with the reply, that he could not ſpeak for many minutes. After this he almoſt inſtantly reſolved to abandon his country, and ſeek for himſelf, his queen, and his ſon, real or pretended, then only ſix months old, an aſylum in France, where he paſſed the remainder of his life among a people who pitied, ridiculed, and deſpiſed him.

From this moment the conſtitution of England, which had fluctuated for ages, was fixed. The nation, repreſented by its parliament, determined the long conteſted limits between the king and the people: they preſcribed to the prince of Orange the terms by which he was to rule, and appointed him king jointly with Mary, who was the next proteſtant heir to the crown. They were ſhortly after crowned by the titles of William III. and Mary, king and queen of England. The prince had his ambition amply gratified, and his wiſdom was repaid with that crown which the folly of his predeceſſor had thrown away.

The power of William was limited on every ſide, and he met with an oppoſition from parliament which he did not expect. His chief object was to humble the power of France, and he fully anticipated the utmoſt efforts of the Engliſh to ſecond his views, but he found them more intent upon guarding their domeſtic liberties than eager againſt continental powers: notwithſtanding this, his reign was ſpent in an almoſt uninterrupted courſe of hoſtilities with France, at an expence ſhe had never known before. The nation had grown cautious through the experience of the two laſt reigns, and he gave his conſent to the “bill of rights,” by which the liberties of the people were confirmed and ſecured, though not in ſo ample a manner as might have been done at a criſis when a crown was beſtowed by the free voice of the people. The laſt two kings had made a very bad uſe of the whole national revenue, of which they had an unlimited uſe, and it was found in their hands quite ſufficient to raiſe and maintain a ſtanding army. The revenue was now divided, part of it was allotted for the national ſervice of the year, and was to be accounted for to parliament; and part, which has ever ſince been denominated the civil liſt money, was given to the king for the ſupport of his houſe and dignity.

William was averſe from perſecution, and began his reign by attempting a repeal of thoſe laws that enjoined uniformity of worſhip, and though he could not do all he wiſhed, yet he obtained practical toleration for the diſſenters; and the laws againſt the papiſts were rarely executed. He was, however, a ſtickler for what he regarded as the privileges of the crown, and often controverted, and remonſtrated againſt the views of his parliament, and was, not unfrequently, arbitrary in his councils. He oppoſed with the utmoſt vehemence the bill for triennial parliaments, and, when it had actually paſſed the two houſes, he refuſed to give it his royal aſſent. The houſe of commons, who are or ought to be the repreſentatives of every individual in the country, took fire at this abuſe of the royal prerogative, and voted, with becoming ſpirit, “that whoever adviſed the king to this meaſure was an enemy to his country,” and no king has ſince ventured upon ſo outrageous a proceeding. The bill, thus rejected, lay dormant till the next ſeſſions, when William found himſelf obliged to comply. The ſame oppoſition and the ſame ſucceſs attended a bill for regulating trials in caſes of high treaſon, by which the accuſed was allowed a copy of his indictment, and a liſt of the names of his jury, two days before his trial, together with counſel to plead in his defence, and that no perſon ſhould be indicted but upon the oaths of two witneſſes. It was by inceſſant ſtruggles againſt the crown that the invaluable rights of the people have been tranſmitted to their poſterity; and a juſt regard to theſe rights, civil and religious, was what led them to agree to the revolution. In other reſpects they had no reaſon to deſire a change, nor can it with juſtice be imputed to the Engliſh that they affect important national revolutions. When James was diſmiſſed, the wealth and proſperity of the nation were at their higheſt pitch, the tonnage of their ſhipping, both for merchandize and war, had been nearly doubled in the laſt 25 years: the increaſe of the cuſtoms, the ſureſt teſt of increaſing commerce, and the annual rental were nearly in the ſame proportion. Hence a ſtrong party was formed againſt the king's ambitious and warlike purſuits, which were not always ſucceſsful, and which drained the country of much wealth. The Iriſh were ſtill deſirous of a Stuart king, as were many of the Engliſh, though they ſpurned the idea of having even James forced upon them by the right of conqueſt. Parliament enabled the king to reduce Ireland, and to gain the famous battle of Boyne, (ſee BOYNE,) which cruſhed all the hopes of the exile king, and in 1692 the marine of France, which had hitherto vied with that of England, received an irrecoverable blow in the defeat at La Hogue.

Invaſions were threatened, and conſpiracies diſcovered every day againſt the government, and the ſupplies required to carry on a continental war obliged the parliament to open new reſources for money. A land-tax was impoſed, and every one's lands were taxed according to their valuations given in by the ſeveral counties. To this reign alſo we are indebted for the moſt important operation in finances that ever took place, which was the carrying on the war by borrowing money upon parliamentary ſecurities, and which form what are called the public funds. The projector of this ſcheme, which has been acted upon, beyond the limits of human imagination, (ſee DEBT, *National*,) was Mr. Charles Montague, afterwards lord Halifax. The argument on which he depended to carry his plan into effect, was that it would oblige the moneyed part of the nation to become the zealous and ſteady friends of the revolution, becauſe, after having lent their money to the nation, they could have no hopes of repayment or even of intereſt for it, but by ſupporting the exiſting government.

Notwithſtanding the advantages which the nation derived from the adminiſtration of William, he was ſubject to ſo many mortifications from his parliament, that he ſeriouſly reſolved to abdicate his throne, a reſolution which he with difficulty abandoned, and certainly with the hope of being ſupported more effectually in the war with France, but he was in a great meaſure diſappointed, and obliged to conclude the peace of Ryſwick in the year 1697; and in the general pacification, the only equivalent obtained by the nation for an immenſe waſte of blood and treaſure, was the king of France's acknowledgment of king William's title to the crown.

One of the laſt and moſt important acts of this reign was the paſſing of a bill for ſettling the ſucceſſion to the crown in the houſe of Hanover, which received the royal aſſent in June 1701. Shortly after this the king felt his conſtitution giving way, which he endeavoured to counteract by the exerciſe of riding, and in one of his excurſions to Hampton court, his horſe fell under him, and he himſelf was thrown off with ſuch violence that his collar-bone was ſeverely fractured, an accident which, in a few days, put an end to his life, in the 52d year of his age, and the eleventh of his reign. The character of this prince will be more particularly given under his own name. It may, however, be obſerved in this place, that he was ill formed for acquiring popularity: his manners were cold and forbidding, and he ſometimes ſeemed almoſt loſt to thoſe principles of liberty, for the ſupport of which he had been raiſed to the throne. Nevertheleſs, the reſcue and preſervation of religion, and public liberty, were the chief glory of William's reign, for under his auſpices England ſuffered grievouſly in her actions both by ſea and land, and the public debt at the time of his death amounted to the ſum of fourteen millions ſterling.

The ſucceſſor to William was Anne, the ſecond daughter of king James by his firſt wife. She aſcended the throne in the thirty-eighth year of her age, having ſuffered many ſevere mortifications during the reign of the late king, but upon her acceſſion ſhe followed his ſteps, and ſhortly after declared war againſt France, appointing the earl, afterwards the duke of Marlborough, to the command of her armies. Under this general many important victories were achieved. Thoſe of Blenheim and Ramillies gave the firſt effectual checks to the French power. By the former, in 1704, the emperor of Germany was ſaved from impending deſtruction, and 20,000 of the enemy were ſaid to have been killed, wounded, or drowned in the Danube. About the ſame time ſir George Rooke reduced the famous fortreſs of Gibraltar, which ſtill remains in our poſſeſſion a monument of the bravery and talents of the Engliſh admiral. The battle of Ramillies, fought in 1706, was of the utmoſt importance to the cauſe for which the war was undertaken; *viz.* to place Charles duke of Auſtria on the throne of Spain, for immediately after that victory, the ſtates of Flanders aſſembled at Ghent, and recognized Charles for their ſovereign. In Spain itſelf the Engliſh were unſucceſsful; the burdens of the war falling chiefly on this country, the people, who are ever delighted at victory, began to murmur at the taxes impoſed on them. Other circumſtances led to diſputes reſpecting the prerogative, the ſucceſſion, and religion, which created great ferments in the nation and parliament. Negociations for peace were carried on ſome time, but without ſucceſs. At this period the leading parties in the nation were whigs and tories, at the head of the former was the duke of Marlborough, who ſupported by the queen was for a continuance of the war, in which her majeſty concurred, till means were found to convince her, that it would finally prove ruinous to her and the people, and that the whigs were inimical to the national religion. The cry of "the church is in danger," at length diſplaced the whigs, and even drove the duke of Marlborough from the command of the army, an act which excited the aſtoniſhment of all Europe, for ſo numerous had been the victories acquired by his valour, and ſo high was his reputation, that his name was equivalent to an army. There is little doubt that whatever the faults of the whigs might have been, the honour and intereſts of the nation were ſacrificed to court intrigues and private cabals. In the midſt of all the diſputes the whigs accompliſhed the union between the two kingdoms of England and Scotland, which has proved of great benefit to both, but which at the time excited the moſt violent clamours againſt the projectors. The Engliſh expected nothing from the union of ſo poor a nation, but a participation of their neceſſities: they contended it were unjuſt that while Scotland was granted an eighth part of the legiſlature, it yet ſhould be taxed only a fortieth part of the ſupplies. The Scots, on the other hand, conceived that their independency would be wholly deſtroyed, and the dignity of the crown betrayed; they dreaded an increaſe of taxes, and were not very anxious for an increaſe of trade. After ſome ineffectual ſtruggles the Union was effected: Scotland was no longer to have a parliament, but to ſend ſixteen peers, choſen by their nobility, and forty-five commoners, to the Engliſh parliament, and from that period the two kingdoms were called by the common name of Great Britain, and all the ſubjects of both were to enjoy a communication of privileges and advantages.

In 1712 conferences for negociation between England and France were opened, which led to peace. This was condemned by the whigs as injurious to the honour and intereſt of the nation. The majority of the houſe of lords inclined to that party, but that of the other houſe was tories. The queen, dreading that the lords might reject the terms of peace, by an unprecedented exerciſe of her authority, created twelve peers at one time, which ſecured the approbation of the parliament for the peace. The remainder of this reign was a ſcene of contention between the two parties. Each reviled the other in turn, and theſe commotions ſerved ſtill more to impair the queen's health, till at length ſhe felt herſelf unequal to the duties of her ſtation. She ſunk into a ſtate of inſenſibility, and found a refuge from her anxiety and cares in lethargic ſlumber. Every precaution was taken to ſecure the ſucceſſion in the houſe of Hanover, and orders were ſent to the heralds at arms to be in readineſs to proclaim the elector of Brunſwick king of Great Britain. The day before the queen died ſhe ſeemed to revive, roſe from her bed, and walked about, when, caſting her eyes on the clock that ſtood in her chamber, ſhe continued to gaze for ſome time, and being aſked what ſhe ſaw more than uſual, ſhe replied only with an expreſſive but dying look, and about ſeven o'clock the next morning, Aug. 1, 1714, ſhe expired in the thirteenth year of her reign. The national debt had, during this reign, encreaſed from fourteen to fifty millions. See ANNE, CHURCHILL, &c.

With this princeſs terminated the line of Stuarts, which, from the acceſſion of James I. 1603, had ſwayed the ſceptre of England one hundred and eleven years, and that of Scotland 343 years. On the death of queen Anne, there was ſtill left the ſon or ſuppoſed ſon of James II. who had been acknowledged king by the court of France on the deceaſe of his father in 1701. In behalf of this prince, rebellions were excited in England in 1715 and 1745. He reſided at Rome, and kept up an appearance of a court till his death in 1765, leaving two ſons, who are ſince dead and without iſſue.

By the act of ſucceſſion George I. ſon of Erneſt Auguſtus, firſt elector of Brunſwick, and Sophia grand-daughter of James I. aſcended the Britiſh throne; his mother, who would have been next in ſucceſſion, having died a ſhort time before. He arrived in England with ſtrong prepoſſeſſions againſt the tory miniſtry, moſt of whom he diſplaced, without producing much effect in England, but in Scotland a rebellion was excited by ſome of the leading men of that country, who paid for their temerity the forfeit of their lives. Commotions and riots were raiſed in London, Oxford, and other parts, but theſe were happily ſuppreſſed, and the ringleaders in various inſtances were made examples of juſtice. The earl of Oxford, who had negociated the peace of Utrecht, was charged with high treaſon on that account, but the proſecution was abandoned. The ſituation of affairs would not permit the miniſtry to venture upon a new parliament, and the members of that which now exiſted voted a continuance of their duration from three to ſeven years, one of the greateſt and moſt indefenſible ſtretches of parliamentary power ever known. Several other meaſures, hoſtile to liberty and the principles of the exiſting conſtitution, took place at the ſame time. Mr. Shippen, a member of parliament, was committed to the Tower for aſſerting in his place, that the king's ſpeech was better calculated for the meridian of Hanover than of London; and a young man, a printer, was actually hanged for a pamphlet, ſaid to have been ſcarcely deſerving of animadverſion. George I. however ſagacious, and in many reſpects moderate, was too much attached to his German dominions, and rendered England in a great meaſure ſubſervient to them. He quarrelled with the czar of Muſcovy about their German concerns, and had nearly involved this country in a war with Charles XII. of Sweden, for having as elector of Hanover purchaſed Bremen and Verden of the Danes. In 1718, he quarrelled with Spain on account of the quadruple alliance that had been formed between Great Britain, France, Germany, and the States General, and admiral ſir George Byng, by his orders, deſtroyed the Spaniſh fleet. The war was quickly terminated by the Spaniards delivering up Sardinia and Sicily, the former to the duke of Savoy, and the latter to the emperor, and by the king of Spain conſenting to ſign the quadruple alliance, in which England was very little if at all intereſted. See ALLIANCE.

The next thing of importance was the ſecuring the dependency of the Iriſh parliament upon that of Great Britain. The houſe of peers in England had reverſed a decree made by the Iriſh houſe, which excited long, animated, and even bitter diſcuſſions, till at length a bill was brought into the Engliſh parliament, by which the Iriſh houſe of lords was deprived of all right of final juriſdiction, which, notwithſtanding the moſt violent oppoſition from ſeveral leading members of both houſes, was carried by a great majority. The ferment occaſioned by theſe diſcuſſions was followed by the South Sea ſcheme, which promiſed immenſe wealth to thoſe who engaged in it, but which left a large part of the nation in diſtreſs and ruin. (See BUBBLE.) Juſtice was demanded, by petitions from all parts, upon the contrivers of the ſcheme, and the nation ſeemed, as to a man, highly exaſperated. During theſe tranſactions, the king, with ſerenity and wiſdom, preſided at the helm, influenced his parliament to purſue equitable meaſures, and, by his councils, endeavoured to reſtore the credit of the nation. The diſcontented availed themſelves of public calamities, and made another attempt againſt the reigning ſovereign. Their deſigns were ſoon detected, and Chriſtopher Layer, a young gentleman of the Middle Temple, was convicted of treaſonable acts, and ſuffered death on the account. Several noblemen and other perſons of diſtinction were ſuſpected of being in the plot, but of theſe the biſhop of Rocheſter was the only victim who was baniſhed the kingdom for life. After the ferment which this plot occaſioned was over, the tranſactions of the reign were few and leſs important in their conſequences. The miniſtry, who were all in the intereſt of Hanover, ventured upon ſeveral bold meaſures, in ſome of which the national intereſt, if not honour, was evidently ſacrificed to that of the electorate. The crown of Great Britain was engaged in every continental diſpute, however remote it was from her own intereſt. Treaties lately concluded with Spain were again broken, and admiral Hoſier was ſent to intercept the Spaniſh galleons from America, an expedition which proved as fatal as it was inglorious. The admiral and moſt of his men periſhed by epidemical diſeaſes, and the hulks of his ſhips rotted ſo as to render them utterly unfit for ſervice. To retaliate, the Spaniards undertook the ſiege of Gibraltar, and with ſimilar ſucceſs. New treaties were ſet on foot, France offered its mediation, and a reconciliation was effected. The king died, as he was travelling to his Hanoverian dominions, at Oſnaburgh, on the 11th June 1727, in the thirteenth year of his reign. During his reign the ſinking fund for diminiſhing the national debt was inſtituted. See DEBT *National*, FUNDS, &c.

Upon the death of George I. his ſon George II. aſcended the throne, with a predilection for his Hanoverian dominions ſimilar to that of the late king. He choſe for his firſt miniſter ſir Robert Walpole, who had filled the ſame high office under his father. This able miniſter was a decided enemy to war, which, in ſome inſtances, led him into difficulties both at home and abroad. His adminiſtration will be more properly conſidered under the article attached to his name, (ſee WALPOLE,) but juſtice requires of us to obſerve, that notwithſtanding ſome of his meaſures, as an attempt at the introduction of the exciſe laws, were liable to great cenſure, yet he was friendly to the exiſting laws: he filled the courts with able and upright judges, and he has not been charged with any attempt at the violation of the known law of the kingdom, and under his adminiſtration the preſs was under little or no reſtraint. His pacific ſyſtem more than repaid to the nation all that was required to ſupport it, by the increaſe of her trade and the improvement of her manufactures. The great objects of controverſy during the early part of this reign were the national debt, and a ſtanding army. Demands for new ſupplies were made every ſeſſion of parliament, either for the purpoſe of ſecuring friends on the continent, or of guarding the internal polity, or for enabling the miniſtry to act vigorouſly in conjunction with their allies abroad. Theſe were as regularly oppoſed as they were made: the ſpeakers of the country party ever inſiſted, that the Engliſh had no buſineſs to embroil themſelves with the affairs of the continent; that expences were incurred without prudence or neceſſity; and that the increaſe of the national debt by multiplying taxes, would in the end become intolerable to the people. A motion was made to revert to the old ſyſtem of triennial parliaments, as they had been ſettled at the revolution. The advocates for this meaſure aſſerted that the ſeptennial act was an encroachment on the rights of the people; that it was introductory to the monſtrous corruptions of government: that during the continuance of that parliament which prolonged its exiſtence from three to ſeven years ſeveral ſevere laws had been enacted; that by one of theſe a man might be removed, and tried at any place where the jury might be found favourable to the crown, and where a priſoner's witneſſes could not and dared not come; that by another, a juſtice of peace was empowered to put the beſt ſubjects to death after reading the riot act. The miniſtry was, however, triumphant, and the oppoſition, who, unqueſtionably, had the weight of argument on their ſides, complained that debate was uſeleſs, and that it was wholly impoſſible that reaſoning could prevail over the corruptions that were ſecretly practiſed by the miniſter. Deſpairing, therefore, of being able to ſtem the torrent of corruption, they retired to their ſeats in the country, and left the miniſtry an undiſputed majority in the houſe.

In November 1737, queen Caroline, conſort to the king died; at this time the king and his ſon Frederick the prince of Wales were at variance. The latter complained that through Walpole's influence he was deprived not only of the power but the proviſion to which his birth was entitled. The king forbade him his preſence, and gave orders that none of his friends ſhould be admitted at court. A motion was made in the houſe of commons for increaſing the prince's ſettlement, which was fifty thouſand pounds; this was oppoſed by ſir Robert Walpole, and rejected by a large majority. The prince now placed himſelf at the head of the oppoſition with ſo much firmneſs, that it was ſeen Walpole's power was drawing to a criſis; but it was not till the year 1742 that he reſigned his employments and was created earl of Orford. The king bore the loſs of his miniſter with the greateſt equanimity, and even conferred titles of honour, and poſts of diſtinction upon the heads of oppoſition. Circumſtances alſo aroſe which induced him to take a leading part in a continental war: in oppoſition to which a rebellion in behalf of the pretender was excited in 1745 in Scotland. Charles, the ſon of the pretender, landed in the Scottiſh iſlands, and ſoon found himſelf at the head of 1500 men. Manifeſtoes were widely diſperſed, inviting the highlanders to join in the cauſe: few, however, ſeemed willing to hazard the dangers of the enterprize. Its boldneſs aſtoniſhed Europe; it awakened the fears of the puſillanimous, the pity of the wiſe, and the loyalty of all. The whole kingdom ſeemed unanimouſly bent upon oppoſing the enterprize which they were ſenſible, as being ſupported only by papiſts, would be inſtrumental in reſtoring popery. The rebels advanced to Perth, where, inſtead of proceeding with increaſed rapidity, they ſtaid to proclaim the prince's father king. The prince was again ſucceſsful at Preſton Pans, and marched to Edinburgh; here he waſted his time in diſſipation and parade, till an opportunity was given to the king to ſend againſt him an effectual force under the duke of Cumberland. The battle of Culloden on the 15th of April 1746, put an end to all hopes of the pretender: the victory on behalf of the king was complete, but the mercileſs fury of the conquerors upon the fallen diſgraced the cauſe, to which every friend of his country wiſhed ſucceſs. The duke ordered nearly forty deſerters to inſtant execution, and the royal army ſpread terror wherever it came, and after a few days the whole country was one ſcene of ſlaughter, deſolation, and plunder; juſtice was forgotten, and every virtue ſeemed to be loſt in the moſt ſavage vengeance. The government on this occaſion was not a little indebted for the ſupport it received to the national debt. The Jacobite party had hoped to ruin public credit, but common danger aboliſhed all diſtinctions, and united them in defence of private property. The merchants agreed to receive bank notes in payment, which prevented the miſchief that was hoped for by a run upon the bank. The defeat of this rebellion in the year 1746 did not reſtore tranquillity to Europe; it was not till after various ſucceſſes in different parts of the globe that the preliminaries of peace were ſigned in April 1748, and in the October following a definitive treaty was concluded at Aix-la-Chapelle. In the proſecution of this war the balance of gain, as far as wealth was concerned, was evidently in favour of Great Britain, and many private perſons made it ſubſervient to the attainment of vaſt fortunes. In the following year, the intereſt of the national debt was reduced from four to three and a half *per* cent. at which rate it was to continue for the next ſeven years, when it was to ſuffer a farther reduction to three *per* cent. This, ſays the hiſtorian, was the boldeſt ſtroke of financing that ever was attempted perhaps in any country, conſiſtently with public faith, for the creditors of government, after a trifling ineffectual oppoſition, continued their money in the funds, and a few who at firſt ſold out were glad, in a ſhort time, to have it placed under the ſame ſecurity.

At this period Mr. Pelham was the miniſter of the country, who turned his attention to the improvement of commerce, manufactures, and fiſheries, the benefits of which deſcended to poſterity. A new treaty of commerce was ſigned at Madrid, between Great Britain and Spain, by which, in conſideration of 100,000*l.* the South Sea Company gave up all their future claims to the Aſſiento contract, by virtue of which that company had ſupplied the Spaniſh Weſt Indies with ſlaves from the coaſt of Africa. (See ASSIENTO.) In March 1750, his royal highneſs Frederic prince of Wales died, to the regret of the nation: and in the following year an act was paſſed for regulating the commencement of the year, by which the old ſtyle was aboliſhed, and the new ſtyle eſtabliſhed, which was done by ſinking eleven days in 1752, and from that time the year was to begin the firſt of January inſtead of March. (See Calendar.) In 1753 the famous act was paſſed for preventing clandeſtine marriages, which at the time excited the moſt violent oppoſition, as replete with the moſt injurious conſequences to the liberties and morality of the people, and as making an impaſſable line between the rich and the poor: and about the ſame time an act equally, or even more unpopular, as attacking the religious prejudices of the people, was paſſed. This was a law for naturalizing the Jews, which, though carried through great oppoſition, was in the next ſeſſion repealed. The game laws were alſo introduced about this period; by theſe none but men poſſeſſed of certain property could have the privilege of carrying a gun, or of otherwiſe deſtroying game, though on grounds which they rented themſelves. This meaſure was ſuppoſed to be a violent encroachment on the liberty of the ſubject; that it would neceſſarily damp the martial ſpirit of the lower orders of ſociety, by preventing them from handling thoſe arms which might one day be neceſſary to defend their country; and at the ſame time, that it gave the rich the ſole enjoyment of a pleaſure, which before had been conſidered as the common privilege of humanity. "Such," ſays a contemporary writer, "were the laws paſſed at this period, through all which a ſpirit of ariſtocracy was diſcerned by ſome. The body of the rich, no longer fearing oppreſſion from the throne, or an infringement of their own liberties, now began to lean heavy on the poor, and to conſider the intereſts of that uſeful part of the ſociety as entirely diſtinct from their own. They never omitted, however, their uſual addreſſes to the throne; and this ſeſſion (1756) was remarkable for an addreſs of thanks to his majeſty, for maintaining, and rendering permanent, the general tranquillity of Europe, at a time when war was kindling in almoſt every quarter of the world."

To the conduct of this war Mr. Pitt was called, as ſecretary of ſtate, and head of the adminiſtration. He had long ſignalized himſelf as a bold, eloquent, and energetic ſpeaker, and he ſoon proved himſelf a moſt able and ſpirited miniſter. In this war the Engliſh in Europe, in Aſia, and America, achieved wonders: they were every where victorious: almoſt all the poſſeſſions of the French in North America and in India fell into our hands; and at the battle of Minden, in Germany, ſeven thouſand of our countrymen defeated an army more than ten times as large. The Engliſh for ſome time bore the increaſing burdens of warfare with cheerfulneſs; and rendered, by every means in their power, the juſt tribute of praiſe to the talents and activity of the miniſter. But at length, glutted almoſt with victory ſucceeding upon victory, they began to reflect upon the proble advantages that might reſult from a continuance in war, when it was evident that the conqueſts made in Germany muſt ever be foreign to the real intereſts of Great Britain; that they were waging an unequal war, and adding new loads of taxes to thoſe already difficult to be borne, for conqueſts which they could neither preſerve nor enjoy. Such were the growing diſcontents of the people, when the French ſhewing ſome diſpoſition to treat for peace, and the charges of the war beginning to amount to eighteen millions a-year, inclined the Britiſh miniſtry to liſten to the propoſals offered them. A negociation was accordingly entered upon, but without ſucceſs. This was in the autumn of the year 1760, and on the 25th day of October, 1760, George II., without any apparent ſymptoms of diſorder, was found expiring in his chamber. He had ariſen at his uſual hour, intending to walk out, but being left alone, he was heard to fall down upon the floor; the noiſe of the fall brought his attendants into the room; he deſired, in a faint and faultering voice, that the princeſs Amelia might be ſent for, but before her arrival he expired, in the 77th year of his age, and the 33d of his reign, in the midſt of victory, and at that very period, when the univerſal enthuſiaſm of conqueſt began to ſubſide into more ſober reflections. The character of this prince will be given under his own name. He was ſucceeded by his grandſon George III., the preſent ſovereign, who aſcended the throne with great advantages. He took the opportunity which his firſt ſpeech to parliament gave him, of appealing to the prejudices and affections of his people. "Born and educated in this country," ſaid he, "I glory in the name of Briton, and the peculiar happineſs of my life will ever conſiſt in promoting the happineſs of a people whoſe loyalty and warm affection to me I conſider as the greateſt, and moſt permanent ſecurity of my throne. The civil and religious rights of my loving ſubjects are equally dear to me with the moſt valuable prerogatives of my crown." The firſt acts of this reign were calculated to convince the people that the war in which they were engaged ſhould be carried on with energy; very brilliant ſucceſſes, and important conqueſts, were the reſult of the plans adopted by Mr. Pitt, who felt himelf reſponſible for almoſt all public meaſures. When, however, he found his influence in the cabinet declining, through the ſuppoſed intrigues of the earl of Bute, he reſigned his high ſituation, declaring he would no longer lie under the reſponſibility of meaſures which he was not allowed to guide. Mr. Pitt retired in October 1761, upon a penſion of 3000*l.* *per ann.* and, at the ſame time, a peerage was conferred upon his lady. Theſe grants were, by his enemies, held out as proper ſubjects to excite the popular clamours againſt the patriotic miniſter. At firſt they ſucceeded, but in a ſhort time an almoſt general diſcontent prevailed in the nation, on account of his removal from office, in the midſt of a war, which he had conducted with ſo much honour to himſelf and to his country, and in a manner that had excited the aſtoniſhment of Europe. The war was ſtill purſued with vigour, and the plans of Mr. Pitt, of which the new miniſter availed himſelf, led to important victories both by ſea and land.

Early in the year 1763, peace was agreed upon, and of ſo little importance had the war been to the intereſts of the Engliſh, who had been almoſt uniformly victorious, and who had acquired by their valour many foreign poſſeſſions, that it was agreed a mutual reſtitution and oblivion ſhould take place, and each party ſit down at the end of the war in the ſame ſituation in which they began it. The peace excited much oppoſition, becauſe the terms were thought extremely inadequate to what might have been expected from the numerous and brilliant victories and advantages obtained in the courſe of a long war. From this period various cauſes contributed to occaſion a ſpirit of diſcontent in the nation. On the 30th of April, 1763, three of the king's meſſengers entered the houſe of Mr. Wilkes, member of parliament for Ayleſbury, and ſeized his perſon by virtue of a warrant from the ſecretary of ſtate, which directed them to ſeize the authors, printers, and publiſhers, of a ſeditious and treaſonable paper, entitled the North Britain, N° 45. This work contained ſtrictures on his majeſty's ſpeech, and Mr. Wilkes was ſuſpected to be the author. He was accordingly arreſted, examined, and cloſely impriſoned, which gave riſe to diſcuſſions on the legality of general warrants, which were in the end declared illegal, and a groſs violation of the liberty of the ſubject. (See Warrants, *General.*) Mr. Wilkes was for this and other publications expelled the houſe, and in 1764 a ſentence of outlawry was iſſued gainſt him.

In 1765, under the adminiſtration of Mr. George Grenville, an act was paſſed for laying a ſtamp-duty on the Britiſh colonies of North America. This kindled a flame in that quarter of the globe, which finally led to a ſeparation of the colonies from the mother country, and eſtabliſhed the independence of America. (See AMERICA and UNITED STATES.) In the year 1768 Mr. Wilkes returned to England, was proſecuted, convicted, and fined in the ſum of 1000*l*. He carried with him the voice of the people, whoſe cauſe he was ſuppoſed to vindicate, and was again elected member for Middleſex; and was again expelled. After the expiration of the term of his impriſonment, in the year 1771, he was elected ſheriff of London, and afterwards choſen member for the county of Middleſex, when he was permitted quietly to take his ſeat; and in the year 1775 he was elected lord mayor of London, an office which he executed to the ſatisfaction of his fellow-citizens. In 1783 all the declarations, orders, and reſolutions of the houſe of commons, reſpecting his election for the county of Middleſex, were ordered to be expunged from the journals of that houſe.

In the year 1772 the clergy petitioned the parliament for relief in matters of ſubſcription to the 39 articles, praying to be reſtored to their undoubted right of interpreting ſcripture for themſelves, without being bound by any human explanation of it, or being required to acknowledge by ſubſcription or declaration, the truth of any formulary of religious faith and doctrine whatever, excepting the Holy Scripture itſelf. The petition was preſented by ſir William Meredith, who, with other members favourable to the principle, enforced it by many arguments drawn from the principles of toleration. It was, however, rejected by a large majority. A bill was ſhortly after brought into the houſe to prevent the deſcendants of his late majeſty from marrying without the conſent of his majeſty, his heirs, and ſucceſſors, which was carried very rapidly through both houſes, and paſſed into a law. A petition was now preſented by the diſſenters, praying to be relieved from the hardſhip of ſubſcribing to the articles of a church to which they did not belong. This petition was received, and a bill brought into the houſe founded upon it, which was carried by a large majority in the commons, but which was rejected in the houſe of lords. From this period the whole intereſt of the country was turned to the conteſts with America, to which we have already referred. The enormous expences occaſioned by this war excited much and almoſt general diſcontent among the people, who began to call aloud for an economical reform in the various departments of the ſtate. Meetings were held in various counties of the kingdom, at which great numbers of freeholders were preſent, who agreed to petition the houſe of commons, "that before any new burdens were laid upon the country, effectual meaſures might be taken by that houſe to inquire into, and correct the abuſes in the expenditure of the public money; to reduce all exorbitant emoluments; to reſcind and aboliſh all ſinecure places, and unmerited penſions; and to appropriate the produce to the neceſſities of the ſtate." In the beginning of the year 1780 theſe petitions were taken into conſideration, and ſome trifling reforms took place. In ſome inſtances, the miniſter, lord North, was left in a minority, and in many others he was obliged to uſe every exertion to carry his meaſures. In a very full houſe, and by a ſmall majority, certain officers under the crown were excluded from having ſeats in the houſe of commons: this they hoped to follow by other arrangements favourable to the rights of the people; but, in a ſhort interval, the miniſter was enabled to apply arguments not generally underſtood, but ſtrongly ſuſpected, which gave him a preponderance in the houſe, and which enabled him to ſtop the progreſs of reform. The people were diſſatisfied, and a ſpirit of diſcontent prevailed in almoſt every part of the kingdom. About this period, the hardſhips which individuals, profeſſing the Roman Catholic religion, had laboured under, awakened the conſideration of the liberal part of the people: and ſome perſons of high conſideration in the ſtate undertook their cauſe, and fully expected they ſhould obtain for them that relief which the nature of their caſe required. The Catholics preſented a dutiful and loyal addreſs to the king, containing the ſtrongeſt aſſurances of affection and fidelity to his perſon and the civil government of the country. This addreſs, which was drawn up with great care, and which contained ſentiments of the moſt unexceptionable nature, was ſigned by ſeveral Roman Catholic peers, and 63 commoners of rank, fortune, and influence in the country. The advocates of the cauſe were aware that the prejudices of the lower claſſes were hoſtile to an extenſion of the privileges of the Catholics, whom they had been accuſtomed to regard as perſecutors from principle, and as deſirous of ſubverting the Proteſtant faith. But ſir George Saville made a motion for the repeal of certain penalties which were attached to the profeſſion of the Catholic religion. He was ſeconded in his exertions by Mr. Dunning, who laid before the houſe an account of the ſtatutes ſtill exiſting againſt the Catholics, by which, among other grievances, it was made high treaſon in any native of theſe realms to teach the doctrines or perform divine ſervice according to the rites of that church; the eſtates of perſons educated abroad in that perſuaſion were forfeited to the next proteſtant heir; a ſon, or any other, the neareſt relation being a Proteſtant, was empowered to take poſſeſſion of his own father's or neareſt of kin's eſtate, during their lives; a Roman Catholic was diſabled from acquiring any legal property by purchaſe. In conſequence of theſe and ſuch like repreſentations, the motion made in favour of the Roman Catholics was received without a diſſenting voice, and a bill in purſuance of its intent was brought in and paſſed both houſes. This act ſeemed to give little offence to perſons of any claſs in England, but in Scotland it excited much indignation, riots enſued, and ſome houſes and chapels were deſtroyed. The contagion at length reached England: a number of perſons aſſembled themſelves together with a view of promoting a petition to parliament for a repeal of the late act in favour of the Papiſts, and they aſſumed the title of "The Proteſtant Aſſociation." Of this aſſociation lord George Gordon was the preſident: who, at the head of 50,000 men, preſented a petition to the houſe of commons on the 2d day of June 1780 At firſt the petitioners behaved with order and decency, but they ſoon became violent againſt the members of the two houſes, who had been friendly to the cauſe of toleration, ſome of whom narrowly eſcaped with their lives. From this time till the 7th of June, London was the ſcene of the moſt atrocious crimes: houſes, chapels, and priſons, were broken open, plundered, and burnt. In one night, and at the ſame hour, it is ſaid, there were 36 buildings on fire. Attempts were made on the bank, but ſuch precautions had been taken as to render that place invulnerable. At length by the exertions of the military, who killed and wounded great numbers of the rioters, the tumult was ſuppreſſed, and the metropolis reſtored to order and tranquillity. Numbers were afterwards tried for aiding and abetting in theſe ſcenes; ſome were convicted and executed, and others acquitted; and the preſident lord George

Gordon was committed to the Tower on a charge of high treaſon, for which he was afterwards tried and found "Not Guilty."

War continued to rage, and from America it had ſpread to almoſt every part of the world, and the Engliſh found themſelves engaged in a conteſt with France, Spain, and Holland: but in the beginning of the year 1782 the oppoſition ſucceeded in forcing miniſters to a pacification. Peace was accordingly concluded, but not ſuch a peace as met the general wiſhes of the people, and thoſe who had made it were obliged to reſign their places to the famous coalition miniſtry under lord North and Mr. Fox. By the latter a bill was brought into parliament, for newly regulating the government of the Eaſt India Company, which occaſioned a great ferment in the country, and which finally drove the author of it, and his party from the helm, who were ſucceeded by the late Mr. Pitt and his friends. One of the firſt acts of this miniſter was a new Eaſt India bill, which was paſſed by a great majority: and ſhortly after, he became the advocate of parliamentary reform, a cauſe which he had eſpouſed before he came into place, and which he pledged himſelf to uſe his utmoſt endeavours to carry into effect. His plan was rejected, and from that time he never ſeriouſly attempted to realize the expectations which he had excited among the friends of liberty. The next important meaſure which he introduced to the notice of parliament was the propoſal of a ſinking fund to be applied towards diſcharging the national debt. (See Debt, *national.* *Sinking* Fund, &c.) We ſhall alſo refer our readers to the life of that miniſter for a more comprehenſive view of his public adminiſtration: to the article Revolution, *French*, for the various occurrences that took place in this country from the year 1788; to the article Slave *Trade* for an account of the proceedings on that ſubject to its final abolition: to the article Test *act* for the attempts made in this reign to obtain a repeal of thoſe obnoxious laws, &c. &c. Henry's Hiſt. Rapin. Act. Regia. Hume. Belſham. Biog. Brit. &c.

England, *Little, beyond Wales*, in *Geography*, is a portion of country lying along the ſouth-weſtern coaſt of South Wales, inhabited by the deſcendants of a colony of Flemings; who came over from Flanders, and ſettled here in the reign of king Henry I. Camden ſays, the occaſion of their emigration was an inundation of the ſea, by which a great part of the Low Countries was overflowed. But it has been ſtated, with more probability, that it was the policy of that wiſe monarch to place a people oppoſite in their language, manners, and opinions to the Welſh, to aſſiſt in his favourite project—the ſubjugation of the country. Another colony from the ſame country was incorporated with the firſt, in the time of Henry II., to which occaſionally were added numerous Anglo-Normans, and others from the Engliſh army. At firſt theſe people were confined to the commot of Rhos, which diſtrict ſtill more *particularly* retains the name of Little England beyond Wales. But their numbers increaſing in the courſe of time, they ſoon ſpread along the whole coaſt, from the lordſhip of Comes to the mouth of the river Tave. And this part of the principality is ſtill divided into two diſtricts, denominated Engliſhery, and Welſhery. The latter, occupied by the original inhabitants, contains the cantreves of Comes, Cilgerran, part of Arberth, and Dewiſland. The former compriſes the remainder of Arberth, and the cantreves of Rhos, Caſtel-Martins, and Dougleddy; and is inhabited by the deſcendants of the Flemings. Like their anceſtors, they are a hardy, induſtrious, and adventurous race. The diſpoſitions of the two people are equally ſtriking and adverſe. While the Welſh are hot, eaſily irritated, and obſtinately tenacious; theſe are not eaſily provoked, are averſe to contention, and avoid litigation. Both are diſtinguiſhable by their mode of dreſs, manner of living, the ſtyle of their buildings, particularly in their churches; and the names they reſpectively give to places. All theſe ſtrongly point out the line of demarcation between them. In the Welſhery, not a word of Engliſh is heard ſpoken, while in the next village within the Engliſhery, not a word of Welſh. The language of the latter diſtrict is not much different from the common dialect of England, except in ſome parts of Rhos and Caſtle-Martin. The two people avoid all commerce as much as poſſible, mutually conſidering each other in a degrading light; and even a pathway will divide them in the ſame pariſh. To ſuch an extent is this perſonal deteſtation carried among the lower claſſes, that a matrimonial connection between the oppoſite parties is conſidered by both an unfortunate event. The Flemings, however, eventually proved a bleſſing to Wales, as well as England; by their introduction of the woollen manufactures. And a work, which proves their induſtry and improving ſpirit, is yet viſible. It is a road of great extent made by them, and ſtill called Fleming's way. Evans's Tour in South Wales.

England, *New*, comprehending the *Northern* or *Eaſtern States* of North America, lies around the great bay which ſets up N.W. between cape Cod and cape Sable, between 41° and 48° N. lat., and between 1° 30′ and 10° 15′ E. long. from Philadelphia, and is bounded N. by Lower Canada; E. by the province of New Brunſwick and the Atlantic ocean; S. by the ſame ocean and Long-iſland Sound; and W. by the ſtate of New York. It lies in the form of a quarter of a circle; its W. line beginning at the mouth of Byram river, which diſcharges itſelf into Long-iſland Sound at the S.W. corner of Connecticut, lat. 41°, runs a little E. of N. until it ſtrikes the 45th degree of latitude, and then curves to the eaſtward, almoſt to the gulf of St. Lawrence. Its extreme length is about 626 miles; its breadth is very unequal, from 100 to 200 miles; containing about 72,000 ſquare miles. This grand diviſion of the United States comprehends the ſtates of Vermont, New Hampſhire, Maſſachuſetts (including the diſtrict of Maine), Rhode Iſland, and Providence Plantations, and Connecticut; which ſee reſpectively. The climate of New England is ſalubrious, as we may infer from the longevity of its inhabitants; one in ſeven living to the age of 70 years, and about one in thirteen or fourteen to 80 years and upwards. The moſt prevalent winds are the N.W., W., and S.W.; but the E. and N.E winds, which are inſalubrious, occur frequently at certain ſeaſons of the year, particularly in April and May, on the ſea-coaſts. The weather is leſs variable than in the middle, and eſpecially the ſouthern ſtates, and more ſo than in Canada. The extremes of heat and cold are, according to Fahrenheit's thermometer, from 20° below to 100° above 0; the medium being from 48° to 50°. The quantity of water which annually falls in New England is from 42 to 48, and yet they ſuffer here more from drought than in England, where the annual quantity of water is eſtimated at about 24 inches. Hence it is inferred that the atmoſphere is remarkably dry, and thus ſome have accounted for its ſingular ſalubrity. Winter commonly commences, in its ſeverity, about the middle of December; ſometimes earlier, and ſometimes not till Chriſtmas. The diſeaſes moſt prevalent in New England are alvine fluxes, St. Anthony's fire, aſthma, atrophy, catarrh, colic, inflammatory, ſlow, nervous, and mixed fevers, pulmonary conſumption, quinſy, and rheumatiſm. The general condition of the New Englanders, which precludes the luxury of the rich and the extreme diſtreſs of the poor, affords them an exemption from a variety of diſeaſes, to which a greater degree of inequality might expoſe them. This country preſents to the traveller a great variety of ſurface, conſiſting of extenſive plains, intermixed with vallies of different breadths from 2 to 20 miles, and with mountains of different elevations. Although it may be deemed, upon the whole, to be high and hilly, its mountains are comparatively ſmall, and run nearly N. and S., in ridges parallel to one another. The weſternmoſt range begins in the county of Fairfield, and, paſſing through the counties of Litchfield and Berkſhire, unites with the Green mountains at Williamſtown, in the N.W. corner of the Maſſachuſetts, being ſeparated only by the narrow valley of Hooſack river. The higheſt part of this range is Toghkonnuck mountain in Egremont, the ſouth-weſtern corner of the ſame ſtate. Over this mountain, elevated probably more than 3000 feet above the ocean, runs the boundary between Maſſachuſetts, Connecticut, and New York. The ſecond range is that of the GREEN *mountains;* which ſee. The third range has the ſame commencement with the ſecond at New Haven, in a delightful eminence called the Eaſt rock, and paſſing through the counties of New Haven, Hartford, and Hampſhire, extends into Canada. The Blue hills in Southington, mount Tom, which is the principal eminence, mount Holyoke, and mount Toby in Sunderland, are the principal ſummits of this range S. of New Hampſhire. This range, which is precipitous and romantic, croſſes Connecticut river juſt below Northampton and Hadley in Maſſachuſetts. The ſouth or eaſtern range begins at Lyme in Connecticut, and forms the eaſtern boundary of the Connecticut valley, until it unites with the laſt-mentioned range in the county of Hampſhire; but is leſs diſtinctly marked by eminences than the others. The chief ſingle mountains are Saddle-mountain in Maſſachuſetts, computed to be about 4000 feet above the ſea, Watchuſett in the county of Worceſter, Aſchutney in the ſtate of Vermont, Monadnock in New Hampſhire, and the White mountains in the ſame ſtate, of which the higheſt ſummit is Mount Waſhington, probably between 10,000 and 11,000 feet above the ocean, and the higheſt land in the United States. This mountain is covered during a great part of the year with ſnow, and is ſeen in fair weather at the diſtance of 90 miles from the ſea, and 160 from its baſe. New England abounds in cataracts and caſcades; thoſe of the White mountains being ſingularly romantic and beautiful. The principal rivers of New England are the Schodack, Penobſcot, Kennebeck, Amariſcoggin, Saco, Piſcataqua, Merrimack, Parkers, Charles, Taunton, Providence, Thames, Connecticut, Hooeſtonnuck or Stratford, Onion, La Moille, and Miſſiſconi. The largeſt of theſe are Penobſcot, Kennebeck, Merrimack, and Connecticut. The chief lakes are Champlain and Memphremagog, lying partly in Vermont and partly in New York; Winnipiſiogee and Umbagog in New Hampſhire; Sebago, Mooſehead, Willeguenguagun, and Chilmacook or Grand lake in Maine. The moſt important and uſeful harbours are thoſe of Machias, Frenchman's bay, Wiſcaſſet, Portland and Wells, in Maine; Piſcataqua in New Hampſhire; Newbury port, Salem, Marble head, Boſton, Provincetown, and New Bedford, in Maſſachuſetts Proper; Newport, Briſtol, and Providence, in Rhode iſland; and New London, New Haven, and Black rock, in Fairfield, in Connecticut. Burlington bay is the moſt conſiderable harbour in lake Champlain, on the Vermont ſhore.

The ſoil of New England is diverſified by every variety from a lean and barren ſand to the richeſt clays and loams. The hills are covered with a brown loam intermixed with gravel, which is favourable to the production of graſs, and in the weſtern parts of the country, of wheat, and all other kinds of grain and fruits ſuited to the climate. Clayey ſoils, when well manured, are very productive. A rich loam, varying towards clay, is prevalent in Connecticut, and is favourable to every kind of cultivation. Sand is generally found on the plains; and the yellow pine plains, which are commonly a mixture of ſand and gravel, are friendly to every production that does not require a richer ſoil. The white pine plains are uſually covered with loam, and theſe, as well as ſome of the laſt-mentioned in the ſame condition, are uncommonly fertile. The vallies are a rich mould; and the intervals, bordering the various ſtreams, are generally ſands formed by earth depoſited by the floods in the ſpring, and are of the richeſt quality.

New England, generally ſpeaking, is better adapted for grazing than for grain, though a ſufficient quantity of the latter is raiſed for home conſumption, if we except wheat which is largely imported, particularly into Maſſachuſetts, from the middle and ſouthern ſtates. Indian corn, rye, oats, barley, buck-wheat, flax and hemp, generally ſucceed very well. Fruits of every kind, which ſuit a temperate climate, may be obtained in abundance. The ſummer heat brings to perfection peaches, apricots, and nectarines. Orchards of apple-trees cover a conſiderable part of the whole country, and cyder is the common drink of the inhabitants. Pears, plums, cherries, currants, gooſeberries, whortleberries, blackberries, bilberries, &c. abound. Perry is made in ſome parts of the country, but not in great quantities. Various ſpecies of the hickery and hazle-nuts, and cheſnuts are plentifully furniſhed by the ſouthern half of New England. Gardening is much improved, and its productions are daily varying and increaſing. But the moſt important production of New England is graſs. The high and rocky ground is in many parts covered with clover, and affords excellent paſture to ſome of the fineſt cattle in the world. The quantity of butter and cheeſe made for exportation is very great. Conſiderable attention is now paid to the raiſing of ſheep; and the wool is in a ſtate of progreſſive improvement. The principal exports of New England are mackarel, ſalmon, cod, and other fiſh; whale-oil and whale-bone, timber, maſts, boards, ſtaves, hoops and ſhingles; horſes, mules, ſalted beef, and pork, pot-aſh, pearl-aſh, flax-ſeed, apples, cyder, corn, butter, and cheeſe. New England is the moſt populous part of the United States; it contained, in 1790, 1,009,522 perſons, and, in 1800, 1,233,011. The great body of the inhabitants conſiſts of landholders and cultivators of the ſoil. As they poſſeſs in fee-ſimple the farms which they cultivate, they are all naturally attached to their country; and the cultivation of the ſoil makes them robuſt and healthy. New England has been not unaptly denominated a nurſery of men; and hence are annually tranſplanted into other parts of the United States, thouſands of its natives. They are almoſt univerſally of Engliſh deſcent; and to this circumſtance, as well as to the general attention that has been paid to education, it is owing that the Engliſh language has been preſerved among them in ſo conſiderable a degree of purity. The New Englanders are generally tall, ſtout, and well-made. Their education, laws, and ſituation ſerve to inſpire them with high notions of liberty, of which they are jealous, in ſome caſes perhaps, to exceſs. A chief foundation of freedom in the New England ſtates is a law, by which inteſtate eſtates deſcend to all the children, or other heirs, in equal proportion; and hence it happens, that the people of New England enjoy an equality of condition, that is unknown in any other part of the world. Beſides, they are frugal and induſtrious, and inured to habits of ſobriety and temperance. Learning is more generally diffuſed among all ranks of people in New England than in any other part of the globe; which is owing to the excellent eſtabliſhment of ſchools in every town. In theſe ſchools, generally ſupported by a public tax, are taught the elements of reading, writing, and arithmetic; and in ſome of the principal and more wealthy towns they are purſuing education in a higher ſcale, and introducing the ſuperior branches of grammar, geography, and other ſciences. Literature is alſo encouraged and diffuſed by the circulation of newſpapers and periodical publications, and by the eſtabliſhment of reading ſocieties and parochial libraries. Curioſity, and a deſire of information, are very prevalent in New England; and the common people, it is ſaid, are diſtinguiſhed by attention and civility to ſtrangers. In former times the New Englanders were ſtrict, to a degree of punctiliouſneſs, in their obſervance of the ſabbath; and hence, as well as from ſome other traits of their character, they acquired the character of a ſuperſtitious and bigotted people. But ſince the war, a catholic, tolerant ſpirit, occaſioned by a more enlarged intercourſe with mankind, has much increaſed, and is becoming univerſal. "If," ſays Dr. Morſe, "they do not go beyond the proper bounds, and liberalize away all true religion, of which there is very great danger, they will counteract that ſtrong propenſity in human nature which leads men to vibrate from one extreme to its oppoſite." A cuſtom ſtill prevails, tranſmitted to the preſent race from their anceſtors, of annually celebrating faſts and thankſgivings. In ſpring, the governors of the ſeveral New England ſtates, Rhode iſland excepted, proclaim a day of faſting, humiliation, and prayer; and in autumn, after harveſt, they appoint a day of public thankſgiving. Many of the women in New England are handſome. Thoſe, who have enjoyed the advantages of a good education, and they are numerous, are genteel, eaſy, and agreeable in their manners, and are ſprightly and ſenſible in their converſation. And it is a laudable practice among the females to accuſtom themſelves at an early period to the management of domeſtic concerns with neatneſs and economy. Employment at the needle, in cookery, and at the ſpinning-wheel, is honourable. The women in country towns manufacture the greater part of the clothing of their families. Their linen and woollen cloths are ſtrong and decent. Among the amuſements of the people of New England is dancing, of which the young people of both ſexes are extremely fond. The athletic and healthy diverſions of cricket, foot-ball, quoits, wreſtling, jumping, hopping, foot-races, and priſon-bars, are univerſally practiſed in the country, and ſome of them in the moſt populous places, and by people of almoſt all ranks. Of the religion of the New Englanders, and of the proviſion that is made for the ſupport of it, we ſhall have occaſion to ſpeak under the article UNITED STATES. We ſhall here merely obſerve, that the conſtitution of theſe ſtates provides againſt the making of any law reſpecting an eſtabliſhment of religion, or prohibiting the free exerciſe of it. And in the conſtitution of the reſpective ſtates, religious liberty is a fundamental principle. Without the aid of civil power, religion is left to be ſupported by its own evidence, by the lives of its profeſſors, and the almighty care of its divine author. Its public teachers are maintained by an equal tax on property, by pew-rents, monies at intereſt, marriage and burial fees, ſmall glebes, land rents, and voluntary contributions. Chriſtians profeſs their religion under various forms, and with different ideas of its doctrines, ordinances, and precepts. Accordingly the ſects of Chriſtians are very numerous and various. Of theſe ſects, thoſe that are called Congregationaliſts are the moſt numerous. In New England there are about 1200 congregations of this denomination. Next to theſe in reſpect of number are Preſbyterians. In New England there are between 40 and 50 Proteſtant epiſcopal churches.

New England owes its firſt ſettlement to religious perſecution; and the inhabitants of this country are deſcended from thoſe that were called Puritans in the mother-country. The firſt attempt to form a regular ſettlement in this part of America was at Sagahadock in 1607; but in the following year, the whole number of thoſe who ſurvived the winter returned to England. The firſt company, that laid the foundation of the New England ſtates, planted themſelves at Plymouth, in November, 1620; though this appellation was given to North Virginia by Capt. Smith in Auguſt 1614. The founders of the colony conſiſted of 101 perſons. In 1640, the importation of ſettlers ceaſed, in conſequence of the abatement of perſecution by the change of affairs in England. At this time the number of emigrants, who had traverſed the ſeas in 298 veſſels, from the commencement of the colony, amounted to 21,200 men, women, and children, forming, perhaps, about 4000 families. In 1760, the number of inhabitants in Maſſachuſetts bay, New Hampſhire, Connecticut, and Rhode iſland, amounted, probably, to half a million. Morſe.

ENGLANTERIA, in *Botany.* See EGLANTERIA.

ENGLECHERIE, ENGLESCHERY, or *Engleſchyre*, a term of great import among our anceſtors, though now obſolete; properly ſignifying the quality of an Engliſhman.

If a man were privately ſlain or murdered, he was anciently accounted francigena (which comprehended every alien, eſpecially the Danes) till englecherie was proved, *i. e.* till it was made to appear that he was an Engliſhman. Bracton, lib. iii.

The origin of the cuſtom anciently ſubſiſting among the Goths in Sweden and Denmark, was thus: king Canutus, having conquered England, at the requeſt of his nobles, ſent back his army into Denmark, only reſerving a guard of Danes for his perſon; and made a law, that if any perſon was murdered, he ſhould be ſuppoſed to be a Dane, if he was not proved to be an Engliſhman by his parents or kindred, and, in default of ſuch proof, if the murderer was unknown, or had made his eſcape, the townſhip where the man was ſlain ſhould be charged to pay ſixty-ſix marks into the exchequer: or if by reaſon of the poverty of the townſhip, that ſum could not be raiſed from thence, it was to be paid by the hundred. After this law, which was continued by William the Conqueror, for the like ſecurity to his own Normans, whenever a murder was committed, it was neceſſary to prove the party ſlain an Engliſhman, that the penalty of ſixty-ſix marks might not be charged on the village. The manner of proving the perſon killed to be an Engliſhman was by two witneſſes, who knew the father and mother, before the coroner, &c. This practice was aboliſhed by ſtatute 14 Edw. III. cap. 4. See MURDER.

ENGLESQUEVILLE, in *Geography*, a ſmall town of France, in the department of the Lower Seine, 18 miles S.W. of Arques. There are ſeveral ſmall towns of the ſame name, in the department which compriſes the former province of Normandy.

ENGLISH, in a general ſenſe, ſomething that relates to the country or people of England. Thus we ſay, the Engliſh crown, Engliſh copperas, Engliſh names, Engliſh money, Engliſh meaſures, Engliſh weights, &c. The ſweating-ſickneſs is called by foreigners *ſudor Anglicanus*, the

Engliſh ſweat. (See Sudor-anglicus.) Dr. Cheyne calls the vapours the Engliſh malady.

English *Borough*. See Borough.

English *Cape*, in *Geography*, a cape on the ſouth coaſt of Newfoundland. N. lat. 46° 49′. W. long. 53° 29′.

English *Cove*, a harbour, or bay, on the coaſt of New Ireland, about 3 or 4 miles from cape St. George.

English *Drops*, *Guttæ Anglicanæ*. See Drop.

English *Harbour*, in *Geography*, one of the beſt harbours in the iſland of Antigua, ſituated on the S.W., a little to the E. of Falmouth harbour. It is well fortified, and has a royal navy-yard and arſenal, with conveniences for careening ſhips of war. N. lat. 17° 8′ 25″. W. long. 61° 27′ 30″.

English *Point*, a cape in the river St. Lawrence, on the coaſt of Canada. N. lat. 49° 40′. W. long. 61° 45′.

English *Reach*, a reach in the ſtraits of Magellan, about 3 leagues broad, between cape Gallant and cape Holland.

English *Road*, a road in the iſland of Eooa, or Middleburgh, in the South Pacific ocean, having 25 fathoms water. S. lat. 21° 20′. W. long. 174° 34′.

English *School of Engraving*. See Engraving.

English, or the English *Tongue*, the language ſpoken by the people of England; and with ſome variation, by thoſe of Scotland, as well as part of Ireland, and the reſt of the Britiſh dominions.

The Engliſh is of Gothic, or Teutonic extraction; this was the root or ſtock upon which ſeveral other dialects have been ſince grafted, particularly the Latin and French. See Teutonic, &c.

The language anciently ſpoken in our iſland was the Britiſh, or Welſh, which was common to the Britons and Gauls; and which ſtill ſubſiſts, in more or leſs purity, in the principality of Wales, the iſlands and Highlands of Scotland, part of Ireland, and ſome provinces of France, particularly Bretagne, and very lately ſubſiſted in the county of Cornwall. (See Cornish *Language*.) This language was the Celtic or Gaelic, which is ſaid to be very copious and expreſſive, and is, probably, one of the moſt ancient languages in the world. It once obtained in moſt of the weſtern regions of Europe: and now remains in the different dialects of the Iriſh, Welſh, and Erſe. See Celts.

As the Roman empire, extending itſelf towards the weſtern parts of Europe, under Julius Cæſar, Claudius, and Domitian, came to take in Gaul and Britain, the Roman tongue became propagated therewith; all the edicts, &c. relating to the public affairs, being deſignedly wrote in that language.

The Latin, however, it is certain, never got ſo much ground, or prevailed ſo far in England, as in Lombardy, Spain, and the Gauls; partly on account of its great diſtance from Rome, and the ſmall reſort of Romans hither; and partly, becauſe the entire reduction of the kingdom was not effected till ſo late as the reign of Claudius, when the empire was on the declining hand, and the new province was forced to be ſoon deſerted by its conquerors, called to defend their territories nearer home.

Britain, thus left naked, became an eaſy prey to the Angli, or Anglo-Saxons, a ſtrolling nation, from Jutland and Norway, who took an eaſy poſſeſſion thereof about the year 450, much about the time that the Franks, another German nation, entered Gaul. The Gauls and Franks, it ſeems, at length came to terms; found means to unite into one nation; and thus, the ancient Gauliſh, with its mixture of Latin, continued the prevailing tongue, only farther intermixed with the Francic or lingua Franca of the new inmates; but the Britons were more conſtant, and determined abſolutely to refuſe any ſuch coalition: they had embraced Chriſtianity, Auguſtine being ſent from Rome to convert them about the year 570, and their competitors were heathens; rather than admit of ſuch an union, they therefore choſe to be ſhut up, with their language, in the mountainous parts of Cambria or Wales.

The Engliſh Saxons, thus left abſolute lords, changed every thing; their own language, a dialect of the Gothic or Teutonic, and altogether diſtinct from the Celtic, was now fully eſtabliſhed, and laid the foundation of the preſent Engliſh tongue: and the very name of the country was henceforth to be Anglo-Saxon. (See Anglo-Saxon.) The new language remained, in good meaſure, pure and unmixed, till the Norman invaſion; the attempts of the Danes, and the neighbourhood of the Britons, indeed, wrought ſome leſſer innovations therein; but, in the main it preſerved itſelf; for, as to the Danes, their language was, probably, from the ſame root with the Saxon; and it did not long remain a diſtinct tongue in any part of England, but was blended with the Anglo-Saxon, and formed a particular dialect of that language.

This Dano-Saxonic dialect was principally ſpoken in the kingdom of Northumberland, where the Danes chiefly prevailed: that the Anglo-Saxon language was ſpoken in the S.E. parts of Scotland at this time is undeniable. When Edgar the Peaceable, king of England, yielded Lothian to Kenneth II. king of Scotland, A.D. 975, it was on theſe expreſs conditions; that the people of that country ſhould ſtill be called Engliſhmen, be governed by the Engliſh laws, and be allowed to ſpeak the Engliſh language.

Edward the Confeſſor, however, who had lived long in France, might poſſibly bring in a little mixture of the dialect of that country.

But William I. and his Normans, having got poſſeſſion of England, an alteration was ſoon attempted: the conqueſt was not complete, unleſs the Conqueror's language, the French and Franco-Gallic, were introduced; and accordingly all his acts, diplomas, edicts, pleadings, and other judicial matters, were written, &c. in that tongue.

But his attempts proved unſucceſsful; the number of Normans he brought over being very ſmall in compariſon of the Engliſh, with whom they were incorporated, they loſt or forgot their own language, ſooner than they could make any change in the Engliſh. This, however, did not hinder, but, by the endeavours of the Conqueror, abundance of French words, though many of them of Latin original, crept into the Engliſh; and many Engliſh words, by degrees, grew out of uſe. Hence it happened, that the Engliſh, which was ſpoken afterwards, and continues to be ſpoken now, is a mixture of the ancient Saxon and this Norman French, together with ſuch new and foreign words as commerce and learning have in the progreſs of time gradually introduced. See Anglo-Saxon.

Upon the whole it appears, that the Teutonic dialect is the baſis of our preſent ſpeech. It has been imported among us in three different forms, the Saxon, the Daniſh, and the Norman; all which have mingled together in our language, ſo that it may be ſuppoſed to exiſt in three different periods, *viz.* Anglo-Saxon, Daniſh-Saxon, and Norman-Saxon. The firſt begins with the Saxon invaſion, the ſecond with the Daniſh, and the third with the Norman. Some have made the properly Engliſh period to commence with Edward I., towards the cloſe of the 13th century; others have referred it to the 14th century; and others again have thought that it ought rather to commence with Henry VIII.; as the controverſies of the Reformation were in fact the cauſe which then aboliſhed the Norman dialect of the court, and introduced the preſent common Engliſh to our worſhip and to our literature. Many of our words are alſo plainly derived from the Latin. But theſe were not introduced directly from the Latin; whereas moſt of them, probably, entered into our tongue through the channel of that Norman French, which William the Conqueror introduced. For, as the Romans had long been in full poſſeſſion of Gaul, the language ſpoken in that country, when it was invaded by the Franks and Normans, was a ſort of corrupted Latin, mingled with Celtic, to which was given the name of Romanſh; and as the Franks and Normans did not, like the Saxons in England, expel the inhabitants, but, after their victories, mingled with them; the language of the country became a compound of the Teutonic dialect imported by theſe conquerors, and of the former corrupted Latin. Hence, the French language has always continued to have a very conſiderable affinity with the Latin; and hence, a great number of words of Latin origin, which were in uſe among the Normans in France, were introduced into our tongue at the conqueſt: to which, indeed, many have been ſince added, directly from the Latin, in conſequence of the great diffuſion of Roman literature throughout all Europe. From the influx of ſo many ſtreams, or the junction of ſo many diſſimilar parts, it naturally follows that the Engliſh, like every compounded language, muſt neceſſarily be ſomewhat irregular. We cannot expect from it, ſays Dr. Blair (Lectures, &c. vol. i.) that correſpondence of parts, that complete analogy in ſtructure, which may be found in thoſe ſimpler languages, which have been formed in a manner within themſelves, and built on one foundation. Hence, it has but ſmall remains of conjugation or declenſion; and its ſyntax is narrow, as there are few marks in the words themſelves that can ſhew their relation to each other, or, in the grammatical ſtyle, point out either their concordance, or their government, in the ſentence. Our words having been brought to us from ſeveral different regions, ſtraggle, if we may ſo ſpeak, aſunder from each other; and do not coaleſce ſo naturally in the ſtructure of a ſentence, as the words in the Greek and Roman tongues. But theſe diſadvantages, if they be ſuch, of a compound language, are balanced by other advantages that attend it; particularly by the number and variety of words with which ſuch a language is likely to be enriched.

As to the origin and etymology of many of our words, Dr. Wallis lays it down, that ſuch words of German original as we have, in common with the French, are to be reckoned as our own, rather than as words borrowed from them; and that the old Gauliſh words, common to the French and the Welſh, which are found in our language, have been likewiſe taken from the Welſh, rather than from the French. Hence, alſo, the ſame author accounts why the names of the divers ſorts of cattle are Saxon; as ox, cow, calf, ſheep, hog, boar, deer, &c. and yet that their fleſh, when prepared for food, is French; as beef, veal, mutton, pork, brawn, veniſon, &c. the Norman ſoldiers not concerning themſelves with paſtures, parks, and the like places, where ſuch creatures are fed and kept, ſo much as with markets, kitchens, feaſts, and entertainments, where the food was either prepared, ſold, or eaten.

Under Henry II., Dr. Swift obſerves, the French made a ſtill greater progreſs; becauſe of the large territories he poſſeſſed on that continent, both from his father and his wife, which occaſioned frequent journies thither, with numerous retinues, &c. And for ſome centuries after, there was a conſtant intercourſe between France and England, by the dominions we poſſeſſed there, and the conqueſts we made; ſo that the language, two or three hundred years ago, ſeems to have had much more French than at preſent.

Beſides this alteration from the conquerors, the language in proceſs of time underwent ſeveral others; and at length came to have numerous words and phraſes of foreign dialects ingrafted into it, in lieu of the ancient Saxon; particularly, by means of negociations and commerce with other nations; by the marriages of royal families; by the affectation of many writers, in moſt ages, who are fond of coining new words, and altering the uſual forms of ſpeech, for the greater delicacy; and, by the neceſſity of framing or borrowing new words, according as new things and inventions turn up: and by ſuch means was the old Anglo-Saxon converted into the preſent Engliſh tongue. See ANGLO-SAXON.

Having traced the riſe and progreſs of our language hiſtorically, we think it may be no incurious amuſement to repreſent by actual examples the ſeveral ſucceſſive changes and ſtages it has paſſed through, to arrive at its preſent perfection: in order to which, we ſhall make uſe of the collections of the ingenious Mr. Greenwood.

From the Saxon invaſion, we have no memorial extant of the language for 250 years: the oldeſt Saxon writing in being is a gloſs on the evangeliſts, written in the year 700, by Eadfride, biſhop of Holy Iſland; in which the three firſt articles of the Lord's Prayer run thus:

"Uren Fader thic arth in heofnas, ſic gehalgud thin noma, to cymeth thin ryc. Sic thin willa ſue is in heofnas, and in eortho," &c. See ANGLO-SAXON.

Two hundred years after, in the year 900, the ſame was rendered thus:

"Thu ure Fader the eart on heofinum, ſi thin nama gehalgod; cum thin ric. Si thin willa on eorthan ſwa, ſwa on heofinum."

In the following age it was turned thus in the Saxon Homilies, ſaid to be tranſlated by king Alfred:

"Fæder ure thu the earth on heofenum, ſi thin nama gehalgod, to be cume thin rice, gewurthe thin willa on eoarthan ſwa, ſwa on heofnum," &c.

About the year 1160, under Henry II., near which period the Saxon began to aſſume a form in which the beginning of the preſent Engliſh may be diſcovered; it was thus rendered by pope Adrian, an Engliſhman, in rhyme:

"Ure Fader in heaven rich,
Thy name be hayled ever lich,
Thou bring us thy michell bliſſe:
Als hit in heaven y-doe
Evar in yearth beene it alſo," &c.

About 100 years after, in the time of Henry III., it was tranſlated thus:

"Fadir that art in heaven bliſſe,
Thin helge nam it wurth the bliſs,
Cumen & mot thy kingdom,
Thin holy will be it all don,
In heaven and in erdh alſo," &c.

Two hundred years after, under Henry VI., it was rendered thus:

"Our Fadir that art in hevenes, halewid be the name, thi kingdom come to thee, be thi will don in eerthe, as in hevene."

Dr. Hickes furniſhes an extraordinary ſpecimen of the Engliſh, as ſpoken in the year 1385, in his Theſaur. Liter. Septent. which we ſhall the rather amuſe the reader with, as it is on this very ſubject, the Engliſh tongue; and contains not only the hiſtory, but the reaſon of the changes and differences therein:

"As it is knowe how meny maner peple beeth in this lond; there beeth alſo ſo many dyvers longages and tonges. Notheleſs Walſche men and Scots that beeth nought medled with other nations, holdeth wel nyh hir firſt longage and ſpeche: but yif the Scottes that were ſometime confederat and woned with the Pictes drawe ſomewhat after hir ſpeche; but the Flemynges that woneth in the weſte ſide of Wales, haveth left her ſtrange ſpech, and ſpeketh Sexonliche now. Alſo Engliſhe men, they had from the bygynnynge thre maner ſpeche; northerne, ſowtherne, and middel ſpeche in the middel of the londe, as they come of three maner of peple of Germania: notheleſs by commyxtion and mellynge firſt with Danes, and afterwards with Normans, in meny the contrary longage is apayred [corrupted.] This appayrynge of the burthe of the tunge is bycauſe of tweie thynges, oon is for children in ſcole agenſt the uſage and maner of all other nations, beeth compelled for to leve hire own longage, and for to conſtrue hir leſſons and here thynges in French, and ſo they haveth ſethe Normans come firſt into Engelond. Alſo gentlemen children beeth taught to ſpeke Frenſche from the tyme that they beeth rokked in here cradel, and kunneth ſpeke and play with a childes broche; and uplondiſſche men will linke hymſelf to gentilmen, and fondeth with great beſyneſſe for to ſpeake Frenſche to be told of. Hit ſeemeth a greet wonder how Engliſche men and her own longage and tonge, is ſo dyverſe of ſown in this oon ilond; and the longage of Normandie is comlynge of another lond, and hath oon manner ſoun amonge alle men that ſpeketh hit arigt in Engelond. Alſo of the foreſaid Saxon tonge that is deled [divided] a three, and is abide ſcarceliche with few uplondiſſche men, is greet wonder. For men of the eſt, with men of the weſt, is, as it were, under the ſame partie of hevene acordeth more in ſownygne of ſpeech, than men of the north, with men of the ſouth. Therefore it is that Mercii, that beeth men of myddel Engelond, as it were parteners of the endes, underſtondeth bettre the ſide longages northerne and ſoutherne, than northerne and ſoutherne underſtondeth either other. All the longage of the Northumbers, and ſpecialliche at York, is ſo ſcharp, ſlitting and frotynge, and unſchape, that we ſoutherne men may that longage unnethe underſtonde. I trow that that is by cauſe that they beeth nyh to ſtrange men and nations, that ſpeketh ſtrongliche, and alſo bycauſe that the kinges of Engelond wonneth alwey fer from that cuntry," &c.

The firſt of our authors, who can properly be ſaid to have written Engliſh, was ſir John Gower, who, in his Confeſſion of a Lover, calls Chaucer his diſciple.

How the Engliſh ſtood about the year 1400, may be ſeen in Chaucer, who refined and improved it very conſiderably; though he is charged with the affectation of mixing too many French and Latin words with his Engliſh, and by that means, with too much altering and corrupting the primitive language.

In the year 1537, the Lord's Prayer was printed according to the following verſion:

"O oure Father which arte in heven, halowed be thy name: let thy kingdome come, thy will be fulfiled as well in erth as it is in heven," &c.

Where the reader will obſerve the diction almoſt brought to the preſent ſtandard; the variations being principally in the orthography. See an hiſtorical view of the progreſs of the Engliſh language, with ſpecimens at different periods, from the age of Alfred to that of Elizabeth, in the Introduction to Dr. Johnſon's Engliſh Dictionary, vol. i. fol.

Spencer, who lived in the ſame age, contributed not a little to the improvement and refining of the tongue: he threw aſide abundance of the outlandiſh ornaments, and wrote a purer Engliſh, yet with more elegance and variety than had been known before. He was ſucceeded by Shakeſpeare, Ben. Johnſon, lord Bacon, Milton, Cowley, Waller, Tillotſon, Dryden, Addiſon, and Pope, &c. whoſe works are in every body's hands; and by whom the language has been tranſmitted to us under all its preſent advantages.

The perfections aſcribed to the Engliſh, and alſo in a degree ſuperior to any of the modern tongues, are, 1. That it is very ſtrong and ſignificant; to which our finely compounded words, formed on the model of the Greeks, do not a little contribute.

This may alſo be partly aſcribed to the national character of the people who ſpeak it, from which language is apt to receive its predominant tincture. Thus, the gravity and thoughtfulneſs, as well as the ſtrength and energy, of the Engliſh, and alſo the gaiety and vivacity of the French, are ſufficiently impreſſed on their native tongues. However, though the Engliſh language poſſeſſes diſtinguiſhing ſtrength and energy, it is naturally prolix, on account of the great number of particles and auxiliary verbs, which in the uſe of it we are obliged conſtantly to employ; and this prolixity muſt, in ſome degree, enfeeble it. We ſeldom can expreſs ſo much by one word as was done by the verbs, and by the nouns, in the Greek and Roman languages. Our ſtyle is leſs compact; our conceptions being ſpread out among more words, and ſplit, as it were, into more parts, make a fainter impreſſion when we utter them. Notwithſtanding this defect, as our language abounds in terms for expreſſing all the ſtrong emotions of the mind, and we have the liberty, in a greater degree than moſt nations, of compounding words, it may be eſteemed to poſſeſs conſiderable force of expreſſion; more eſpecially when we compare it with the other modern tongues, though much below the ancient. The ſtyle of Milton alone, both in poetry and proſe, affords ſufficient evidence, that the Engliſh tongue is far from being deſtitute of nerves and energy.

2. The Engliſh language is copious; of which Mr. Greenwood gives us inſtances in the word ſtriking; which we have above thirty different ſynonymous expreſſions for; as *to ſmite*, *bang*, *beat*, *baſt*, *buffet*, *cuff*, *hit*, *thump*, *thwack*, *ſlap*, *rap*, *tap*, *kick*, *ſpurn*, *box*, *yerke*, *pummel*, *punch*, &c. and the word *anger*, for which he enumerates above forty. So we ſay *to ſeeth* or *boil* fleſh, *ſtew* prunes, *poche* eggs, *coddle* apples, *bake* bread; for which expreſſions, *to ſeeth*, *ſtew*, *poche*, *coddle*, and *bake*, the Latins, with all the boaſted copia of the tongue, have only one word, *coquere*; and the French, as much as they abound with terms of cookery, not many more; the word *cuire* ſerving indifferently for *ſeething*, *boiling*, *baking*, *ſtewing*, and *codling*.

Indeed, few languages are more copious than the Engliſh. In all grave ſubjects eſpecially, hiſtorical, critical, political, and moral, no writer can juſtly complain of the barrenneſs of our tongue. We are alſo rich in the language of poetry. Our poetical ſtyle differs widely from proſe, not in point of numbers only, but in the very words themſelves; which ſhews what a ſtock and compaſs of words we may ſelect and employ, ſuited to different occaſions. In this reſpect we are infinitely ſuperior to the French, whoſe poetical language, if it were not diſtinguiſhed by rhyme, would not be known to differ from their ordinary proſe. It is chiefly, however, on grave ſubjects, and with reſpect to the ſtronger emotions of the mind, that our language diſplays its power of expreſſion. But, in deſcribing the more delicate ſentiments and emotions, our tongue is not ſo fertile; and we muſt acknowledge its inferiority to the French. This is, perhaps, the happieſt language for converſation in the known world; but, on the higher ſubjects of compoſition, it is much excelled by the Engliſh.

3. The Engliſh language is not deſtitute of flexibility, This power of accommodation to different ſtyles and manners, ſo as to be either grave and ſtrong, or eaſy and flowing, or tender and gentle, or pompous and magnificent, as an author's genius prompts or occaſions require, is a quality of great importance both in ſpeaking and writing. This property of a language ſeems to depend upon three things: its copiouſneſs; the different arrangements of which its words are ſuſceptible; and the variety and beauty of the ſound of thoſe words, ſo as to correſpond to many different ſubjects. The Greek poſſeſſed this property in a ſupereminent degree; the Latin was, in this reſpect, inferior to it; and among the modern tongues, the Italian poſſeſſes flexibility in a greater degree than the French; and though our language has leſs of it than the Italian, it poſſeſſes a conſiderable degree of this quality. If any one will conſider the diverſity of ſtyle which appears in ſome of our claſſics; that great difference of manner, for inſtance, which is marked by the ſtyle of lord Shafteſbury, and that of dean Swift; he will perceive, in our tongue, ſuch a circle of expreſſion, ſuch a power of accommodation to the different taſte of writers, as redounds not a little to its honour.

4. Some have challenged to the Engliſh language the praiſe of being muſical and harmonious; and in this reſpect Mr. Dennis makes no ſcruple to aſſert it ſuperior even to the French. This, which ſome may think ſtrange, he proves hence, that we have blank verſe which is harmonious by mere force of numbers and quantity; whereas the French have long ago deſiſted from all pretenſions to poetical numbers, without the aſſiſtance of rhyme.

It may be added on this laſt head, from Mr. Welſtead, that the Engliſh has many meaſures, the iambic and trochee, for inſtance, in common with the Greek and Latin; an advantage ariſing from the variation of the accent; and that rhyme is peculiarly natural to it, varying itſelf to the ear with exceſſive ſweetneſs; not to mention the cæſuras, pauſes, tranſpoſitions, and numberleſs other graces, which the Engliſh verſification is capable of, probably beyond every other living language.

The Engliſh has, indeed, been reproached on account of its deficiency in harmony of ſound; but the charge has been extended too far. The melody of our verſification, and the power which our language poſſeſſes of ſupporting poetical numbers, without any aſſiſtance from rhyme, afford ſufficient proof that our language is far from being unmuſical. Next to the Italian, our verſe is the moſt diverſified and harmonious of any of the modern dialects; and far exceeds the French in variety, ſweetneſs, and melody. Mr. Sheridan has ſhewn, in his Lectures, that we abound more in vowel and diphthong ſounds than moſt languages; and theſe, too, ſo divided into long and ſhort, as to afford a proper diverſity in the quantity of our ſyllables. Our conſonants, he obſerves, though they appear crowded to the eye on paper, often form combinations not diſagreeable to the ear in pronouncing; and, in particular, the objection which has been made to the frequent recurrence of the hiſſing conſonant *s* in our language is unjuſt and ill-founded: for this letter frequently loſes the hiſſing ſound, eſpecially in the final ſyllables, and is transformed into a *z*, affording a ſound on which the ear can reſt with pleaſure. After all, it muſt be allowed, that ſtrength and expreſſiveneſs, more than grace and melody, are the diſtinguiſhing properties of the Engliſh tongue. It is a remarkable peculiarity of Engliſh pronunciation, that the accent is thrown farther back, or nearer the beginning of a word, than is done by any other nation; and the general effect of this practice of haſtening the accent is to give a briſk and a ſpirited, but at the ſame time a rapid and hurried, and not very muſical, tone to the whole pronunciation of a people.

5. The Engliſh tongue is, without doubt, the moſt ſimple in its form and conſtruction of all the European dialects. It is free from all intricacy of caſes, declenſions, moods, and tenſes. The words are ſubject to fewer variations from their original form than thoſe of any other language. Its ſubſtantives have no diſtinction of gender, except what nature has made, and but one variation in caſe. Its adjectives admit of no change at all, except what expreſſes the degree of compariſon. Its verbs, inſtead of running through all the varieties of ancient conjugation, ſuffer no more than four or five changes in termination. By the help of a few prepoſitions and auxiliary verbs, all the purpoſes of ſignificancy in meaning are accompliſhed; while the words commonly preſerve their form unchanged; which ſtructure, though it has its diſadvantages in point of elegance, brevity, and force, contributes to facility. However, biſhop Lowth has obſerved in the Preface to his Grammar, that the ſimplicity and facility of our language occaſion its being frequently written and ſpoken with leſs accuracy. See GRAMMAR, LANGUAGE, STYLE, SYNTAX, &c.

Some object to the Engliſh, that it conſiſts too much of monoſyllables; which others repreſent as an excellence, becauſe it argues a greater antiquity, if what Salmaſius ſays be true: Certum quippe eſt, linguas omnes, quæ monoſyllabis conſtant, cæteris eſſe antiquiores;" he adds, that the "ancient Greek abounded herein, as appears from the ancient poets, and ſuch as affected antiquity." De Re Helleniſt.

But we have a farther advantage from our monoſyllables, *viz.* "conciſeneſs;" as we are hereby enabled to expreſs more matter in the ſame compaſs of letters than any other modern tongue. The only thing we ſuffer by it, is, ſomething in point of ſoftneſs and numbers; and yet we have verſes compoſed wholly of monoſyllables, that do not want harmony; as that of Creech,

> "Nor could the world have borne ſo fierce a flame."

Others object to our language, that it does not equal the ſoftneſs, the delicacy, of the more ſouthern languages, of France, Spain, and Italy. It ſeems to retain ſomewhat of the Gothic roughneſs of the people who framed and introduced it; the ſoil and climate it was planted in, not tending much to mellow and refine it.

To this purpoſe does Dr. Swift ſpeak, who accounts for the effect hence, that the Latin tongue was never in its purity in our iſland; and beſides, it was removed, in its imperfect ſtate, before it could have time to incorporate with the language of the country, and ſubdue and ſoften it, as it did in the other provinces of France and Spain, &c. But it is to be obſerved, that, upon the whole, this, ſuppoſing it true, does not lie as an objection againſt the language, but the people: our manners are alſo leſs poliſhed than ſome of our neighbours; we are not yet arrived at that pitch of moleſſe, of delicateſſe, of ſoupleſſe, which we cenſure in them; and it is but juſt our language correſpond with the reſt of our character.

Mr. Welſtead is of opinion, that the Engliſh language is not capable of a much greater perfection than it has already attained. We have trafficked, he obſerves, with every country for the enriching of it; the ancients and moderns have both contributed to give it ſplendour and magnificence; the faireſt cyons that could be had from the gardens of France and Italy, have been grafted on our old ſtocks, to refine the ſavageneſs of the breed; we have laid aſide moſt of our harſh, antique words, and retained few but thoſe of good and ſound energy: the moſt beautiful poliſh is at length given to our tongue that it will bear, without deſtroying and altering the very baſis and ground work of it; its Teutonic ruſt is worn away, and little or nothing is wanting either of copiouſneſs or harmony. He goes on to argue the maturity and perfection of the Engliſh, from another very extrinſic principle, *viz.* by comparing the time and circumſtances of the improvements made ſince the firſt refiners of it; with thoſe of the Greek, Latin, French, and other tongues that confeſſedly have riſen to their height.

Every civilized nation, that author thinks, has its claſſical age; and he ſuggeſts, that the Engliſh are not far from it. So that what remains to be done for the Engliſh tongue, ſhould not be to advance, but to fix it where it is, and prevent its declining. There is, in effect, a point of perfection, which when a language has once arrived at, it cannot exceed, though it may degenerate from it; and thus it happened to the two fineſt languages that the world has known.

It may ſeem odd to talk of fixing ſo unſtable a thing as language: the Greek liturgies of St. Baſil, and St. Chryſoſtom, ſtill uſed in that church, the one for ſolemn, the other for common days, have been a long time unintelligible to the people; ſo much has the vulgar Greek degenerated from its original purity! Polybius teſtifies, that the articles of truce between the Romans and Carthaginians could ſcarcely be underſtood by the moſt learned Roman antiquaries, three hundred and fifty years after the time in which they were made. In effect, from the days of Romulus to thoſe of Julius Cæſar, the Latin was perpetually changing; and what was written three hundred years before Tully, was as unintelligible in his time as the Engliſh and French of the ſame period are now; and theſe two have changed as much ſince William the Conqueror, in about eight hundred years, as the Latin appears to have done in a like term.

Whether our language will decline as faſt as the Roman did, may admit of ſome doubt; there being many circumſtances in the affairs of the nation, which contributed to that ſpeedy corruption, that may not, in all probability, find place among us. The French for about two centuries paſt, has been poliſhing as much as it will bear; and it appears to be now declining, by the natural inconſtancy of that people, and the affectation of ſome late authors, to introduce cant words, which is the moſt ruinous corruption in any language. But without ſome ſuch conſideration there does not ſeem any abſolute neceſſity, why a language ſhould be perpetually changing.

We find examples to the contrary: from Homer to Plutarch, are above a thouſand years; and ſo long, at leaſt, Dr. Swift thinks, we may allow the purity of the Greek; the Grecians ſpread their colonies round all the coaſts and iſlands of Aſia Minor, and the Ægean ſea, where the language was preſerved entire for many ages after they themſelves became provinces to Rome, and were over-run by the barbarous nations. The Chineſe have books in their language above two thouſand years old; neither have the frequent conqueſts of the Tartars been able to alter it. And the German, Spaniſh, and Italian, have admitted few or no changes for ſome ages paſt.

On ſuch conſiderations, that author moved the then prime miniſter, the earl of Oxford, to eſtabliſh a ſociety, or academy, for the ſettling, and aſcertaining, the purity of our tongue; to ſet a mark on the improprieties which cuſtom has made familiar, to throw out vicious phraſes and words, to correct others, and perhaps retrieve ſome others now grown obſolete, and to adjuſt the orthography, pointing, &c.

Without ſome ſuch means, he complains that the fame any writer can expect will be ſo ſhort and ſcanty, as by no means to be a ſufficient motive to call forth, and engage a man to exert his genius. Our language is chiefly confined to theſe two iſlands; and it is hard our authors' fame ſhould be limited in time as well as place. Were it not for the Bible and Common-Prayer, we ſhould hardly have been able to underſtand any thing written about two centuries ago.

It is a melancholy reflection, that Petrarch ſtill ſpeaks good Italian; whereas Chaucer, who lived an hundred years later, is not to be underſtood by an Engliſh reader without a Saxon and French gloſſary. And what ſecurity has Dryden himſelf, while things continue on their preſent footing, that he ſhall not, in a like ſpace of time, become as obſolete as Chaucer is?

Grammars and dictionaries, with whatever care and judgment they are compoſed, will prove but a feeble ſtay to a fleeting language, unleſs they have ſome extraordinary ſanction and authority. And, what is to be lamented, ſuch writings have contributed to the corruption almoſt as much as the perfection of our tongue.

Dr. Gill, Ben Johnſon, and Hexham, it is certain, by forcing the Engliſh tongue to the Latin method, have clogged and perplexed it with abundance of uſeleſs precepts concerning caſes, genders, and declenſion of nouns, tenſes, moods, and conjugations of verbs, and other things which our language has nothing to do with. Nor have even Dr. Wallis, Greenwood, &c. though ſenſible of the fault in thoſe others, been able wholly to keep clear of it themſelves. See STYLE.

ENGLISH *Town*, in *Geography*, a ſmall village in the north-weſtern part of Monmouth county, in New Jerſey, on the road from Princeton to Shrewſbury; 21 miles from the former, and ſix W. of Monmouth court-houſe.

ENGLISH *Turn.* See DETOUR *Des Anglois.*

ENGLSTAIN, a town of Germany, in the archduchy of Auſtria; ſix miles N.W. of Zwetl.

ENGONASIS,, Εγγονασις, in *Aſtronomy*, Hercules; one of the northern conſtellations. See HERCULES.

ENGOUTED, in *Falconry*, is ſaid of a hawk's feathers, when they have black ſpots in them.

ENGRAFTING. See GRAFTING.

ENGRAILED, or INGRAILED, in *Heraldry*, (from the French *grêle*, hail) is when a thing is repreſented with its edges ragged, or notched, ſemi-circularly, as if broken by ſomething falling on it. See INDENTED and INVECTED.

Spelman expreſſes it in Latin by *imbricatus;* others by *ingrediatus;* and others by *ſtriatus.*

ENGRAPPLE. This is a device in uſe principally in *Naval Warfare*, where it is intended to retain an enemy's veſſel in ſome particular poſition, eſpecially for the purpoſe of boarding. When an opportunity may offer of grappling acroſs a ſhip's bows, or ſtern, ſo as to allow raking her fore and aft, the battle is uſually but of ſhort duration; it being almoſt impoſſible for a crew to ſtand to their guns while ſubject to ſo deſtructive a fire. Generally we find, that when a commander is intent on boarding his opponent, he has his yard-arms ſupplied with ſmall grapnails, which being lowered down at pleaſure, among the enemy's rigging, hook therein, and thus prevent her from retiring to avoid the boarders. Sometimes poles, having long barbs at their ends, are uſed for the ſame purpoſe; theſe are chiefly managed by the forecaſtle-men, and have their butts laſhed to the *davit*, or to the *cat-head*. Whatever contrivance may be in uſe for engrappling, it is expedient that the implement be every where ſufficiently ſolid or firm to retain its hold, and to reſiſt the hatchet, otherwiſe the enemy would ſpeedily cut them away: thus, all grap-nails ſhould be ſuſpended by means of chains, paſſed through blocks at the yard-arms; nor ſhould the tackle, by which they are acted upon, be hauled tight until the points of the grap-nails may be firmly hooked among the ſhrowd-hawſers, or ſome ſuch ſubſtantial part of the enemy's rigging, which he could not, with ſafety to his maſts or yards, cut away. Where it is practicable, a very ſtrong chain ſhould be paſſed round the whole of the ſhrowd-hawſers of that maſt, reſpectively, oppoſite which the veſſel is engrappled; or, if that be too hazardous, the chain-plates may be ſecured in a ſimilar manner. It is evident, that were the former to be all included, the enemy muſt cut away every ſupport on that ſide his maſt, before he could extricate himſelf; in the latter inſtance, as the chain-plates are of iron, and very ſubſtantial, nothing but the chain, whereby they are embraced, giving way, could afford the means of ſeparation.

Sometimes ſhips become fortuitouſly engrappled, by the flukes of their anchors hooking among the rigging of the veſſels oppoſed to them: this, however, is ſeldom permanent; for as the engrappling ariſes from accident, ſo does a lift, or heave of the ſea, ordinarily ſet the parties at liberty, either by tearing away whatever hitches upon the fluke, or by cauſing the latter to unhook itſelf. Where the ſea runs high, this is often the caſe; expoſing both veſſels to the moſt imminent danger, and always cauſing conſiderable damage. Hence, it ſhould ever be conſidered by a commander, how far the ſafety of his ſhip may become queſtionable in the attempt to approach his opponent, when there is much ſwell. The practice of engrappling is, indeed, but rarely reſorted to in ſhips of the line, or even by frigates; but is extremely common among privateers abounding in men, and intent upon bringing an engagement to a very ſpeedy iſſue, ſo as to ſave their hulls and rigging from ſuch damages as might compel them to ſeek a port wherein to re-fit.

ENGRAVER, one who practiſes the art of engraving. See Engraving.

Engraver's *Act*, the act for ſecuring the copy-right of engraved prints. That engravers might enjoy the fair advantages ariſing from the exerciſe of their own talents, and that the public at large might in due time ſucceed to ſuch advantages, an act of parliament was paſſed in the 8th year of Geo. II., "for the encouragement of the arts of deſigning, engraving, and etching hiſtorical and other prints, by veſting the properties thereof in the inventors and engravers, during a time therein mentioned."

After thus veſting the property for the term of *fourteen* years, to commence from *the day* of publication, it enacts that the name of the proprietor ſhall be engraved on each plate; "and any printſeller, or other perſon, who ſhall engrave, etch, or in any other manner copy, and ſell, or cauſe to be engraved, etched, or copied and ſold, in the whole or in part by varying, adding to or diminiſhing from the main deſign, or ſhall print, reprint, or import for ſale any ſuch print or prints, "without the conſent of the proprietor firſt had and obtained in writing," ſigned by him in the preſence of two credible witneſſes, or knowing the ſame to be ſo printed, &c. without conſent of the proprietor, ſhall publiſh, ſell, or expoſe to ſale, then ſuch offender "ſhall forfeit the plate or plates" on which ſuch print or prints are or ſhall be copied, and all and every ſheet or ſheets (being part of or whereon ſuch print or prints are or ſhall be ſo copied or printed) "to the proprietor or proprietors of ſuch original print or prints," who ſhall forthwith deſtroy the ſame. And further, that every ſuch offender ſhall forfeit five ſhillings for every print which ſhall be found in his cuſtody, either printed and publiſhed, or expoſed to ſale; one moiety to the king and the other to the informer.—*Note*, Theſe penalties do not extend to purchaſers of plates from the original proprietors (ſ. 2.): and actions for offending againſt this act muſt be brought within three months (ſ. 3.)

The act of 7 Geo. III. c. 38. after reciting that the preceding act had been found ineffectual, enacts, that the original inventors, deſigners, or engravers of any print, "map, chart, or plan, or any other print whatſoever," taken from any picture, drawing, or ſculpture, are entitled to the benefit and protection of the recited and preſent acts; and by (ſect. 7,) *extends* the rights intended to be ſecured by this and the former act to the term of *twenty-eight* years.

A ſubſequent act (paſſed in the 17th of Geo. III.) ſtates, that the former acts have not anſwered the purpoſes for which they were intended, and that it is neceſſary for the encouragement of artiſts, that further proviſions ſhall be made. It therefore enacts, that if any engraver, etcher, printſeller, or other perſon, ſhall, within the time limited by the aforeſaid acts, engrave or etch, or cauſe, or procure to be engraved or etched, or worked, in "mezzotinto, or chiaro-ſcuro, or otherwiſe," copy; or who ſhall print, re-print, or import for ſale, any copy of any hiſtorical print, or any portrait, converſation, landſcape, or architecture, map, chart, or plan, or any other print whatſoever, which hath, or have been, or ſhall be engraved, etched, drawn, or deſigned "in any part of Great Britain," without the expreſs conſent of the proprietors firſt had and obtained in writing, then every ſuch proprietor ſhall and may in a ſpecial action on the caſe to be brought againſt the offending party, recover *ſuch* damages *as a jury* on the trial of ſuch action, upon the execution of a writ of enquiry thereon, "ſhall give or aſſeſs," together with "double coſts of ſuit."

The following are the moſt important caſes which have ſubſequently occurred, and which are introduced to ſhew the legal conſtruction which has been put upon the aforeſaid act of parliament, by magiſtrates of high authority.

In the ſittings after Hilary term, 25 Geo. III. before lord chief juſtice Manſfield, Sayer brought an action againſt Moore for pirating ſea charts. The charts which had been copied were four in number, which Moore had made into one large map. It appeared in evidence that the defendant had taken the body of his publication from that of the plaintiff; and that the plaintiff had originally been at great expence in procuring materials for theſe maps; but it was alſo proved that the defendant had made many material alterations and improvements thereupon. Lord Manſfield's addreſs to the jury upon this occaſion is remarkable and important. "The rule of deciſion in this caſe, he obſerved, is a matter of great conſequence to the country: in deciding it we muſt take care to guard againſt two extremes equally prejudicial; the one, that men of ability who have employed their time for the ſervice of the community, may not be deprived of their juſt merits, and the reward of their ingenuity and labour: the other, that the world may not be deprived of improvement, nor the progreſs of the arts be retarded: the act that ſecures copy-right to authors, guards againſt the piracy of the words and ſentiments; but it does not prohibit writing upon the ſame ſubject, as in the caſes of hiſtories and dictionaries: in the firſt a man may give a relation of the ſame fact, and in the ſame order of time; in the latter an interpretation is given of the identical words: in all theſe caſes, the queſtion of fact to come before a jury, is whether the alteration be colourable or not; there muſt be ſuch a ſimilitude as to make it probable and reaſonable to ſuppoſe that one is a tranſcript of the other; ſo in the caſe of prints, no doubt different men may take different engravings from the ſame picture. The ſame principle holds with regard to charts: whoever has it in his intention to publiſh a chart, may take advantage of all prior publications; there is no monopoly of the ſubject here, any more than in the other inſtances, but upon any queſtion of this nature the jury will decide whether it be a ſervile imitation or not. If an erroneous chart be made, God forbid it ſhould not be corrected, ſince it thereby becomes more ſerviceable and uſeful for the purpoſes to which it is applied: but here you are told that there are various and very material alterations: the defendant therefore has been correcting errors, and not ſervilely copying. If you think ſo, you will find for the defendant; if you think it a mere ſervile imitation, and pirated from the other, you will find for the plaintiff." [Verdict for defendant.] No action therefore lies in future for publiſhing ſea charts on an improved and more uſeful principle, even though many of the lines ſhould be copied from older charts.

In Eaſter term, 10 Geo. III. Wil. 60. Sayer loſt his action againſt Dicey for copying and ſelling a print, becauſe though the *year* of our Lord, wherein the original plate was publiſhed was engraved thereon, the *day of the month* was not.

In Michaelmas term, 33 Geo. III. 5 T. R. 41. an action was brought againſt Symonds and others, for pirating a portrait of the counteſs of Huntingdon. Bowyer was the original proprietor, and had aſſigned his right through Fittler to Thompſon, by whom the action was maintained. On becoming poſſeſſed of the plate, Thompſon had inſerted his own name in the inſcription inſtead of Bowyer's, "preſerving the original date" of 26th day of Auguſt, 1790; but the objection ſtarted on this ground was over-ruled by the court, and the plaintiff obtained a verdict and 10*l.* damages.

ENGRAVING, English, *Origin and Progreſs of.* In England, the *art* of engraving has gradually ariſen from its rude mechanical practice by our Britiſh anceſtors. It may be ſaid to be indigenous to our ſoil. Roman and Saxon improvements have from time to time been engrafted; and more recently, ſhoots from the engraving of Germany, Italy, and France, have alſo been engrafted by the enterprize of individuals, not by the wiſdom or authority of the ſtate, on the original ſtock. It will probably excite the ſurpriſe of poſterity, that *this* art has hitherto been cultivated, (if ſuch might be called cultivation,) in Great Britain in no other way, though Great Britain be the choſen ſeat of modern commerce; and engraving, being in its nature the moſt commercial of thoſe arts which adminiſter to calm and elegant enjoyment, affords the moſt efficient means of diffuſing through the world a juſt and general taſte in the fine arts, and, conſequently, in thoſe numerous branches of manufacture which are derived from, and ſuſtained by, thoſe arts.

That it was rudely practiſed in this iſland from a very early period, may be ſeen by the remains of inſtruments of war, and other antiquities which have been found in the Celtic and Saxon tumuli; theſe, as is obſerved by that intelligent artiſt and antiquary, the late Mr. Strutt, frequently bear marks of the graver, or of ſome tool which cannot have been very diſſimilar; and the numerous coins of Cunobelin muſt ſatisfy every inquirer of the early Britiſh exiſtence of this ſpecies of engraving, an art which was probably introduced from Rome during the reign of that prince.

The art of die-engraving could not have exiſted alone; it implies the exiſtence of other modes of ingenuity; and, with the uſe of money, muſt have ſpread the ameliorating influence of art. But all riſing ingenuity, and even this mode of engraving, appears to have ſunk under the Roman and Daniſh ravages, which ſoon ſucceeded. Excepting theſe coins, thoſe of Carauſius, and a few others of leſs certain date, and the war implements mentioned above, faint indeed are the traces of Britiſh engraving, until the time of Alfred the Great.

"Under the protection of that excellent monarch," ſays Strutt, "the arts begun to manifeſt themſelves in a ſuperior degree. He not only encouraged ſuch artiſts as were in England at the time, but invited others from abroad; and the works of the Anglo-Saxon goldſmiths, who were the principal engravers of that day, were held in the higheſt eſteem upon the continent as well as in their native country. The caſkets which they made for the preſervation of the relics of ſaints, and other pious purpoſes, were ornamented with precious ſtones and engravings in ſo excellent a ſtyle, as to excite the admiration of *all who ſaw* them." Wonder is the concomitant of ignorance. There is, however, yet preſerved in the Muſeum at Oxford a very valuable jewel of gold, adorned with enamelling, and a kind of fillagree work, in the midſt of which is ſeen the half figure of a man, which is ſuppoſed by Hickes and Wooton to repreſent Jeſus Chriſt, and conjectured by Strutt to be rather intended for St. Cuthbert. The back of this curious remnant of antiquity is ornamented with engraved foliage and flowers. From the unqueſtionable teſtimony of its own legend, this jewel is known to have been made at the command of Alfred the Great, and was one of the very few articles he could have carried with him when he retreated to the iſle of Athelney; where it has ſince been found.

Archbiſhop Dunſtan is ſaid to have worked in the precious metals, frequently adorning his works with images and letters which he engraved thereon. Oſbern (his biographer) calls him the firſt of engravers; but it has been emphatically obſerved, that he who could add the title of *Saint* to the name of Dunſtan, would not heſitate to call him a Raphael in painting, or an Audran in engraving; and the ſpecimen of his drawing, which is ſtill preſerved in the Bodleian library, leaves us little to regret in the entire loſs of his engravings.

The engraving of Dunſtan and his contemporary *workmen*, was doubtleſs the degenerate iſſue of the art which the patronage of Alfred had called forth. In the tempeſt of war, and the night of ignorance and ſuperſtition that ſucceeded, ſcarcely a glimmering of its light was ſeen. The mingled work of the engraver, chaſer, enameller, and goldſmith, which is ſeen in Alfred's jewel, entirely diſappeared, but die-engraving, as it afforded the means of iſſuing money, became to the Anglo-Saxon princes an art of neceſſity, becauſe inſeparable from the exiſting ſyſtem of government and polity; and hence, while other arts pined and periſhed, it was enabled to ſurvive the inclemency of thoſe barbarous ages, and to preſerve and tranſmit to better times the art of the engraver.

Laws of Athelſtan and Canute, appointing the number of minters who ſhall reſide in their principal towns, and for the puniſhment of thoſe who ſhall dare to adulterate the coinage of the realm, are ſtill extant, and may be read in Thwaite's obſervations on Anglo-Saxon and Anglo-Daniſh Coins.

It may be preſumed, that the art of die-engraving, and the weak tenures by which landed property was previouſly held, gave riſe to the engraving and the uſe of ſeals. Before their introduction, Ingulphus expreſly ſays, that lands were ſometimes diſpoſed of by word of mouth; ſometimes by laying a turf of the land granted with religious ſolemnity on the holy altar; and in other inſtances the lord gave to the tenant a ſword, bow, helmet, arrow, or drinking-horn to certify the tranſfer; a drinking-horn is mentioned by Lewis as being in the poſſeſſion of a Mr. Pyſſey of Berkſhire, on which was engraven, "I king Knoute (Canute) have given thee this horn to hold thy land by."

In corroboration of the idea that the numiſmatic proceſs ſuggeſted both the manner of engraving and of *uſing* ſeals, we may mention that the matrices of ancient Engliſh ſeals, of which ſome few are yet remaining, are formed with the ſame kind of cutting and punching implements which were uſed by the die-engraver; they were of braſs, as were probably the dies of that period, and from that time to the preſent, metal ſeals have continued to be executed with the ſame implements uſed in the ſame manner, or with no other variations than have been produced by the gradual improvement of ſociety operating on the peculiarities of individual talent: alſo (ſee Seal-engraving,) that they were at firſt impreſſed as money is coined, namely, by a forcible blow, and that *lead* received the impreſſion; and from the teſtimony of Ingulphus it further appears, that ſeals were by no means common in England before his time; he ſays that, "the Normans, diſliking the Engliſh manner of ratifying their chirographs (or charters), ordered them to be confirmed by impreſſions on *wax* from the ſpecial ſeals of the parties concerned. The only ſeal in England that is known to have been impreſſed on wax before this period, is that of Edward the Confeſſor; but as this prince is known to have received his education in Normandy, the ſingularity is accounted for.

From this time the uſe and ſacredneſs of ſeals went on increaſing in the public eſtimation, ſo that before the lapſe of a century, their devices, forms, and ſizes, appropriated to the different ranks in ſociety, were gradually ſettled. Even the etiquette of ſealing on different coloured waxes, was aſcertained with ſufficient ſcrupuloſity.

An impreſſion from the ſeal of Anſelm, the primate, has been copied, and is introduced (ſee *Pl. of Britiſh Engravings*, *fig.* 2.) from which ſome idea may be formed of the Anglo-Norman ſtyle of deſign and engraving, as compared with what had preceded it. The archbiſhop has loſt his head, and has probably been decapitated in effigy, on account of his cropped hair, and by ſome of thoſe reſentful partizans of the long and curled locks, which were faſhionable at the court of William Rufus. Againſt long hair, Anſelm had preached with ſome apparent ſucceſs, and with a vehemence which is highly extolled by Eadmer, his companion and ſecretary; but it has been obſerved, that though the clergy at that time could overturn thrones, and had authority ſufficient to ſend above a million of men on *their* errand, to the deſarts of Aſia, they could not prevail againſt certain faſhions.

It appears that ſome argillaceous ſubſtance, apparently pipe clay, has in this inſtance been mixed with the wax of the ſeal; which has afterwards been painted either with a view to its better preſervation, or to give the true tint of the rank of a Norman archbiſhop. The ſmall folded parchment to which it is appendant, or rather which depends from it (ſee the engraving) is a grant of church land. The prolixity of modern legal forms might bluſh before its brevity.

About, or ſoon after, the time now under our obſervation, a new ſpecies of engraving, more ſimple in its nature than thoſe which had preceded it, was either introduced into or invented in England; of which there is ſcarcely an old country church of any conſequence, but affords ſome curious ſpecimens, and England more than any other nation in Europe. The braſs plates on our old ſepulchral monuments are executed entirely with the graver; the ſhadows, where ſhadowing is attempted, being expreſſed by lines (or ſtrokes,) ſtrengthened in proportion to the required depth of ſhade, and occaſionally croſſed with other lines a ſecond, and in ſome inſtances a third time, preciſely in the ſame manner as a copper plate is engraven that is intended for printing. On other occaſions a mere outline only has been cut.

Theſe engraved effigies are often found cemented on thoſe horizontal tomb-ſtones, which form part of the pavement within the churches, where the feet of the congregation, which kept the lights bright by friction, filled the inciſions with duſt, and thus darkened the ſhades; very neat or exquiſite workmanſhip was not therefore aimed at, and is not to be expected; yet ſome of theſe engravings bear no ſmall evidence of the abilities of thoſe by whom they were performed, and conſidering the dark period during which they were executed, are entitled to more praiſe than many engravings which have been ſubſequently produced. The engraver's ſtyle of drawing the human figure differs little from that of the contemporary illuminators of miſſals, and though the hands, feet, and other nudities are rarely tolerable, the ſtiffneſs of the draperies does in many inſtances bear conſiderable reſemblance to the tiſſued and embroidered veſtments of the entombed abbots, and other dignitaries of the early Catholic church; while the faces occaſionally diſplay attempts not altogether ſucceſsleſs, as it ſhould ſeem, at individual portraiture.

That which has been ſelected as a ſpecimen of this mode of engraving, is from the tomb of William de Fulbourn, in Fulbourn church, Cambridgeſhire, and is copied, with the permiſſion of the Meſſrs. Lyſons, from their Magna Britannia. William de Fulbourn was appointed a baron of the exchequer in the year 1328, and is here repreſented (ſee the *Plate* of *Engliſh Engravings*, *fig.* 3.) "with the effigies of an eccleſiaſtic in a richly ornamented cope, under an elegant canopy, engraved on braſs," &c. &c. See Lyſons's Cambridgeſhire, p. 64. Part of the canopy and finale have been omitted on account of the ſmaller dimenſions of our plate. The pattern of the embroidery, as may be ſeen, is far from being inelegant, and the recurring initials, (W. F.) roſes, and other ornaments, are engraved with no inconſiderable care and neatneſs.

Philoſophers have remarked how frequently man has ſtumbled or ſtopt ſhort at the very threſhold of improvement. From the time of the Cruſades, Great Britain has been in poſſeſſion of an art of engraving from which ink might have been delivered, and conſequently impreſſions multiplied, either on the ſame vellum on which books were formerly written, or, ſince the middle of the 12th century, on paper itſelf: yet until about the year 1460, no man appears to have thought of delivering ink from the inciſions of the graver.

Whether accident or deſign, and whether Italy or Germany had the honour of giving birth to an invention, of which three centuries and a half have not ſerved fully to develope the important conſequences to ſociety, has been much diſputed among the curious. Mr. Strutt is among the number of thoſe who have purſued theſe inquiries with conſiderable diligence. After diſcuſſing the German and Italian pretenſions, he at length brings forward an impreſſion from an engraved braſs plate in his own poſſeſſion, which he conceives to be Engliſh, and which he thinks *may* claim the palm of early date. Its ſtyle of art is truly that of the early German ſchool, and alſo that of the engravers of the Engliſh ſepulchral braſſes of the fifteenth century; yet from another circumſtance, which ſhall be mentioned anon, the writer of this article is led to think that Mr.

Strutt's plate, and the tenor of his reaſoning thereupon, are more curious, than his concluſion is well founded.

Mr. Strutt ſays, "no one ſeems to have ſuppoſed that we could lay even the moſt diſtant claim to a rivalſhip (much leſs to a priority) with reſpect to the early practice of engraving, with any of the continental nations famous for the arts. But when we conſider how many engravers we had in England, about the time in which the diſcovery of taking impreſſions from copper-plates was made, as the many monumental engravings remaining in our churches to this day ſufficiently teſtify, (and a little examination of theſe early ſpecimens of the art will prove how well they were adapted to the purpoſe of printing,) we ſhall readily conceive that if they did not themſelves diſcover this mode of multiplying their works, they would at leaſt have inſtantly adopted it, as ſoon as the knowledge of ſuch an invention had reached them."

"There can be little doubt of the antiquity of the engraving here produced; and that it was made for the purpoſe of printing, the letters being reverſed upon the plate ſufficiently prove. So that if it ſhould be urged, though we ſee no kind of reaſon for ſuch a ſuppoſition, (this is ſurely more than ſtrict criticiſm will concede to Mr. Strutt,) that the plate itſelf was executed abroad, at the command of ſome Engliſh devotee, it muſt at leaſt be granted that the mode of taking impreſſions from it was underſtood in England, or the plate could not have been of any uſe to the owner of it; and that the engraving was the work of ſome Engliſh artiſt, *or* executed at the deſign of ſome Engliſh perſonage; no one, I conceive, will doubt on examining the contents of the inſcriptions. They conſiſt of particular invocations to ſaints, comprehended in ſeven compartments, the initial letters of each invocation or prayer being ornamented with the repreſentation of the perſonages to whom it is addreſſed." Here follows a particular deſcription of the ſeveral compartments.

"The addreſs to the Engliſh ſaints in the fifth petition, plainly, we think, determines the country to which it belonged. The ſtyle of the drawing, and the manner in which the little figures are compoſed, being placed in the initial letters, bear an exact reſemblance to the illuminated delineations which we meet with in manuſcripts of the fifteenth century, eſpecially towards the commencement of it; and the writing alſo has every appearance of equal antiquity."

If we ſhould proceed thus far with Mr. Strutt, and admit his reaſoning, it will ſcarcely be practicable to travel with him further, though he be in general, as to matters of fact, an excellent guide. The invocations, which cover the far greater part of the plate, are not in the Engliſh, but the Latin language, and Mr. Strutt informs his readers, that they are "evidently ſtamped upon the plate with ſmall punches, and re-touched afterwards with the graver." Now, no man would cut an alphabet of punches, (or puncheons, as they are ſometimes technically termed,) for the ſake of engraving, or ſtamping, ſuch a plate as Mr. Strutt has brought forward, nor would probably any cauſe of leſs magnitude than the formation of matrices for an alphabet of moveable types, induce an artificer to beſtow the time and pains, neceſſary to the production of ſuch an alphabet of puncheons. From this ſingle circumſtance, the preſent writer is inclined to refer the engraving in queſtion, in whatever country it may have been executed, to a period ſubſequent to the invention of moveable types; conſequently if it was executed in England, it muſt have been after the year 1471, when, according to Dr. Middleton, Caxton had returned from abroad, and began to print books in Weſtminſter Abbey.

Another reaſon, which does not ſeem to have preſented itſelf to Mr. Strutt, why the invention of printing with the rolling preſs from plates of metal cannot, in fairneſs, be aſſigned to England, is that to ſuppoſe this art to have been known here before the experiments of Finiguerra, we muſt alſo ſuppoſe that almoſt a century elapſed between the firſt and ſecond examples of Engliſh copper-plate printing, which is a thing not to be ſuppoſed for a moment.

Of the engravings that accompanied an edition of Veſalius's anatomy, which was printed in England in the year 1545, Mr. Ames ſays, "theſe plates are ſome of the firſt rolling preſs printing in England." Of theſe plates, Thomas Geminus, or Gemini, was the engraver: they were not the very firſt that were *publiſhed* here. "The birth of Mankind, otherwyſe called the Woman's book," made its appearance in 1540, and contains ſome ſmall anonymous copper-plate cuts, yet Geminus might poſſibly have begun his engravings more than four years before the date of their publication: at leaſt he is the firſt engraver in England of whoſe name we are in poſſeſſion, and whoſe works were printed on paper.

The firſt edition of Geminus's Veſalius was dedicated to king Henry VIII. He publiſhed a tranſlation by Nicholas Udal, of the ſame work, in 1552, and dedicated it to Edward VI. The tranſlator in his preface ſays, "Accepte therefore jentell reader, this treatiſe of anatomie, thankfully interpreting the labours of Thomas Gemini, the workman. He that with his great charge, watch and travayle, hath ſet out theſe figures in pourtrature, will moſt willingly be amended, or better perfected of his own workmanſhip, if admoniſhed."

Thoſe who have ſeen the maſterly wood engravings to the original Veſalius, publiſhed at Padua, in 1542, engravings that were done under the eye, and, as ſome have ſaid, touched by the hand, of Titian, will perceive that Gemini has left abundant room for admonition: yet the conſideration that his work was a firſt attempt, at once to tranſplant a new art to England, and to extend the knowledge of anatomy, will probably be received as no unſatisfactory apology for the defects of theſe engravings.

Gemini lived in Black-Friars: he printed and publiſhed other books, among which are a ſmall tract on midwifery, with copper-plate engravings, (which is, perhaps, the ſame that is mentioned above, under the title of "the Birth of Mankind, &c.") a prognoſtication relating to the weather, the phenomena of the heavens, &c. decorated with a number of cuts, and another edition of his Veſalius, printed in 1559, and dedicated to queen Elizabeth

Lord Orford has obſerved that, "ſo congenial an art as engraving, when once diſcovered, could not fail to ſpread in an age of literature. That accompliſhed prelate, archbiſhop Parker, who thought that whatever tended to enlighten and cultivate the human mind, was within his province, ſeems to have been the moſt conſpicuous patron of the art, in the reign of Elizabeth. He employed, in his palace at Lambeth, a painter and two or three engravers. Of theſe engravers, the chief was Remigius Hogenbergh, who twice engraved the archbiſhop's head, which, if Vertue be right, was the firſt portrait printed in England, from an engraving on copper; Remigius had a brother whoſe name was Francis, by whoſe hand is extant a print of queen Mary I. dated in the year 1555. Under it is written "Veritas Temporis Filia." In the ſet of Saxton's maps, thoſe of Gaul and Belgium are by this artiſt, and he has alſo engraved *views* both in Bruin's Civitates Orbis Terrarum, printed in 1572 at Cologn, and in Abraham Ortelius's Theatrum Orbis Terrarum, printed in 1570 at Antwerp. On the foreground of one of the views contained in the latter work, are two figures dreſſed in the coſtume of the times, one of which is the portrait of Ortelius himſelf, (as the inſcription beneath informs us); and the other that of Hoefnagle the engraver, who, though a native of Antwerp, was among the firſt of thoſe who practiſed the art in England. The map of England in this work was by Humphrey Lhuyd of Denbighſhire, and that of Spain by Thomas Geminus, whom we have already mentioned. Lord Orford thinks it creditable to England, that we had at this time, "profeſſors worthy of being employed to adorn Flemiſh editions; Flanders being at that time a capital theatre of arts and learning;" and Ortelius himſelf commends the Engliſh engravers, ſpecifying beſides thoſe whom we named, Antony Jenkenſon, and Robert Leeth.

Chriſtopher Saxton deſerves mention here, for at once extending the knowledge of our national geography, enlarging the field of engraving, and raiſing himſelf to eminence from the condition of a ſervant. He was a native of Yorkſhire, and lived at Tingley, near Leeds, in the ſervice of Thomas Sekeford, eſq. maſter of the Requeſts, and of the court of Wards. Encouraged by this gentleman, who kindly aſſiſted him with money, Saxton undertook to make a complete ſet of maps of the counties of England and Wales. Many of the plates he engraved himſelf, and in others was aſſiſted by Francis Hogenbergh, Nicholas Reynold, and Auguſtin Ryther. Six years were employed in the work, which commenced in the year 1573. Theſe were *the firſt* county maps that ever appeared in England, and Thoreſby ſays of that of Yorkſhire, which is three feet wide, that it is "the beſt that ever was made of that county." Ryther had the chief hand in engraving it, and at the corners are views of the city of York, and the port of Hull. Theſe maps are alſo adorned with the royal arms, and thoſe of the patron "Maſter Sekeford," and are dedicated to the queen.

In lord Orford's catalogue is a worthleſs portrait of George Hoefnagle, who engraved about this time a map of Briſtol, and a view of the palace of Nonſuch, which, though once ſo magnificent, is now only known from deſcription and the print of Hoefnagle. He worked entirely with the graver, and, as has already been mentioned, was one of thoſe employed by Ortelius, in his great work, which may truly be called ſo, when we conſider the time when, and the circumſtances under which, it was produced.

We have paſſed over Cole, Bettes, the de Brees, and others: and even the names of many of thoſe who ſerved to mark no era in the art of which we are here tracing the progreſs in England; who neither invented nor introduced a new ſtyle, nor diſtinguiſhed themſelves in thoſe which were previouſly known and practiſed; we ſhall paſs over them with a general reference to Strutt, Grainger, and lord Orford's catalogue, where their names and the dates of their works may be found, with ſuch liſts of their performances as thoſe authors, with the aſſiſtance of George Vertue, were able to form or collect.

Notwithſtanding the praiſe of Ortelius, Engliſh copperplate engraving retained, for more than an hundred years, much of its original coarſeneſs and vulgarity. The ſtyle of Reginald Elſtracke, who lived at the cloſe of the ſixteenth and beginning of the ſeventeeth centuries, is occaſionally ſomewhat neater than that of his predeceſſors, but ſtill deſtitute of taſte. His inſtrument was the graver, but faint indeed are the mental rays that attended its progreſs.

Elſtracke worked chiefly for the bookſellers; and his beſt works are portraits, which are for the moſt part, if not entirely, after his own drawings. They are in number at leaſt thirty; and among the beſt of them are thoſe of ſir Philip Sydney, engraved ſoon after his death, and "ΒΑΖΙΛΙΩLOGIA, or the true and lively Effigies of all our Engliſh Kings from the Conqueſt to the preſent time" (1618.) His portrait of queen Mary of Scotland is probably, on the whole, his beſt performance.

Francis Delaram was contemporary with Elſtracke. His workmanſhip, for it can ſcarcely yet be called art, and certainly not fine art, was ſomewhat neater than that of Elſtracke, but equally taſteleſs. The ſquareneſs or rectangularity of his croſſings gives a peculiar dryneſs to his ſtyle of engraving; he drew but indifferently, his outlines are hard, and his draperies heavy. Unleſs we may except the following plates, which are after his own deſigns, his portraits are the beſt of his works. The frontiſpiece for "Wyther's Preparation to the Pſalter," ornamented with emblematical figures, and dated 1619. The frontiſpiece to "The Seven golden Candleſticks," 1624. "Nero Cæſar, or Monarchie Depraved," 1627; this alſo is a frontiſpiece. And the beſt of his portraits are thoſe of "James the Firſt," an upright whole ſheet print, as large as life. "Queen Mary and Queen Elizabeth," ſmall uprights. "Henry Percy, Earl of Northumberland," dated 1619. "Frances, Ducheſs of Richmond and Lenox," and "Sir Thomas Greſham."

But the family of the Paſſes, or *de* Paſſes, of whom the elder came hither from Utrecht, early in the ſeventeenth century, introduced a better taſte, and a neater and more elaborate ſtyle of engraving than had hitherto been practiſed in England.

Criſpin de Paſſe was a man of letters, ſtudious, and of a liberal mind. Holland's Heroologia was embelliſhed and publiſhed at his expence; and in the preface to a drawing-book, publiſhed by him at Amſterdam, in the year 1643, (after his departure from England,) he diſcovers ſome knowledge in geometry and perſpective; gives directions for the proportions of the human body; for drawing in the academy by lamp light, and for the uſe of the lay-figure in ſtudying draperies; and details the proportions of horſes, lions, and other quadrupeds, and of birds and fiſhes. In the ſame preface he ſays of himſelf that he applied early to the ſtudy of the arts, and mentions Rubens, Bloemart, and other diſtinguiſhed contemporary artiſts, as his friends and encouragers: but he appears alſo to have looked with advantage at the neater productions of the German ſchool of engraving. The following is a tolerably juſt eſtimate of his powers as an artiſt, and is from the pen of the late Mr. Strutt.

"Paſſe worked entirely with the graver, in a neat, clear ſtyle, which has much originality; and, excepting ſome little ſtiffneſs which frequently appears, and the want of harmony with reſpect to the diſtribution of the light and ſhadow, (a fault which prevailed at the time in which he lived,) his beſt works poſſeſs a very conſiderable ſhare of merit, eſpecially his portraits, many of which he drew from the life; and the far greater part of his hiſtorical and emblematical ſubjects are engraved from his own compoſitions. He drew the human figure very correctly," (but the proportions and ſtyle of his figures are thoſe of the ſchool of Rubens,) "and marked the extremities with a degree of exactneſs, not uſually found in the works of thoſe maſters who employed themſelves upon ſmall ſubjects."

Mr. Strutt ſhould have recollected here, that exquiſite examples of delicate marking and elaborate workmanſhip might then have been ſeen, and, probably, were ſeen by Criſpin Paſſe, in the works of the Behams, Penz, and thoſe other German artiſts who are emphatically termed the *little* maſters; particularly in the engravings of Bartholomew Beham, who had ſtudied under Marc Antonio.

The ſons of this artiſt, who were Criſpin junior, William, and Simon, and his daughter Magdalen de Paſſe, followed the inſtructions and the ſtyle, and in ſome inſtances ſurpaſſed the merits, of their father; though the works of Magdalen, the firſt female engraver we read of who practiſed the art in England, are not equal to the beſt of thoſe of her brethren. In three plates from Ovid's Metamorphoſes, which ſhe has engraved after pictures by Elſheimer, ſhe has judiciouſly imitated the ſtyle of count Goudt, but has not produced the ſame forcible effect, nor attained the ſame exquiſite degree of finiſh. Liſts of the numerous portraits and other engravings by this family, may be ſeen in lord Orford's Catalogue, and Mr. Strutt's Dictionary of Engravers; and in the Royal library at Paris, before the revolution, was a collection of their works in large volumes, of which there were either two or three.

From Simon Paſſe the art deſcended to his pupil John Payne. Other engravers were practiſing in England at the time, but of inferior merit. Payne had caught the mantle of the Paſſes. Strutt ſays of him that "he was a man of genius, and though his works are not very numerous, they nevertheleſs manifeſt his ſuperior abilities. He was recommended to Charles I., and had a fair proſpect of making his fortune; but careleſs of that as he was of his fame, he neglected his buſineſs and died in indigence, A.D. 1647 or 48, before he had reached his 40th year. His chief engravings conſiſt of frontiſpieces and other book-plates, and portraits. But he alſo engraved a variety of other ſubjects, ſuch as landſcapes, flowers, &c. His portraits, however, are, in my opinion, by far his beſt works. Thoſe he executed entirely with the graver in a free open ſtyle, ſo managed as to produce a very pleaſing effect. Mr. Evelyn, ſpeaking of this artiſt, commends him alſo for a ſhip which he engraved. This ſhip, as Vertue informs us, was the Royal Sovereign, built by Phineas Pett. The print was of a prodigious ſize, and engraved on two plates, being, when joined, three feet long, by two feet two inches high." His beſt portraits are from Cornelius Janſen.

Having proceeded thus far with the progreſs in England of the art of engraving on *copper*, it behoves us to attend to the introduction and early progreſs of that of engraving on *wood*.

The art of engraving, and printing from, blocks of wood, was introduced into England about the ſame time with the mode of printing with the rolling preſs from engravings on copper: if, indeed, *wood* were really the material uſed for thoſe engravings which are called, and generally ſuppoſed to be, wood engravings, and which are common from the time of the firſt promulgation of the art through the fifteenth and the two following centuries, and where the printing ink is evidently delivered from "lines croſſing each other," and with the letter-preſs.

The earlieſt Engliſh engravings of this kind which the preſent writer has examined, unleſs thoſe which are publiſhed with the mark of Holbein are really by his hand, and were any of them performed after his arrival in this country, are thoſe of Chriſtopher Switzer, who lived at the cloſe of the ſixteenth and beginning of the ſeventeenth centuries. He was probably a German by birth, though he reſided in England. Vertue ſays, he cut a ſet of the broad ſeals of England, which may be ſeen in the Harleian library, but impreſſions from the blocks of coins and ſeals which he cut for Speed's hiſtory are not uncommon; and here the remarkable dark croſſings occur, and may be particularly obſerved in the four blocks which are entitled "portraitures of the ancient and of the more civil Britons." Speed calls this artiſt "the moſt exquiſite and curious hand of that age," and he probably was ſo, if we confine the remark to wood-engraving, and to England. Evelyn ſays of Switzer's ſon, who ſucceeded him in his profeſſion, and was alſo named Chriſtopher, "we have likewiſe a Switzer for cutting in wood, the ſon of a father, who diſcovered his dexterity in the herbals ſet forth by Mr. Parkinſon, Lobel, and divers other works with due commendation;" which ſhews that the elder Switzer engraved the blocks of botanical ſubjects for Lobel's obſervations, and Parkinſon's "Paradiſus Terreſtris," which was publiſhed in 1629.

It may have been perceived that of the fact of dark lines croſſing each other, being printed from the ſurfaces of engraved blocks and with the letter-preſs, the preſent writer entertains conſiderable doubt. His doubt is founded on the extreme difficulty, amounting to impracticability, though not to abſolute impoſſibility, of cutting away the minute lozenges of wood, or interſtices between the croſſed lines, ſo as to leave ſuch a ſurface of dark croſſings as muſt have preſented itſelf to the letter preſs printers of this period.

To print dark croſſings from the inciſions of the graver, and with the rolling-preſs, may be conceived to be comparatively eaſy: but as printing from the *ſurface*, and with the letter preſs, was preferred on account of its ſuperior facility, we are reduced in reaſoning upon theſe engravings, if we ſuppoſe them to have been performed on *wood*, to the monſtrous abſurdity of ſuppoſing, that a difficult and tedious, was preferred to a ſimple and eaſy proceſs, and that on account of its ſuperior facility!

Theſe conſiderations have led to the ſuppoſition that the prints in queſtion were not taken immediately from the engravings, but from caſts of ſome kind, for which the engravings, on whatever ſubſtances they were performed, did but ſerve as matrices or moulds. Yet wood cannot be caſt in moulds: and in the library of Mr. Anthony Carliſle, profeſſor of anatomy to the Royal Academy (whoſe name is, undeſignedly on the part of the author, omitted in a note to the volume of lectures on engraving delivered at the Royal Inſtitution, p. 205.) are two books illuſtrated with letter preſs engravings, which appear to contradict the above hypotheſis. It may not be impertinent here to tranſcribe a paſſage from the *manuſcript* of the lecturer.

"I have to regret that this part of the lecture is ſo little better than a ſtatement of doubts. Since this volume has been in the preſs, I have ſeen, in the library of Mr. Carliſle the anatomiſt, a copy of Johnſon's tranſlation of Ambroſe Parey's anatomy, printed in 1691, which is illuſtrated with letter preſs engravings where dark croſſings frequently occur, and in the preface to which the author ſays, 'the figures in this work are not the ſame uſed by my author; but according to thoſe of Bauhine, which were uſed in the work of Dr. Crook.' Upon referring to the latter work, which I found in the ſame library, and which was printed in 1631, it was evident that the prints were not copies, but impreſſed from the very ſame engravings: but there was this remarkable difference which *ordinary* incredulity could ſcarcely ſtand againſt, that in Johnſon's work the prints were obviouſly impreſſed from ſome ſubſtance which had been *worm-eaten* in the courſe of the ſixty years it had lain by, and which could not therefore have been *metal*." The remainder of this note would be ſuperfluous: the inference is obvious. But, the public muſt not be led aſtray, nor muſt the author of that note let paſs this opportunity of controverting himſelf.

It has ſince come to his knowledge, and is an undoubted fact, that old lead is not unfrequently found perforated by worms, or by ſome ſmall animalculæ, which leave behind circular holes of exactly the ſame kind and ſize, which we ſo frequently ſee in old wooden furniture, books, &c. He reſumes therefore his opinion, and indeed a further and more particular inſpection of the productions of this kind, of the German ſchool, has confirmed his belief, that the numerous prints produced at this early period in Germany and the Low Countries, which are ſuppoſed to be impreſſed from engravings on wood, are really printed from metal caſts.

As Dr. Crook's anatomical work was publiſhed but two years after Parkinſon's Paradiſus Terreſtris, it is probable that one of the Switzers engraved the anonymous anatomical figures which are the ſubjects of the above comments. The art of engraving, on whatever ſubſtance was then employed to enable the printer to produce dark croſſings from the ſurface of the work, was an exotic tranſplanted from Germany or the Low Countries, and appears never to have taken root in our ſoil. It died away with or ſoon after the Switzers, and has never revived ſince: for the art of engraving on wood, as practiſed by the Bewicks of Newcaſtle and their diſciples, and imitators, is to be conſidered as quite a diſtinct art. But, for further information on this ſubject, ſee Letter Press Engraving, and Wood Engraving.

Contemporary with the younger Switzer and with Hollar, of whom we ſhall preſently treat, were Robert VanderVoerſt and Lucas Vorſterman, who were rival competitors for public fame, and rivals alſo in the favour of king Charles I. Charles was the firſt Engliſh monarch who was ſufficiently ſenſible of the beauty of engraving, and of the popular and important purpoſes to which it might be applied, to appoint an engraver royal. The king took care to ſee that the title was not worthleſsly thrown away, in mere kindneſs to a courtier, and Voerſt was the firſt artiſt on whom that honour was conferred. He was a native of Holland, and in what year he came hither is uncertain. He was an able draftſman, and hatched his drawings with pen and ink, as was the general cuſtom of the artiſts, particularly the engravers, of that period. A drawing of this kind performed on vellum, and of which the ſubject was the Madonna with the infant Jeſus and St. John, he had the honour of preſenting to the king, for whom he afterwards engraved a portrait of his majeſty's ſiſter, and a plate from a picture which Vandyke painted to ſupply the place of that one of Titian's Cæſars which by ſome accident had been loſt or deſtroyed: ſo that Voerſt's title was not merely nominal. He engraved alſo from Vandyke, the portraits of Charles I. and his queen; (from the ſame celebrated picture which has been ſubſequently engraved by Vertue) that of the queen alone; ſir Kenelm Digby, Inigo Jones, and ſeveral others, of which a liſt may be ſeen in lord Orford's catalogue. He handled his graver in a bold, free, and commanding ſtyle.

The ſtyle of Vorſterman exhibits more careful finiſhing and painter-like feeling, and muſt on the whole be allowed to be ſuperior to that of his rival. He was to Rubens and Vandyke in England, and the Low Countries, what Marc Antonio was to Raphael in Italy. He may be ſaid at once to have ſucceſsfully tranſlated and ſtereotyped the great originals of thoſe very diſtinguiſhed painters.

Mr. Strutt ſays of him with great truth that no one ever engraved more ſucceſsfully from the pictures of Rubens: than whom, no painter that ever lived had the pleaſure of ſeeing ſo great a number of his pictures finely engraved. Vorſterman drew the human figure with correctneſs and taſte. He was maſter of the graver, and could handle it with the utmoſt facility; but he paid much greater attention to the general effect of his prints, than to the regularity of the ſtrokes; and like Gerard Audran, wiſhed to enter into the thoughts of the maſter, and tranſcribe on copper the very life and ſpirit of his pictures, rather than ſhew his own dexterity in the mere mechanical part of the workmanſhip. The heads of his figures are finely drawn, and the extremities marked in a very maſterly manner. Vertue mentions with approbation two drawings by Vorſterman, namely, a portrait of prince Henry, and a woman's head, after Leonardo da Vinci.

This celebrated engraver was a native of Antwerp, but from whom, or whether from any maſter, he learned the principles of painting and engraving, does not appear. He came over into England about the year 1623, and was occaſionally employed both by king Charles I. and the earl of Arundel. His engravings are numerous, and chiefly from Rubens, Vandyke, and Holbein. Among thoſe which may be mentioned with diſtinction are; from the former maſter, "The fall of the Damned," (a large upright); "The battle of the Amazons," a large and grand plate, printed on ſix ſheets; "Lot leaving Sodom;" "The temptation of Job;" "Suſanna and the Elders," and ſeveral others, particularly the "Return from Egypt," which he has treated in a manner differing from his uſual ſtyle, and more bold and open. From Vandyke he has engraved a dead Chriſt, ſupported on the lap of the Virgin, and a conſiderable number of admirable portraits, among which are thoſe of Charles I. and Vandyke himſelf; and from Holbein, he has engraved "Thomas duke of Norfolk," with the ſtaves of lord treaſurer, and earl Marſhal, "Eraſmus, ſir Thomas More," and the painter himſelf. Sir Thomas has here a flatter face and ſmaller bonnet than in other pictures of him; and from the circumſtance of Holbein's pencil being placed in his left hand, may be inferred, not that this print was a copy from another without being reverſed on the copper (as lord Orford has ſurmiſed) but that Holbein painted with his left hand: a truth which the painter here meant to ſay of himſelf, and which the engraver has faithfully reported.

Nor muſt the illuſtrious name of ſir Anthony Vandyke be omitted, in enumerating thoſe of the artiſts who contributed to accelerate the progreſs of Britiſh engraving. The portraits which he etched of Snyders, Vorſterman, Paul Pontius, and other diſtinguiſhed artiſts who were his contemporaries and friends, excited the juſt ſurpriſe and emulation of the painters and engravers of that age, and the beſt of them have continued to the preſent to be examples of excellence. Among the beſt may be reckoned that head of himſelf, looking over his ſhoulder, where he has introduced the golden chain which he had the honour of receiving, together with his majeſty's picture in miniature, at the hands of Charles I. a circumſtance which ſerves to ſhew that he etched this plate at leaſt, and preſumptively others, after his arrival in England. In ſome of thoſe which he had previouſly executed, we ſee him contending, as it were, againſt the difficulties of his own imperfect knowledge of the newly acquired art, and that his plates are accordingly blurred with accidental ſcratches, and blotted and ſtained with foul biting, which all the ſkill of Bolſwert, Neeffs, and Vorſterman, who ſeverally employed the graver in finiſhing moſt of his draperies and ſome of his faces, has not been ſufficient to obliterate or conceal. His ſtyle of etching is original, vigorous, free, and expreſſive, and in ſome inſtances he has finiſhed his heads with conſiderable care. The tranſcendental taſte and judgment which he has ſo amply diſplayed in his pictures, guided and determined his hand in etching, and though nearly two centuries, which have boaſted of their refinements, have elapſed ſince the period of their production, his "Ecce Homo" and his portraits, ſtill preſerve their ſtations in the collections of the taſteful, and are ſtill eſteemed among the moſt highly valued ſtudies both of the portrait painter and engraver. By liberating Britiſh portrait engraving from the ſtiff regularity of the graving tool, which had before been too much regarded as a teſt of merit, Vandyke extended the views of the taſteful, while he taught the true value of outline, and light and ſhade.

It would not now be eaſy to aſcertain the preciſe time when that important branch of engraving, which is technically termed *etching*, (for an explanation of its proceſs, ſee the article ETCHING,) was introduced into England. Ortelius's and Bruin's publications contain ſome prints where etching appears to be mingled with the work of the graver, but if they are by Engliſh artiſts, thoſe artiſts probably acquired their knowledge of etching in Flanders, where they practiſed it; and on the whole it ſeems highly probable, that no etching was performed in England till the period of Vandyke's and Hollar's reſidence in London, and that the honour of having introduced it belongs to one or the other of theſe diſtinguiſhed characters. Vandyke was here and in high favour at the court of Charles I. when Hollar arrived, but whether he had then performed any of his admirable etchings is no where recorded; and as they are without dates, cannot now be eaſily aſcertained. As neither of theſe diſtinguiſhed men was the diſcoverer of an art, though each was the inventor of a ſtyle, it may be enough to believe it highly probable, that Vandyke was the firſt perſon who etched portraits in England, and Hollar the firſt who etched landſcape and natural hiſtory.

It is not certain, that William James Delft, or *Van* Delft, (for he was ſo named from the place of his nativity,) was ever in England. Yet from his ſtyling himſelf the king of England's engraver, and engraving portraits of Charles I., his queen Henriette Maria, and the duke of Buckingham, it ſhould ſeem to be not improbable that he ſucceeded Voerſt. Strutt ſays of him, that "he drew and painted portraits with great taſte, and in a ſtyle that acquired him conſiderable reputation; but as an engraver of portraits he is more generally known, and in that light only I ſhall conſider him. He worked entirely with the graver, and handled that inſtrument with the greateſt facility. He drew correctly, and his beſt prints are very finely finiſhed. Conſidering the great number of plates which were completed by the graver of this artiſt, it is not reaſonable to ſuppoſe they ſhould be all alike or equal in merit. Accordingly I ſhall diſtinguiſh two manners in which he engraved, and produced many excellent plates in both: firſt, a bold, powerful open ſtyle, productive of a fine effect; and as a ſpecimen of it I would refer the reader to the portrait of Hugo Grotius, dated 1632: ſecondly, a neat and much more finiſhed manner, as we find in the admirable portrait of Michael Miravelt (a near relation to the engraver,) from a picture of Vandyke." From the pictures of Michael and John Miravelt, he engraved a conſiderable number of portraits.

Wenceſlaus Hollar, who has been already named, if not the firſt perſon who practiſed the art of etching in England, was the firſt who particularly diſtinguiſhed himſelf in etching landſcape, ſhipping, antiquities, and natural hiſtory.

This diſtinguiſhed artiſt, a gentleman by birth, was a native of Prague in Bohemia, and intended by his parents to have been educated to the ſtudy of the law; but the civil commotions which happened in his youth, and which led to the memorable battle of Prague, obliging them to abandon this intention, and his genius for art diſcovering itſelf about the ſame time, he was placed under Marian, an able deſigner and engraver of views, and by the time he had attained the age of nineteen, Hollar produced two plates, of which the ſubjects were an Ecce Homo and a Madonna, and child, (the latter from Albert Durer,) which drew forth the notice of the public, and confirmed the hopes of his friends. In the courſe of the next year (1636,) he engraved another of Albert Durer's Madonnas, and a plate which the ſuperſtitious might regard as ominous of his future fate, of "Fortune ſurmounting a Globe," which was alſo from Albert Durer.

He ſoon afterwards excelled in drawing geometrical and perſpective views and plans of buildings; ancient and modern churches and abbies, cities and towns; landſcapes; and various kinds of natural and artificial curioſities, ſome of which he executed with a pen in a very maſterly and peculiar ſtyle. To this art of drawing with a pen, he ſubſequently added the uſe of water-colours, which he occaſionally, in the treatment of ſuch ſubjects, as butterflies, beetles, &c. heightened and enriched with gilding in a very beautiful manner, as the volume of his drawings now in the poſſeſſion of John Townley, eſq. F. R. S. and F. A. S. of Park ſtreet, Weſtminſter, abundantly teſtifies.

After paſſing ſome years in travelling through Germany, during which he drew and engraved views of Frankfort, Wurtſburg, Cologn, and other of its principal cities; but where he met with little encouragement: the earl of Arundel, then on an embaſſy to the Imperial court, met with him at Cologn, and being ſtruck with his uncommon abilities, and particularly delighted with a large drawing of Prague, which Vertue ſays, "was curiouſly and exactly done with the pen and pencil," took him under his protection, and Hollar travelled in the ambaſſador's ſuite, from Cologn to Mentz, Prague, Nuremberg, Augſburg, Wurtſburg, Frankfort, Regenſburg, Vienna, and finally to England, where it is ſaid the noble earl recommended him to the favour of king Charles I.

There is ſome reaſon to fear that lord Arundel's patronage of Hollar was more nominal than real; and that the vanity of the patron was more gratified, than the fortune of the artiſt was promoted, by their connection. That Hollar was left deſtitute by the death of this nobleman, notwithſtanding that political, were then added to his profeſſional, merits, (for he was a zealous adherent to the cauſe of royalty and lord Arundel,) is freely excuſed on the ground of his lordſhip's own reverſe of fortune, but it appears to imply more neglect than the liberal would elſe be diſpoſed to impute to this nobleman, that during the firſt year of Hollar's arrival in England he was under the neceſſity of drawing and etching his view of Greenwich, which is more than two feet in length, for the paltry ſum of thirty ſhillings! Yet the reader muſt wiſh in vain for a more honourable contraſt between the parſimony of Stent, who purchaſed a *commodity* of Greenwich, with no other view than to enrich himſelf by the profits it might produce; and the liberality of the exalted peer, who deſerved his exaltation as the patron and protector of talent, alive to the charms of art, and kindling with the flame of contemporary genius.

But it muſt be candidly allowed that the art of Hollar had little affinity with that of Vandyke, and, ſo dependent is the judgment in fine art of ſome men, upon the opinions of others, that the merit which lord Arundel thought he had diſcovered at Cologne or at Prague, might have faded in his own eſtimation when he approached the light of the court of London. Notwithſtanding his own partiality and native feeling for the merits of Hollar, Vertue is obliged to confeſs of him that "it is certain he could not ſo well enter into that maſter's (Vandyke's) true manner of drawing in his grace and touches, as other engravers, ſome in England and others abroad, who had ſtudied his way or manner of drawing and painting; for which reaſon "he could not obtain Vandyke's recommendation, nor that of his admirers." Portrait painting was then the reigning faſhion in England, and as the national taſte for art was baſking in the meridian ſplendour of the powers of Vandyke, it is not ſurpriſing that the leſs fortunate and more humble claims of Hollar were little ſeen, and met with ſmall comparative encouragement.

Though the warmth of lord Arundel's patronage might perhaps be damped by theſe cauſes, he continued in ſome degree to befriend our artiſt. On his arrival in London, Hollar ſat down with his habitual induſtry to engraving, and after producing his large plate of Greenwich, which ſhewed what he could do in this department of engraving, put aſide for a time his talents for landſcape and natural hiſtory, in order to accommodate himſelf to the public occaſions and the prevailing taſte, and ſoon completed an equeſtrian portrait of his patron, with two plates of king Richard II. kneeling before his patron ſaints, from an ancient altar folding table, and ſome other works from the Arundelian collection, including the curious cup which was deſigned by Andrea Mantegna.

In the year 1641, which was the year of Vandyke's deceaſe, he engraved ſome portraits, including thoſe of the king and queen, from the pictures of that celebrated painter. He had now been introduced to teach drawing to ſome branch of the royal family. Vertue thinks it was to teach prince Charles, having "ſeen a book mounting the arms or badge of the prince of Wales, (the crown and feathers,) wherein were drawings of parts of faces, &c. to begin to learn from, with ſome of Hollar's hand-writing:" but in an inſcription under his portrait, publiſhed at Antwerp in 1648, and which inſcription is ſuppoſed to have been ſupplied by himſelf, he ſays, he "had been domeſtic ſervant to the duke of York."

However this may have been, the civil wars which broke out ſoon after this maſterſhip or ſervitude, toſſed Hollar about with the royal party, ruined his better hopes, and obliged lord Arundel to return into Flanders. The engraver being left behind, reſolved to try the fortune of war, and entering the army under the command of the marquis of Wincheſter, was made priſoner at Baſing-houſe, in Hampſhire, from which having, with ſome difficulty, effected his eſcape, he went over to Antwerp, in the year 1645, and once more ſought the patronage or conſolation of the earl of Arundel. He remained in that city for ſome years, endeavouring, through means of his art, to retrieve his ſhattered circumſtances; but his patron going to Italy for the benefit of his health, and dying at Padua in 1646, Hollar was left to the accidents of precarious encouragement and the avarice of trade. He fell again into diſtreſs, and was obliged to work for the book and printſellers at very low prices.

Under ſuch circumſtances were produced his book of heads, after da Vinci; his thirty-eight plates of ſhells, with many other ſubjects from the Arundelian collection; a conſiderable number of landſcapes after Breughel, Elſheimer, Teniers, and other maſters, and a ſtill greater number of portraits, among which were thoſe of Charles I., Charles II. when a youth, after Vandyke, the duke of York, after Teniers, which is now become very ſcarce, and his own portrait, after Meyſens. At the period of the reſtoration Hollar returned to England, where, though he found ſufficient employment to occupy his time, the prices he received for his engravings were ſo very inadequate to the labour which they neceſſarily required, that he could but barely ſubſiſt; and the plague putting for ſome time an effectual ſtop to buſineſs, and being ſoon after ſucceeded by the fire of London, the pecuniary embarraſſments of our artiſt were greater than ever, of which Leake, Jennings, Mark, and thoſe other dealers, for whom, in the courſe of the years 1666 and 67, he engraved various views and plans of London, before and after the great fire, did not fail to take advantage.

"Born to misfortune as the ſparks fly upwards," it was ſoon the fate of Hollar to turn his hopes once more toward the court, for that protection and encouragement which commerce blindly refuſed him; and in the years 1668 and 69 he was employed by government under the orders of lord Howard, to make drawings of the town and forts of Tangiers, which he afterwards engraved. In this perilous ſervice, he narrowly eſcaped being killed or made priſoner by the Turks. The ſhip, on board which he had embarked for England, the Mary Roſe, Capt. Kempthorn, fought ſeven Algerine Corſairs off Cadiz, and had eleven men killed and ſeventeen wounded; but Hollar eſcaped unhurt, and had afterwards the honour of engraving a plate of the battle.

On his return to England, he received no more for the difficulties and dangers which he had encountered, the drawings he had made, and the year he had ſpent in this arduous ſervice, than one hundred pounds; and this, according to Vertue, was not obtained till after long attendance at the public offices, and experiencing many of thoſe rebuffs "which patient merit from the unworthy takes."

From this time till the year 1677, when death put a final period to his exertions, he ſpent much of his time in travelling through the northern counties of England, and delineating and engraving their topography, and produced thoſe plates which are now objects of ſo great curioſity, and will be yet more highly valued by poſterity, as ſhewing what England was (and what Hollar was) during the reign of Charles II. The plates for Thoroton's Nottinghamſhire and Sandford's Genealogical Hiſtory, were engraved in the courſe of the three laſt years of his life.

He uſed to work for the mercenary book and printſellers at the rate of fourpence an hour, always having an hour-glaſs before him; and was ſo ſcrupulouſly exact, that when obliged to attend the calls of nature, or whilſt talking, (though with the perſons for whom he was working, and about their own buſineſs,) he conſtantly laid the glaſs on its ſide, to prevent the ſand from running. Yet notwithſtanding his exemplary induſtry, and this rigid adherence to principle; notwithſtanding his extraordinary merit as an artiſt; notwithſtanding his loyalty and the paſt favour of lord Arundel and Charles I., Hollar died poor and miſerable, after a life of viciſſitude, and for the moſt part of ſuffering.

During the diſſolute reign of the ſecond Charles, who was to liſten to the claims of modeſt and retired merit? The delighted purchaſers of his "Seleucus," after Julio Romano; his "Fountain of Pleaſures;" or his "Queen Sheba viſiting Solomon," (as will be the caſe under any reign where *patrons* are content to be acquainted with contemporary art only through the medium of paraſites and dealers,) were either heedleſs of what befel their author, or were deceived into the belief that he was at leaſt comfortably provided for; and while Stent, Overton, Green, and the reſt of the dealers of that day, enjoyed their fire-ſides in comfort, or rioted in the lap of luxury, on the profits of his works, the engraver of more than two thouſand plates, which are ſince ſought for through Europe, and moſt of which are after his own deſigns, expired in the very act of intreating the bailiffs, who had entered his wretched apartment, for a little forbearance.

Hollar's plates are for the moſt part etchings, touched here and there, where ſuperior clearneſs was wanted, or the aqua-fortis had not accompliſhed its purpoſe, with the graver. His ſmall plates are ſuperior to his larger; his ſtyle of handling his etching-needle is pleaſing, and was original; and, in the accuracy, freedom, lightneſs, ſpirit, and finiſh of his cities, abbies, cathedrals, and ſome other of his landſcapes, and his plates of natural hiſtory and ſtill life, he much excelled his contemporaries; even thoſe on the continent: but in drawing the human figure he was not equally well informed, and his hands and feet are therefore often defective.

In conformity with the falſe preference which faſhion had conferred on works performed ſolely with the graving-tool, he attempted to execute ſome plates with the graver only, but has here failed of the ſucceſs that attended him in etching.

Hollar appears to have been a meek-tempered man, and to have wanted the neceſſary confidence in his own powers or the public taſte, to venture on publiſhing any of his own engravings; though Vertue aſcribes this effect to a different cauſe, which, no doubt, was at leaſt a concomitant, he ſays, "I don't find that at any time he worked for himſelf, to ſell or publiſh, as has been cuſtomary with profeſſors of that art (engraving) when they had ſubſtance of their own, or friends and intereſt ſufficient." Alas! what is ſociety if it befriend not the ingenious.

The innate love of engraving muſt be ſtrong in ſome minds, or the neceſſity of practiſing that art muſt be imperious, for Hollar to have left ſucceſſors. The truth, however, is, that in the department of his art, in which Hollar's merit chiefly reſided, he had no ſucceſſor, for Barlow, of whom we ſhall preſently ſpeak, was an Engliſh painter, who merely learned of him the proceſs of laying etching-grounds and uſing aqua-fortis; and William Carter, Daniel King, and Thomas Dudley, who were all natives of England, and pupils of Hollar, rather followed him to the grave, than ſucceeded him in art. The former was uſed occaſionally to aſſiſt his maſter; imitated feebly his ſtyle of etching; and is the engraver of the vignette head-pieces to Ogilby's Homer, and probably of many other of thoſe anonymous book-plates that ſome collectors aſcribe to Hollar. King is ſomewhat more conſpicuous. He publiſhed "The Vale Royal of Cheſhire" from his own drawings; and engraved for Dugdale's Monaſticon, and ſome other plates of topographical ſubjects. Dudley has occaſionally ſubſcribed himſelf "quondam condiſcipulus W. Hollar," and Mr. Strutt's account of him is as follows. "He was a native of England, and one of the pupils of the famous Hollar, whoſe manner of engraving he imitated. But though he never equalled his maſter in the lightneſs of his point or freedom of execution, his etchings are not without merit. His moſt conſiderable work was a ſet of cuts for the life of Æſop, prefixed to the laſt edition of his Fables, publiſhed by Barlow. He alſo etched the portrait of biſhop Ruſſel, which is ſubſcribed Thomas Dudley Anglus fecit 1679."

R. Gaywood has alſo been mentioned as a diſciple of Hollar, but he etched no views, or other landſcapes, and in engraving portraits employed leſs of etching; and, in ſhort, did not confine himſelf to the ſtyle of that maſter, but blended with it what he acquired from ſtudying Vorſt, Vorſterman, and the other engravers of the Vandyke ſchool.

Gaywood engraved a conſiderable number of portraits, among which are thoſe of queen Mary of Scotland, with a croſs; the counteſs of Portland, Holbein, Vandyke, and Dr. Fauſtus. The only hiſtorical engraving of any conſequence from his hand is the couchant Venus of Titian, which was once in king Charles's collection, and ſince in that of the earl of Cholmondeley.

Of Francis Barlow much more may with the greateſt truth be aſſerted. This artiſt was a native of Lincolnſhire, but in what year he was born was not known. He received his firſt inſtructions in art from a portrait painter of ſmall note of the name of Shepherd, and if he learned the uſe of the engraver's inſtruments from Hollar, he formed a ſtyle for himſelf.

The inventive powers of Barlow were extremely fertile. His great merit lay in deſigning and etching quadrupeds, birds, fiſhes, inſects; in ſhort, the whole volume of animated nature appears to have been open to his view, and in this reſpect, he is the fitteſt of all men to be the companion of that great moral philoſopher Æſop, whoſe fables he has ſo admirably embelliſhed. His human figures, which with conſiderable judgment he occaſionally introduced, exhibit the dreſſes and manners of his age; he had obſerved the natural inſtincts and cuſtoms of animals, and has delineated them with a fidelity which is ſurpriſing; and his landſcape back grounds often aſſume a grandeur which could only reſult from elevated ideas of art.

His compoſitions ſhew that he had ſtudied the animal and landſcape painters who preceded him, as well as nature herſelf, with advantage. In forming his ſtyle of etching, he has evidently looked at the animals of Hollar, yet is original, vigorous, free, and ſo happily varied, as to expreſs the feathery and hairy ſurfaces of birds and quadrupeds with a degree of ſucceſs which none of his predeceſſors, and only Hollar among his contemporaries, will bear to be compared with.

The frontiſpiece to his Æſop's fables, where Æſop himſelf appears ſurrounded by animals; the angler and entreating fiſh, with its landſcape accompaniments; the proſtrate camel; the battle of the frogs and mice; and the oak, and reed bending before the ſtorm, may be mentioned with diſtinguiſhed praiſe. His foxes, camels, aſſes, and wolves, are in general moſt excellent, and all his birds are ſo, without exception: but his lions, wherever they occur, are either ideal lions, and not well conceived, or ſhew that he had once ſeen and drawn from a bad model, and repeated it wherever he had occaſion for a lion.

Part of "Monk's funeral" is Barlow's engraving: and ſeveral of the plates for Edward Benlowe's "Theophila," publiſhed in folio, A. D. 1652; and ſome of thoſe for Ogilby's Virgil, are alſo deſigned and etched by Barlow.

That at ſome period of his life he had travelled northward, may be ſeen in the print which F. Place has engraved after his drawing of "the Baſs Iſland," wherein he has introduced ſoland geeſe, curlews, gulls, and all the varieties of Northern ſea fowl; and if he ſailed thither from any port of Scotland, it was probably during this journey that he ſaw in the latter country an eagle ſoaring with a cat in its talons, of which he afterward engraved a ſpirited plate. This anecdote is recorded both by lord Orford and Mr. Strutt, who agree in ſtating that Barlow witneſſed this contention in the air whilſt he was drawing a view in Scotland, and that the cat's reſiſtance had the effect of bringing both animals to the ground.

At one period of his life, probably towards its cloſe, he reſided near the ſign of the Drum in Drury-lane. That he was induſtrious is atteſted in the great number of his productions: yet notwithſtanding this circumſtance, and the praiſe of ſuperior excellence to which he is ſo juſtly entitled: and notwithſtanding the aſſiſtance of (Mr. Strutt ſays) "a conſiderable ſum of money," (he does not ſay how much) which was left him by a friend, he died in indigent circumſtances in the year 1702.

Francis Place has ſometimes been ſpoken of as if he had learned etching of Hollar, but in a letter to Mr. Vertue he denies this; and indeed the ſtyle which he adopted and the number of plates which he has engraved after the drawings and pictures of Barlow, teaches us rather to think he muſt have ſtudied under that maſter, if under any maſter at all. Lord Orford ſays "his prints are very ſcarce," but in a book which contains "ſixty-ſeven excellent and uſeful prints of birds and beaſts" after Barlow, to which modern ſtudents and even academicians are not a little indebted, and worn impreſſions of which book may now be purchaſed of Carington Bowles for half a guinea the ſet, are twenty plates of a moderate ſize, which bear the name of Place, beſide others which on a critical inſpection may be ſeen to be from the ſame hand. The birds in theſe prints are etched with ſo much of the ſpirit and feeling of Barlow himſelf, that they might well be ſuſpected to be his own performance, but for the name of Francis Place, which is annexed; nor are his graſſy foregrounds, and the foliage and ramifications of his trees leſs excellent.

"This ingenious artiſt was the ſon of Mr. Rowland Place, of Dinſdale, in the county of Durham." When young he was articled as clerk to an attorney in London, where he continued till the year 1665, when certain officers coming to ſhut up the houſe where he reſided, on account of the plague, he took the opportunity of quitting a profeſſion that did not accord with his inclination, "and of following (ſays lord Orford) the roving life he loved, and the arts for which he had talents."

In the courſe of his various rambles, he drew, painted, and engraved, as inclination prompted or opportunity occurred, beſides diſcovering ſome occaſional diſpoſition to mineralogical reſearch, and ſkill in the manufacture of pottery.

He drew and engraved views of Tinmouth caſtle and light houſe, the cathedral of York; Scarborough caſtle, ſeveral plates for Thoreſby's Topography of Leeds, beſide various other views in England, Wales, Scotland, and Ireland, and the figures for Godartius's book of inſects.

His former biographers agree in affirming that during the reign of Charles II. he was offered a penſion of 500*l. per annum*, to draw the royal navy, but declined accepting it, having a competence without, and from his natural love of independence and diſlike of confinement. He died in the manor houſe of York in the year 1728.

Beſide the etchings which are here enumerated, and ſeveral others, Place engraved the portaits of biſhop Crewe, general Lambert, and Richard Thompſon, in mezzotinto: to treat of the diſcovery and introduction of which art, we muſt return back a few years.

Mr. Evelyn has been juſtly ridiculed by lord Orford, for the myſterious and paradoxical manner in which he announces prince Rupert's diſcovery of mezzotinto. It is, perhaps, one of the moſt honeſt, moſt candid, and moſt happily expreſſed, of the numerous pages which his lordſhip has written on the ſubject of fine art. "Ancient ſages, ſays he, uſed to wrap up their doctrines, diſcoveries or nonſenſe, in ſuch unintelligible jargon: (as Mr. Evelyn's) and the baby world, who preferred being impoſed upon to being taught, thought themſelves extremely obliged for being told any ſecret which they could not comprehend. They would be reckoned mountebanks in this age, who ſhould pretend to inſtruct without informing; and one cannot help wondering that ſo beneficent a nature as Mr. Evelyn's ſhould juggle with mankind, when the inventor himſelf had conſented that the new art ſhould be made public.

"It is a trite obſervation that gunpowder was diſcovered by a monk, and printing by a ſoldier. It is an additional honour to the latter profeſſion to have invented mezzotinto. Few royal names appear at the head of diſcoveries; nor is it ſurpriſing. One cannot expect that many of the leaſt common rank ſhould be bleſſed with uncommon abilities. Quickneſs to ſeize and ſagacity to apply are requiſite to fortuitous diſcoveries. Gunpowder, or printing, might have fallen in many a prince's way, and the world have been ſtill happy or unhappy enough not to poſſeſs thoſe arts. Born with the taſte of an uncle whom his ſword was not fortunate in defending, prince Rupert was fond of thoſe ſciences which ſoften and adorn a hero's private hours, and knew how to mix them with his minutes of amuſement without dedicating his life to theſe purſuits; (like us, who, wanting capacity for momentous views, make ſerious ſtudy of what is only the tranſitory occupation of a genius.) Had the court of the firſt Charles been peaceful, how agreeably had the prince's congenial propenſity flattered and confirmed the inclination of his uncle! How the muſe of art would have repaid the patronage of the monarch, when for his firſt artiſt ſhe would have preſented him with his nephew! How different a figure did the ſame prince make in a reign of diſſimilar complexion! The philoſophic warrior, who could relax himſelf into the ornament of a refined court, was thought a ſavage mechanic, when courtiers were only voluptuous wits. Yet if the prince was defective in the tranſient varniſh of a court, he at leaſt was adorned by the arts with that poliſh which alone can make a court attract the attention of ſubſequent ages.

"Going out early one morning during his retirement at Bruſſells, he obſerved the centinel at ſome diſtance from his poſt, very buſy doing ſomething to his piece. The prince aſked the ſoldier what he was about? he replied, the dew had fallen in the night, had made his fuſil ruſty, and that he was ſcraping and cleaning it. The prince looking at it, was ſtruck with ſomething like a figure eaten into the barrel, with innumerable little holes cloſed together like friezed work on gold or ſilver, part of which the fellow had ſcraped away.

"The *genie ſecond en experiences*, from ſo trifling an accident conceived mezzotinto. The prince concluded that ſome contrivance might be found to cover a braſs plate with ſuch a grained ground of fine preſſed holes, which would undoubtedly give an impreſſion all black; and that by ſcraping away proper parts, the ſmooth ſuperficies would leave the reſt of the paper white."

Communicating his idea to Wallerant Vaillant, a reputable painter then in the neighbourhood of Bruſſells, they made ſeveral experiments, and at laſt invented a ſteel roller with projecting points or teeth like a file, which effectually produced the black ground, and which being ſcraped away, or diminiſhed at pleaſure, left the gradations of light.

Such was the invention of mezzotinto according to lord Orford, Mr. Evelyn, and Mr. Vertue; but the baron Heinnekin affirms that "it was not prince Rupert who invented the art of engraving in mezzotinto, as Vertue and ſeveral other authors pretend to ſay; but it was the lieutenant colonel de Siegen, an officer in the ſervice of the landgrave of Heſſe, who firſt engraved in this manner; and the print which he produced was a portrait of the princeſs Amelia Elizabeth of Heſſe, engraved as early as the year 1643. Prince Rupert, he adds, learned the ſecret from this gentleman, and brought it into England when he came over the ſecond time with Charles II."

The preſent writer has not ſeen the print thus ſpoken of by the baron: and the preciſe date of prince Rupert's diſcovery is no where mentioned. But if a mezzotinto engraving dated ſeventeen years before the reſtoration can be produced, and the date be genuine, it certainly goes far toward proving Heinnekin's aſſertion. Vertue acknowledges to have ſeen an oval head of Leopold William, archduke of Auſtria, in mezzotinto, that was dated in 1656, which he eſteems the earlieſt. It is inſcribed "Theodorus Caſparus á Furſtenburgh canonicus ad vivum pinxit et fecit;" but this argues little againſt prince Rupert's diſcovery, ſince it is quite within probability that Caſparus might have learned the art from the prince or Vaillant during their reſidence in the Low Countries.

The earlieſt of Rupert's engravings in mezzotinto, that is now extant, is dated in 1658. It is an half length figure from Spagnoletto: the ſubject, an executioner holding a ſword in one hand and in the other a head, which is probably intended for that of John the Baptiſt, and upon the ſword are the initials R. P. F. ſurmounted with a coronet. It is further diſtinguiſhed by the following inſcription on a tablet beneath "SP in RVP. P. fecit. Francofurti. anno 1658 M. A. P. M."

Return we now to the hiſtorical progreſs of Engliſh *engraving*, properly ſo called; referring to the word MEZZOTINTO, for the improved modern proceſs of that branch of the art.

Lord Orford ſpeaks of William Faithorne the elder with diſtinguiſhed praiſe, and has given a tolerably correct liſt of his engravings, which he has ſeparated into five claſſes, and to which the reader, who may wiſh to arrange the works of Faithorne, is referred. He lived at the ſame period with Hollar, and about the year 1654 in the very ſame houſe; but the year of his birth has not been aſcertained. He was the diſciple of Peak, the painter and print-ſeller, who was afterwards knighted, for whom he worked three or four years. With Peak he eſpouſed the royal cauſe, when the civil wars broke out between king Charles and his parliament; and with him, and probably with Hollar alſo, was taken priſoner at Baſing-houſe; from whence he was ſent to London, and confined for ſome time in the priſon of Alderſgate. In this uncomfortable ſituation he exerciſed his ſkill as an engraver; and here he produced a ſmall head of the firſt Villiers duke of Buckingham, which is in the circular ſtyle of Mellan.

At the ſolicitation of his friends, he was releaſed from confinement, and permitted to retire to France: though Graham ſays, he was baniſhed for refuſing to take the oaths of allegiance to Cromwell, and that he ſtudied ſeveral years under Champagne.

Vertue, who received his accounts of Faithorne from Mr. W. Hill Clark, and Mr. Bagford, lord Orford's librarian, ſeems to diſcredit theſe facts; but all agree that he found protection and encouragement in France from the abbe de Marolles, and obtained improvement under the juſtly celebrated Nanteuil.

The latter indeed is ſufficiently obvious in his engravings. At his return to England, which lord Orford thinks was before the time of the protectorate, he married a ſiſter of captain Cround, by whom he had two ſons, and opened a print-ſhop oppoſite the Palſgrave-head tavern, without Temple-bar, aſſuming the ſign of the Ship. Here he not only followed his art, but ſold Italian, French, and Dutch prints, and alſo the engravings of other Engliſh artiſts; ſome of which are ſtill to be ſeen with the ſubſcription "ſold by William Faithorne." And here he appears to have remained about 30 years.

"Some time after the year 1680," ſays lord Orford, "Faithorne quitted his ſhop, and retired to a more private life in Printing-houſe yard, Blackfriars; ſtill engraving, but chiefly painting from the life in crayons, in which art he had formerly received inſtructions at Paris from Nanteuil." He alſo painted miniatures, and drew portraits in black and white. Faithorne was a robuſt and vigorous man; but the miſconduct and conſequent misfortunes of his ſon William, broke down his frame and ſpirits, and he died in the year 1691, and was interred in the church of St. Anne, Blackfriars.

The principal part of his engravings appears to have been executed during his reſidence near Temple-bar, where he alſo wrote and publiſhed a "Treatiſe on Engraving," A.D. 1662, which he dedicated to his former maſter, ſir Robert Peake. The contents of this book, as diſplayed in the title page, are as follows: "The Art of Graving and Etching, wherein is expreſſed the true way of graving on Copper; alſo, the Manner and Method of that famous Callot and Mr. Boſs, in their ſeveral ways of Etching."

Portraits conſtitute by far the moſt numerous part of this artiſt's works. He worked almoſt entirely with the graver, in a free and clear ſtyle, paying more attention to the beauty of his lines than moſt of his Britiſh predeceſſors. In the early part of his life, he ſeems to have followed the Dutch and Flemiſh manner of engraving; but on his return from France, his improvement was evidently conſiderable. His portraits are his beſt works; and the beſt of his portraits are juſtly admired for their delicacy, freedom, and force of chiaro-ſcuro.

Mr. Strutt has diſtinguiſhed the following among the more valuable of Faithorne's hiſtorical engravings: "a holy Family," from S. Vouet, a middling ſized plate, in the ſtyle of Couvy; "a dead Chriſt," from Vandyke; "the laſt Supper," without any painter's name, in folio; "Chriſt praying in the Garden," the ſame; "the Marriage of Cana in Galilee," an etching, the ſame; "the Scourging of Chriſt," from Deepenbeck. Under this latter print is written "Faithorne Sculp. Antwerp, 1657," which date ſeems to have eſcaped the notice of Vertue, and to falſify the opinion that lord Orford, on his authority, had formed, that "Faithorne returned to England before the protectorate."

His portraits, as has been already intimated, are too numerous to be detailed in this place.

William Faithorne the younger was far inferior to his father as an artiſt. His principal works are portraits, ſcraped in mezzotinto, of which Vertue has particularized about thirty, with three prints of fancy ſubjects, and a head of St. Mary Magdalen.

John Fillian was alſo a diſciple of the elder Faithorne, whoſe ſtyle and ſome of whoſe portraits he copied. He was living in 1656, but died at an early age. His principal works are, "a Head of his Maſter," looking over his ſhoulder, which is copied from a print by Faithorne himſelf; the portraits of "Thomas Cromwell," and "Paracelſus," and the "Frontiſpiece" to Heylin's Coſmography, in folio.

Of Peter Lombart, Vertue has been able to trace little, but that he came from Paris, and returned thither after remaining for ſome years in England; to which Strutt adds, that he was a native of France, and came into England before the revolution.

He worked in a neat, laboured ſtyle, and diſcovers but little taſte. His drawing is frequently incorrect; his outlines hard; his ſhadows deficient in force and boldneſs; his lights of too low a tone, and even his engravings after Vandyke are deficient in *force*, though he has diſcovered a tolerable eye for the *harmony*, of chiaro-ſcuro. Yet he worked after the pictures of the greateſt maſters: after Raphael, Guido, Pouſſin, Annibal Carracci, and Vandyke. Among the beſt of his engravings are, "the laſt Supper," a large upright, from Nicholas Pouſſin; "the Angel appearing to Joſeph," after Ph. Champagne; "the Cruciſixion," from the ſame maſter; the "Frontiſpiece," and ſeveral other plates for Ogilby's Virgil. Among his portraits from Vandyke is that of "Charles I." on horſeback, a large half-ſheet print. From this plate he afterwards eraſed the face, and ſubſtituted that of "Cromwell;" and at a ſubſequent period, "with the vicar of Bray's graver," as lord Orford wittily ſays, reſtored the king's.

Vertue has enumerated twenty other of his portraits, which are chiefly after the ſame maſter; and to them may be added a ſet of twelve half-lengths of rather a large ſize, of which ten are portraits of celebrated ladies of the court of king Charles.

Notwithſtanding his reſerve in communicating prince Rupert's diſcovery of mezzotinto, John Evelyn, eſq. of Wooton, in Surrey, is entitled to honourable mention in this place. He was the firſt Engliſh gentleman who wrote upon the ſubject of engraving; and though his "Sculptura" be deficient in artiſtical knowledge and feeling, it is a work of conſiderable erudition, and has contributed not a little to the advancement of the art; while it clearly evinces his love for engraving, the excellence of the example which he wiſhed to ſet, and the general goodneſs of his heart. Lord Orford handſomely ſays of him: "If Mr. Evelyn had not been an artiſt himſelf, as I think I can prove [that he was], I ſhould yet have found it difficult to deny myſelf the pleaſure of allotting him a place among the arts he loved, promoted, patronized; and it will be but juſtice to inſcribe his name with due panegyric in theſe records, as I have once or twice taken upon me to criticiſe him: but they are trifling blemiſhes, when compared with his amiable virtues and beneficence; and it may be remarked, that the worſt I have ſaid of him is, that he knew more than he always communicated."

The duration of the life of this great contributor to learning and the arts was protracted to 86 years, and he died in 1705.

It appears now to be agreed among the connoiſſeurs, that the five ſmall prints of Mr. Evelyn's "Journey from Naples to Rome," which his biographer thought were etched by Mr. Hoare, are Evelyn's own performances; and to theſe Mr. Strutt has added a "Portrait of Dobſon" the painter, from a picture by himſelf.

David Loggan was a native of Dantzick; he was born about the year 1635, and died in 1693. From Simon Paſs, in Denmark, he is ſaid to have received his earlieſt inſtructions in engraving; he afterwards reſided in Holland, where he ſtudied under Hondius; and a ſhort time before the reſtoration he came to England.

His drawings of All-Soul's college being taken great notice of at Oxford, he was requeſted to undertake plates of the public buildings in that univerſity. By theſe engravings he firſt diſtinguiſhed himſelf; and at Oxford he remained a conſiderable time, and married Mrs. Jordan of a good family, near Witney. In the latter part of his life he reſided in Leiceſter fields, London; where he died.

In ſatiriſing the vanity of a certain dramatic poet, Dryden ſays,

> "And in the front of all his ſenſeleſs plays,
> Makes David Loggan crown his head with bays."

Yet as Loggan's merits as an engraver were not ſuch as to crown his own with laſting reputation: his *name* will probably live much longer than his works will be cared for. He etched very little, and his ſtyle of engraving, though it has a certain degree of neatneſs, is ſtiff and taſteleſs. His portraits, of which he executed a conſiderable number, are chiefly after his own drawings in black lead, which he handled with more ability, at leaſt with a better taſte, than his graver.

Vertue has enumerated 76 portraits from the hand of Loggan, of which the principal are, three plates of "Charles II.;" "Mother Louſe of Louſe-hall," which it ſeems added much to his contemporary reputation; and "George duke of Albemarle," a half-ſheet print, and probably his beſt portrait from the life. He alſo engraved two views of "Cambridge;" a whole ſheet view of "King's "College Chapel" in that univerſity; ſeveral views of public Buildings at Oxford; and eleven plates of the "Habits of the Academics" at that univerſity, which are entitled, "Habitus Academicorum Oxoniæ à Doctore ad Servientem;" and had (what ſeems an odd thing) a licence for fifteen years for vending his "Oxonia Illuſtrata."

With David Loggan came over from Holland Abraham Blooteling and Gerard Valck, men of ſuperior talents, though probably of inferior addreſs. Vertue informs us, that whilſt in England, Blooteling received thirty guineas (a large price in thoſe days) for an etching of the duke of Norfolk. His powers were various: he etched, engraved, and ſcraped in mezzotinto. His etchings are ſpirited and free; and his mezzotintos of a clear grain, and tolerably well drawn. About eighteen of his portraits are enumerated by Vertue, of which the principal are, "Anthony earl of Shafteſbury," one of the ſcarceſt of Blooteling's works; and "Prince Rupert," after ſir P. Lely. The portrait of "Admiral Kortenaer," a large upright, from Bartholomew Vander Helſt, is not among thoſe mentioned by Vertue.

After remaining ſome few years in England, Blooteling returned to Amſterdam; and in the year 1685, publiſhed there the "Gems of Leonardo Auguſtino," from plates etched by himſelf.

Gerard Valck was originally Blooteling's ſervant, (perhaps apprentice,) but afterwards married his ſiſter. Some of the beſt engravings, or beſt parts of thoſe engravings, which were publiſhed in the name of Loggan, are probably the performances of Valck, who alſo aſſiſted Peter Schenck in his large Dutch Atlas, publiſhed in 1683. Lord Orford ſays, that he "engraved one of the fineſt prints we have: it is the famous "Ducheſs of Mazarine," ſitting in very looſe attire, with one hand on an urn;" but this praiſe is more than the engraving deſerves. His other works are, a "Bathſheba bathing," from B. Graat; and the portraits of "Robert Lord Brooke," and "John Duke of Lauderdale." Vertue knew of no other plates that were entirely engraved by Valck.

Notwithſtanding the "Sculptura" of Evelyn, and the merits of Hollar, Barlow, Faithorne, and the engravers of the Vandyke ſchool, the taſteleſſneſs and diſſolute manners of the court of Charles II. had now reduced the art of engraving to a very low ebb. Its records are ſcarcely more than thoſe of the commoneſt trade.

Edward le Davis was of Welſh extraction, and, having ſome inclination for the arts, was articled as an apprentice to David Loggan. Being maltreated by his miſtreſs, who obliged him to wear a livery, and follow her as a ſervant, he abſented himſelf, went over to France, and became a dealer in pictures. On his return he drew and engraved ſeveral portraits, and ſome other ſubjects; but their merits are inconſiderable. Vertue mentions the names of nine of theſe portraits, of which the moſt remarkable are, "King Charles II." ſeated, whoſe face was afterwards eraſed from the copper, and that of William III. ſubſtituted in its ſtead; "Queen Catherine of England," a large whole length; and "James Duke of York," a large head in an oval, ſurrounded by flowers. Le Davis alſo engraved an "Ecce Homo," after Caracci, which is become ſcarce; and "a Merry Andrew," after Frank Hals.

About the ſame time with Blooteling, Michael Burghers was alſo driven hither by the troubles in the United Netherlands, and ſettled at Oxford. His works are executed entirely with the graver, in a ſtiff, laboured ſtyle: and his drawing of the human figure very defective. The moſt valuable of his engravings are the antiquities, conſiſting of ancient pavements, ruined monaſteries, &c. which he executed for that indefatigable antiquary, Thomas Hearne. Mr. Strutt, ſpeaking of them, ſays, "though we cannot admire the taſte with which they are executed, yet they become eſtimable, becauſe they ſtill continue to us an idea of thoſe monuments of antiquity, which time had otherwiſe obliterated for ever."

Excepting theſe, his beſt prints are probably a few which he copied from Mellan, wherein he imitated the ſpiral ſtyle of that ſingular maſter, and among which are, a large "Face of our Saviour," executed in a ſingle ſpiral line; and "a Frontiſpiece" to Creech's tranſlation of the Satires of Horace, a much ſmaller plate. He alſo engraved ſome few of the "Oxford Almanacks," beginning (though the plate appears without his name) in the year 1676, and did ſeveral other plates, among which are the old chapel of Queen's college, before it was pulled down, for that learned univerſity; ſometimes adding to his name, when he inſcribed it beneath his engravings, "Academiæ Oxon. Calcographus."

Peter Vanderbank was an engraver of more merit. He was born at Paris, though probably of Dutch anceſtors. and ſtudied under De Poilly. He arrived in England about the year 1674, and here he married the ſiſter of Mr. Foreſter of Bradfield, in Hertfordſhire. Lord Orford ſays, he "was ſoon admired for the ſoftneſs of his prints, and ſtill more for the ſize of them; ſome of his heads being the largeſt that had yet appeared in England." But ſoftneſs and admiration are comparative terms; and the reader muſt not ſuppoſe that his portraits are in that reſpect comparable with thoſe of Nanteuil or Houbraken. Yet the merit of paying more attention than had hitherto been paid in England to the manual part of engraving is certainly his; and this circumſtance, added to the large dimenſions of many of his plates, occaſioned them to occupy ſo much time, that he was by no means adequately compenſated for his labour. After ſtruggling for a time with poverty, print-dealers, and the low taſte of the times, he retired without compromiſing his merits, and found an aſylum under the friendly roof of his brother-in-law at Bradfield, where he died in the year 1697.

"After his death, his widow diſpoſed of his plates to Brown, the print-ſeller, who made great advantage of them, and left an eaſy fortune."

Vanderbank engraved ſome plates after Verrio's pictures at Windſor, but by far the greater part of his works are portraits, of which Vertue has enumerated no fewer than fifty! which, conſidering the large ſize of ſome of them, is no trifling evidence of his profeſſional diligence. Thoſe of moſt importance are, "King Charles II." in his greater robes, after Gaſcar, (done the year after Vanderbank's arrival;) another portrait of Charles, two feet four inches high, by two feet wide! "King James II." after ſir Godfrey Kneller, large; "Mary his Queen," ditto; ſeparate plates of "King William" and "Queen Mary;" "Thomas Lamplugh, archbiſhop of York," which is one of the fineſt of his works; and two heads of Waller the poet, at the ages of twenty-three and ſeventy-ſix.

Arthur Soly, William Elder, John Drapentier, Robert Jackſon, Francis Bragge, Paul Vanſomer, Nicholas Yates, John Collins, Simon Gribelin, William and John Clarke, and R. Tompſon, who all lived and engraved about the time now under our obſervation, are unworthy of particular notice. "The art of engraving," ſays Vertue, "had ſunk ſo low about the cloſe of the century, that Verrio, Cooke, and Laguerre, could find no better artiſts to engrave their deſigns than Gribelin and Vanſomer." "He might in juſtice have added," obſerves lord Orford, "that the engravers were good enough for the painters."

Of Robert White, who was born in London in the year 1645, and died in 1704, little more can be ſaid, except on the ſcore of his drawings in black-lead, and his profeſſional induſtry, which, judging from the number of his engravings, may well excite our ſurpriſe. Vertue praiſes his portraits more than they will be found to deſerve as engravings. Yet all his biographers agree that the merit of producing a ſtrong likeneſs was certainly his, and in portrait engraving this is the firſt of merits.

The preſident of the Royal Academy (Mr. Weſt) is in poſſeſſion of ſome of his pencil drawings on vellum, which are ſuperior to his prints; and ſir Godfrey Kneller thought ſo well of them, that he painted White's portrait in return for drawings of his own and his brother's, from the hand of the engraver. The reader will find White's portrait of ſir Godfrey in Sandrart's lives of the painters.

From David Loggan he learned the rudiments of engraving, and in the year 1674, which is two years before Burghers was employed on the "Oxford Almanack," White produced the firſt of that ſeries.

For the generality of his portraits for books, which are diſfigured by the broad borders that were then the faſhion, he received at the rate of four pounds each, with the occaſional addition of ten ſhillings; thirty pounds, which was paid him by Mr. Sowters of Exeter for a portrait of the king of Sweden, (which the preſent writer has not ſeen, but which was probably of much larger dimenſions,) has been ſpoken of as an extraordinary price. So great, however, is the number of his engravings, that in the courſe of forty years he ſaved from four to five thouſand pounds; and yet, ſay his biographers, (with little reflection copying each other,) by ſome miſfortune or ſudden extravagance, he died in indigent circumſtances at his houſe in Bloomſbury. The reader, probably, will not readily believe, that the habits acquired by the patient profeſſional induſtry of forty years, could plunge into ſudden extravagance.

Of his own works he made no regular collection, but when he had done a plate, rolled up two or three proofs, and flung them into a cloſet, where they were found in heaps. Many of theſe proofs may now be found in the collections of thoſe curious perſons who take Grainger for their guide.

The plates which he had by him were, after his deceaſe, ſold to a printſeller in the Poultry, who in a few years, according to lord Orford and Mr. Strutt, enriched himſelf by the purchaſe. Vertue expreſſes his honeſt diſpleaſure that ſo large a portion of the produce of our engraver's induſtry ſhould devolve to the dealer; but ſo it has ever been: and if he complains for White, how loudly ſhould he complain for Milton!

The number of his portraits of which Vertue has collected the names, are two hundred and ſeventy-five, of which, two are ſcraped in mezzotinto, and all the reſt engraved in lines. Some few of Robert White's plates are finiſhed by his ſon George, who chiefly practiſed in mezzotinto, but engraved a few plates in lines, of which the principal one is a large portrait of "James Gardiner," biſhop of Lincoln.

John Sturt, the pupil of White, who was born in London in the year 1658, and lived to the age of ſeventy-two, was a man of ignorant ingenuity. His principal work is the "Book of Common Prayer," which he engraved on ſilver plates. The top of every page is ornamented with a ſmall hiſtorical vignette. Prefixed is the buſt of George I. in a circle, and facing it the prince and princeſs of Wales. The peculiarity of this work is, that the lines of the king's face are expreſſed by writing, ſo ſmall that few perſons can read it without a magnifying glaſs, and that this writing conſiſts of the Lord's prayer, the Ten Commandments, prayers for the royal family, and the 21ſt Pſalm. So that here are prayers which cannot be read, and a head which might have been better produced with a hundredth part of the labour. This *uncommon* Common Prayer Book was publiſhed by ſubſcription in London in the year 1717. It was in large octavo, and was followed by a "Companion to the Altar" of the ſame ſize, and executed in the ſame manner. Sturt was alſo the firſt man who poſed the wondering multitude of "microſcopic wights," by engraving the Lord's Prayer within the area of a circle of the dimenſions of a ſilver penny.

To this wonder-niggling ſtate was engraving reduced, when, at the commencement of the new century, ſir Nicholas Dorigny ſhone forth on the darkened arts of England. He was born in France, and was a younger ſon of Michael Dorigny, by a daughter of Vouet the painter. His father dying whilſt he was young, he was brought up to the ſtudy of the law, which he purſued till he was about thirty years of age: being then examined, in order to his admiſſion into the corps of advocates, the judge found him very difficult of hearing, and accordingly adviſed him to relinquiſh a profeſſion for which he was in this reſpect ſo ill qualified by nature. He took the advice, and immediately applied himſelf to drawing with great aſſiduity. After a year's experience in this art he repaired to Rome, where his brother at that time reſided, and here he followed painting for ſome years; when, having acquired great freedom of hand, and being uncommonly docile and flexible in his diſpoſition, he followed the recommendation of certain friends, who adviſed him to ſtudy etching. In this art he produced ſeveral works of merit, but the engravings of Audran, which were now the topic of general and juſt encomium, convinced him that the ſtyle he had adopted was ſuſceptible of great improvement; and he employed *ten years* in emulating the vigour and grandeur of that diſtinguiſhed artiſt. He had now etched many plates, and among them the ſeries from the fable of "Cupid and Pſyche," after Raffaelle, when, feeling that he had not acquired that command of the graver which was neceſſary to the harmonious perfection which he contemplated, he abandoned engraving for a ſhort time and returned to his pencils. "A word from a friend," ſays lord Orford, "would have thrown him back to the law:" this, however, it is not eaſy to believe.

After two months re-application to painting, he reſolved to acquire that power over the graver, of which he had ſo ſtrongly felt or fancied the neceſſity. All theſe feelings and reſolutions are thoſe of an artiſt of genius. With a little inſtruction, he rapidly acquired the knowledge and power of which he was in queſt, and begun to engrave the ſet of "Seven Planets," after Raffaelle; in which he ſucceeded ſo well, that he was now emboldened to undertake Raffaelle's "Transfiguration," the accompliſhment of which raiſed his reputation to an extraordinary height.

Being known to ſeveral Engliſh noblemen and gentlemen of rank, who at that time reſided in Italy, he was perſuaded to come to England, and undertake to engrave the Cartoons. He arrived in June 1711, but experienced ſome diſappointment, and was not enabled to begin his drawings till the year following, the intervening time being ſpent in raiſing a fund to enable him to proſecute his intended work.

At firſt it was propoſed that the plates ſhould be engraved at queen Anne's expence, and that the impreſſions ſhould be given as preſents to the nobility, foreign princes, miniſters, &c.; but this was too liberal even for what has been emphatically called the Auguſtan age of England, which had now commenced. Dorigny eſtimated the expences at four or five thouſand pounds, but though the lord treaſurer Orford exerted himſelf greatly in the cauſe of the artiſt, he could not obtain the ſum, and this plan was conſequently rendered abortive.

The engraver had, however, an apartment aſſigned him in Hampton Court palace, and the work was at laſt undertaken by a public ſubſcription, at four guineas the ſet.

The labour of ſeven plates of the large dimenſions that were reſolved on, appearing too great for the hand of a ſingle individual, who was not young, Dorigny was induced to ſend to Paris for aſſiſtance; and for the firſt two or three years obtained that of Dupuis and Duboſc, who both quitted him before the engravings from the Cartoons were half completed.

In ſomewhat leſs than ſeven years, however, from the date of his arrival, (namely, on the 1ſt day of April, 1719,) Dorigny had the honour of preſenting two complete ſets of theſe celebrated engravings (with an engraved dedication) to king George I., one ſet to the prince, and another to the princeſs, when he received from his majeſty a purſe of a hundred guineas, and a medal from the prince; and the duke of Devonſhire, of whom he had borrowed four hundred pounds, freely remitted the intereſt for four years. His reputation from this time continued to increaſe through Europe, and in the year following, he received the further honour of knighthood from the hand of his majeſty.

In a few years after the completion of the Cartoons, the eyes of our engraver began to grow dim, and either this circumſtance, or the natural inclination of man to return to the place of his nativity, occaſioned his return to Paris, where, in the year 1725, he was made a member of the Royal Academy of Arts, and where he died at the advanced age of eighty-nine.

His drawings from the old maſters, chiefly after Raffaelle, Dominichino, Guercino, and Daniel de Volterra, have been much admired, and have ſold for conſiderable ſums; and beſides the plates mentioned above, he engraved "St. Peter curing the lame Man," a large upright from Civoli, which is one of his early works, and in the dark manner of his father; "The Deſcent from the Croſs," after Daniel de Volterra, a very fine engraving; the "Martyrdom of St. Sebaſtian," after Dominichino, an upright, and equally meritorious; "The Holy Trinity," from Guido; and a few other plates from A. Carracci, Lanfranc, and Louis Dorigny, his brother.

When the late period of life at which Dorigny began to uſe the graver is conſidered, the power which he acquired over that inſtrument muſt be regarded as extraordinary: the art with which he mingled the lines of the graver with thoſe of the etching-needle is alſo much to be admired; and though it muſt be allowed that in copying Raffaelle's forms he has often loſt much of their exquiſite grace and chaſteneſs, and has rendered the characters of his heads but coarſely, yet on the whole he rides his graphic Pegaſus with maſculine grace. There is a manly energy and freedom in his ſtyle, bridled by ſimplicity; his ſhadows are full-toned, clear, and rich; and though his fleſh be deficient in characteriſtic texture, the lines are often conducted over his draperies with unprecedented freedom and elegance, of which the figure of "St. Paul preaching at Athens," and that of the ſame apoſtle in the Cartoon of "Elymas the ſorcerer, ſtruck blind," may be ſufficient examples. Indeed, a critical eye may trace in the arrangement of Dorigny's lines, the rudimental principle of that ſimple ſyſtem of drapery-engraving, which Mr. Heath and his ſchool have ſince poliſhed and rendered more perfect.

Charles Dupuis, who has been mentioned as the aſſiſtant of Dorigny, engraved ſome plates from the hiſtory of the misfortunes of Charles I., but the climate of England not agreeing with his conſtitution, he returned to Paris, and died there in the year 1743. A younger brother of his alſo came over, but returned in diſappointment, finding Britiſh encouragement leſs than he had expected.

Claude Duboſc quitted Dorigny's ſervice at the ſame time with Dupuis, but ſettled here, and, with more boldneſs than ability, undertook to engrave the Cartoons on a ſmaller ſcale than Dorigny's for the printſellers, who preſumptively, were *cunning* enough to think, not of tranſcending, but of *underſelling* the engravings of that diſtinguiſhed artiſt. He next engaged himſelf to engrave a ſet of the duke of Marlborough's battles, for which he received at the rate of four-ſcore pounds *per* plate. At firſt he had no aſſiſtance but what he received from du Guernier, but afterwards ſent to Paris for Beauvais and Baron, who aſſiſted him in the completion of theſe engravings. He now commenced printſeller, and publiſhed in numbers a tranſlation of Picart's "Religious Ceremonies," in engraving which, he was aſſiſted by Gravelot and Scotin, who came over to England for that purpoſe.

Duboſc's ſtyle of engraving is heavy, and his drawing of the naked very indifferent, which renders it not improbable that the worſt parts of Dorigny's Cartoons are by his hand. Among his works, which are not very numerous, the "Continence of Scipio," from that picture of Nicholas Pouſſin, which was in the Houghton Collection, is probably the beſt.

Of the Winſtanleys, as engravers, little can be ſaid. Henry (the elder) etched ſeveral views of "The Palace at Audley-end;" and Hamlet (ſon of the former) etched twenty plates from the earl of Derby's Collection, and a ſet of prints from ſir James Thornhill's "Cupola of St. Paul's Cathedral."

The father was projector and builder of the Eddyſtone light-houſe, and when it was thrown down by a dreadful tempeſt, was buried in its ruins. To his etchings of Audley-end, which were dedicated to king James II., he added an inſcription in honour of ſir Chriſtopher Wren, and the plates being "reſerved by the deſcendants of the earl of Suffolk," (according to lord Orford,) the impreſſions are now become ſcarce.

The ſon ſtudied under the Knellers, and afterwards in Italy, yet he made no great figure as an artiſt. The nobleman quoted above, ſpeaks of his houſe at Littlebury, where "were ſeveral mechanic tricks to ſurpriſe the populace, which were known by the name of "Winſtanley's Wonders." Theſe childiſh contrivances, I ſuppoſe, he learned in Italy, where they do not let their religion monopolize *all* kinds of legerdemain. In the noble palace of the villa Borgheſe," adds his lordſhip, "was the noble ſtatue of Seneca dying in the bath, and a devil that ſtarted out of a clock-caſe as you entered the room." Hamlet painted a few portraits with moderate ability.

The aſſiſtance which du Guernier rendered to Duboſc in his "Battles of the Duke of Marlborough," has been already mentioned. He ſtudied under Chatillon, at Paris, and came to England in 1708. The London Academy, as it was called, was then eſtabliſhing under the auſpices of ſir Godfrey Kneller, and du Guernier was choſen director of it, and continued to to the time of his death, which was occaſioned by the ſmall-pox, and happened Sept. 19, 1716, when he was but thirty-nine years of age. Beſides his ſhare of the Marlborough's battles, he engraved a few frontiſpieces, chiefly for plays, and, at the inſtance of lord Halifax, a large print of "Lot and his Daughter," from Caravaggio, and the portraits (large) of the "Duke and Ducheſs of Queenſbury."

Bickham, Coignard, Johnſon, George King, Nichols, and Simpſon, who were all contemporary, are paſſed over for reaſons which have formerly been given. John Kip engraved a conſiderable number of the palaces and ſeats of the nobility and gentry from Knyff, but they were indifferent, and were far from advancing the art.

It has been already mentioned, that Girard Scotin, the younger, came over from Paris to aſſiſt Duboſc. He ſtudied under his father, who was an engraver and a diſciple of De Poilly, but was a man of more induſtry than talent. His principal works are, "Beliſarius," a large plate, after Vandyke, or Murillo, for it does not appear to be aſcertained to which of theſe maſters this celebrated picture ſhould be aſcribed; and "Alfred receiving the Account of the defeat of the Danes," from Blakeney He alſo aſſiſted Hogarth in ſome of his ſeries, and engraved a few portraits.

Henry Gravelot, who came hither at the ſame time, was an artiſt of much more taſte. His opportunities of obſerving nature had been more various and extenſive than fell to the lot of many of his contemporary profeſſors of the fine arts. He was a native of France, but had been in America as ſecretary to the governor of Canada: the climate diſagreeing with him, he returned to Paris, whence he was invited to England by Duboſc.

He was for ſome time employed in Glouceſterſhire, drawing churches and antiquities, and, according to lord Orford, he drew the monuments of kings for Vertue. For the bookſellers he made a very great number of deſigns, both hiſtorical and ornamental, wherein his taſte and the fertility of his inventive powers are eminently conſpicuous. From many of theſe he made etchings, as alſo many after the deſigns of Hayman, and the ſame taſte and facility attended his etching-needle, which is conſpicuous in the productions of his pencil.

In ſir Thomas Hanmer's and Theobald's editions of Shakeſpeare, a great number of his engravings, and ſeveral of his deſigns, may be found. His principal work on copper is a large print of "Kirkſtall Abbey," which Strutt ſpeaks of as a fine ſpecimen of his abilities, but which the preſent writer has not ſeen. He lived to the age of ſeventy-four, and died at Paris in the year 1773.

Bernard Baron was alſo tranſplanted hither from the continent by Duboſc, who appears to have been a great ſpeculator in this ſpecies of culture. They differed, and went to law, on the ſubject of a ſet of engravings after Dr. Mead's pictures from the hiſtory of Ulyſſes, by Rubens, but were afterwards reconciled, and went to Paris together in the year 1729. After engraving ſome plates for Monſ.

Crozat, from the royal collection, he returned to England, and here he executed a conſiderable number, and had the ſatisfaction of working after ſome of the fineſt pictures in the kingdom.

His ſtyle is chiefly ſtudied from that of ſir Nicholas Dorigny, generally coarſe, but occaſionally ſomewhat ſoftened and incorporated with the prevailing taſte of the French ſchool. His principal engravings are as follow, and are all large plates. "Vandyke's equeſtrian figure of Charles I." from the royal gallery at Kenſington; the "Cornaro family," from the celebrated Titian at Northumberland houſe; the "Pembroke family," from the ſame maſter, at Wilton houſe; the "Naſſau family," from the ſame, in the collection of earl Cowper; the "Jupiter and Antiope," alſo after Titian, executed in Paris; "Henry VIII. granting the charter of incorporation to the company of Surgeons" from Holbein. Baron died in Panton ſquare, Piccadilly, in the year 1762.

Chereau, the younger, was alſo imported from Paris by Duboſc, and engraved a profile likeneſs of George I. which poſſeſſes ſome merit, but finding or fancying, that his talents were undervalued in England, he ſoon returned.

Michael Vandergucht, originally of Antwerp, ſtudied under Boutats, but was the maſter of Vertue. The year of his arrival in England is not known: here, however, he met with ſome encouragement, and reſided in London. His chief employment was to engrave anatomical figures, but he ſometimes undertook ſubjects of a different kind. His maſter-piece, according to Vertue, was a portrait of Mr. Savage. He alſo engraved a very large plate of the royal navy from Baſton.

John Vandergucht, ſon of the preceding, was born in 1697, and acquired from his father the manual practice of engraving, but ſtudied drawing under Lewis Cheron, and afterwards at the London Academy. He was employed by Cheſelden to draw and engrave the ſubjects for his Oſteology, a work by which he obtained much credit; and he had a conſiderable ſum for engraving "Sir James Thornhill's cupola of St. Paul's cathedral." The ſix academy figures which he engraved from the drawings of his maſter Cheron, ſhew that he underſtood drawing better than he could manage the graver. He alſo engraved Pouſſin's "Tancred and Erminia."

He produced a great number of book-plates, of which the merits were not great, and ſome were alſo engraved by his brother Gerard Vandergucht, who was a great dealer in pictures, lived to the age of eighty years, and died in 1778 at his houſe in Brook-ſtreet, the ſame that is now inhabited by Treſham the academician.

George Vertue was born in the year 1684, in the pariſh of St. Martin in the Fields, London, and was put apprentice at the age of thirteen to a maſter who engraved heraldry on plate. This perſon being obliged to leave the kingdom by the time Vertue had been three or four years under him, our artiſt returned to his parents. He then gave himſelf entirely to the ſtudy of drawing for two years, when he became the pupil of Michael Vandergucht; with whom he engaged to remain three years, but protracted his ſtay to ſeven, when he quitted his maſter on handſome terms, and begun to engrave book-plates for himſelf.

"The art was then, ſays lord Orford, at the loweſt ebb in England. The beſt performers were worn out; the war with France ſhut the door againſt recruits; and the animoſity of faction diverted public attention from the common arts of amuſement." At this period our young engraver was recommended to the notice of ſir Godfrey Kneller, whoſe reputation ſuſtained the remaining dignity of art: Kneller befriended him, and he was ſoon after employed by lord Somers, who, according to Strutt, "rewarded him generouſly," and by his talents and induſtry he was now enabled to ſupport his widowed mother, with her family of ſeveral children.

In the year 1711 he begun to ſtudy at the academy which ſir Godfrey had recently inſtituted; where he continued to draw for ſome years with great aſſiduity. He had now produced his famous head of archbiſhop Tillotſon, which lord Orford emphatically calls "the ground-work of his reputation," and ſoon after the acceſſion of the preſent royal family, he publiſhed a large portrait of king George I. from a picture by Kneller. "As it was the firſt portrait of that monarch, many thouſands were ſold, though by no means a laborious or valuable performance. However it was ſhewn at court, and was followed by his undertaking to engrave portraits of the prince and princeſs."

Vertue had now commenced thoſe biographical and antiquarian reſearches, in which he has been ſo eminently ſucceſsful. In theſe purſuits he made many journeys to different parts of our iſland, and his time was induſtriouſly employed in making drawings, catalogues, and various memoranda.

"His thirſt after Britiſh antiquities ſoon led him to a congenial Mæcenas. That munificent collector, Robert Harley, ſecond earl of Oxford, diſtinguiſhed the merit and application of Vertue;" and the invariable gratitude of the latter, expreſſed on all occaſions, atteſts at once the bounty of his patron and his own humility.

Another of his patrons was Heneage Finch, earl of Winchelſea, whoſe portrait he painted and engraved, and who, being preſident of the Society of Antiquaries on its revival, in 1717, appointed Vertue, who was a member, engraver to that learned body.

Henry Hare, the laſt lord Coleraine, was alſo one of his antiquarian benefactors, and the univerſity of Oxford employed him for many years to engrave the head pieces for their almanacks.

With lord Orford, lord Coleraine, and Mr. Stephens the hiſtoriographer, he made ſeveral tours to various parts of England. For the former he engraved portraits of "Matthew Prior," "ſir Hugh Middleton," and other diſtinguiſhed men: for the duke of Montague he engraved, "ſir Ralph Windwood;" for ſir Paul Methuen, the portraits of "Cortez," and "Archbiſhop Warham" from Holbein's original at Lambeth; and for lord Burlington, Zucchero's "Queen Mary of Scotland," a plate which evinces more felicity, and a better taſte of execution, than moſt other of his works.

In the year 1727 he travelled with lord Orford to Burleigh, Lincoln, Welbeck, Chatſworth, and York, at which latter place he obtained from Francis Place, whom we have mentioned, many of thoſe anecdotes of Hollar which are inſerted in his biography.

In the next year, the duke of Dorſet invited him to Knowle. From the gallery there, he copied the portraits of ſeveral of the poets. Here he was on fairy ground, and Arcadia was on the confines; but he was diſappointed on an excurſion to Penſhurſt, at not finding there any portrait of ſir Philip Sydney.

In 1730 appeared his twelve heads of diſtinguiſhed poets, one of his capital works, which he meant to have followed with the portraits of other eminent men, arranged in claſſes, but this ſcheme was taken out of his hands by the Meſſrs. Knapton; and there is reaſon to think that Vertue's rigid regard for veracity, which made him juſtly ſcrupulous of authenticating the likeneſſes of deceaſed characters without the cleareſt proofs, and not the ſuperior taſte or diſcernment of the Knapton's, made them engage the ſuperior talents of Houbraken and Gravelot, to finiſh a work which our artiſt had begun, and had himſelf projected.

His next conſiderable production was, the portraits of king Charles I. and the loyal ſufferers in his cauſe, with their characters ſubjoined from Clarendon. But this was ſcarcely finiſhed, before Rapin's hiſtory of England appeared, “a work, (ſays he,) which had a prodigious run, inſomuch that it became all the converſation of the town and country, and the noiſe being heightened by oppoſition and party, it was propoſed to publiſh it in folio by numbers, of which thouſands were ſold every week.” The Meſſrs. Knapton engaged Vertue to accompany it with effigies of the kings and other ſuitable embelliſhments, an undertaking which occupied three years of his life. He preſented a copy of this work, when finiſhed, richly bound, to the prince of Wales, at Kenſington.

He now renewed his topographical journies, accompanied ſometimes by the earl of Leiceſter, ſometimes by lord Oxford, and ſometimes by Roger Gale the antiquary; and between the years 1734-38, viſited St. Albans, Northampton, Oxford, Penſhurſt, Warwick, Coventry, Stratford, and travelled through the counties of Kent, Suſſex, and Hampſhire, where he made various ſketches, drawings, and notes, always preſenting a duplicate of his obſervations to his patron lord Oxford.

In 1739, he travelled eaſtward with lord Coleraine, through the counties of Eſſex, Suffolk, and Norfolk, ſtopping as uſual to make drawings and obſervations at every memorable church, ſeat, or other ſpot congenial to his purſuits. In 1741 he loſt his noble friend and patron the earl of Oxford, who died on the 16th of June. But his merit and modeſty ſtill raiſed him benefactors. The counteſs dowager of Oxford, even, alleviated his loſs, and the ducheſs of Portland (their daughter), the duke of Richmond, and lord Burlington, did not forget him among the artiſts whom they patronized.

In the year 1749, he found a yet more exalted protector in the prince of Wales, whom he often had the honour of attending, and to whom he ſold many prints, miniature pictures, &c.

“He had now reaſon to flatter himſelf with permanent fortune. He ſaw his fate linked with the revival of the arts he loved; he was uſeful to a prince who trod in the ſteps of the accompliſhed Charles, and no Hugh Peters (adds lord Orford) ſeemed to threaten havoc to the growing collection.” But the death of this prince ſuddenly blaſted the hopes of Vertue, and affected him with conſiderable dejection of ſpirits, from which, according to his lordſhip, he never perfectly recovered. He died in the year 1756, and was buried in the cloiſters of Weſtminſter abbey.

By the majority of connoiſſeurs, Vertue's talents as an engraver have been over-rated. He rarely riſes above mediocrity, and ſometimes ſinks below it, yet the preſent writer muſt freely declare his ſurpriſe when he firſt ſaw a good impreſſion of Vertue's print of “Mary Queen of Scotland,” after Zucchero, at the ſuperior merits which it diſplayed.

A much more copious biography of this artiſt will be found in the printed works of lord Orford, and alſo a catalogue of his engravings (amounting to near five hundred!) claſſed under the heads of “Royal Portraits,” “Noblemen,” “Biſhops,” “Poets,” “Antiquaries,” “Tombs,” “Hiſtoric Prints,” “Coins,” “Medals,” “Frontiſpieces,” &c. &c. &c.

To all the diſtinguiſhed notice and patronage with which Vertue was honoured, and to the repeated praiſe of lord Orford, who was one of his friends, he was entitled leſs by his talents as an artiſt, or native independence of mind, than by his patience and accuracy of reſearch as an antiquary, and as his noble biographer cannot boaſt of his genius, it might, perhaps, have been thought that he did right to dwell with ſo much ſeeming approbation on his diligence and humility; if he had not himſelf left poſterity ſuch abundant room to wiſh that he had reſpected genius more, and been leſs completely ſatisfied with the blandiſhments, which plodding mediocrity may with little difficulty acquire.

We now approach the leſs patronized and more highly reſpectable name of William Hogarth, upon whoſe valuable works as painter and engraver, ſo many volumes might be profitably written. The able pen to which the biography of the former deſcription of artiſts is confided, will doubtleſs claim Hogarth as a painter, yet, as he was both by education and long practice an engraver alſo, he muſt not here be paſſed in ſilence.

In the narrative which he left behind of his own life and opinions, where his philoſophy is not leſs conſpicuous than his manly frankneſs, and where his foreſight with reſpect to the well-being of Britiſh art has ſhewn itſelf prophetic, he informs us, that he was born in London in the year 1697; that during his infancy he derived uncommon pleaſure from ſhews and mimickry; that an early acceſs to a neighbouring painter drew his attention from play; and that when at ſchool his exerciſes were remarkable for the ornaments with which they were adorned.

He was ſcarcely more attracted by art, than driven from literature, which was the profeſſion of his father. “Beſides the natural turn I had for drawing,” proceeds he, “I had before my eyes the precarious ſituation of men of claſſical education. I ſaw the difficulties under which my father laboured, and the many inconveniences he endured from his dependance being chiefly on his pen, and the cruel treatment he met with from bookſellers and printers. It was, therefore, very conformable to my own wiſhes that I was taken from ſchool, and ſerved a long apprenticeſhip to a ſilver-plate engraver.

“I ſoon found this buſineſs in every reſpect too limited. The paintings of St. Paul's cathedral and Greenwich hoſpital, which were at that time going on, ran in my head, and I determined that ſilver-plate engraving ſhould be followed no longer than neceſſity obliged me to it.

“Engraving on copper was, at twenty years of age, my utmoſt ambition. To attain this it was neceſſary that I ſhould learn to draw objects ſomething like nature, inſtead of the monſters of heraldry, and the common methods of ſtudy being much too tedious for one who loved his pleaſure, I was led to conſider whether a ſhorter road than that uſually travelled was not to be found. I had learned by practice to copy with tolerable exactneſs in the uſual way; but it occurred to me that there were many diſadvantages attending this method of ſtudy, as having faulty originals,” &c. Drawing in an academy, (Hogarth means a ſchool,) though it ſhould be after the life, will not make the ſtudent an artiſt, for as the eye is often taken from the original to draw a bit at a time, it is poſſible he may know no more of what he has been copying when his work is finiſhed, than he did before it was begun.

“More reaſons, not neceſſary to enumerate, ſtruck me as ſtrong objections to this practice, and led me to wiſh that I could find the ſhorter path, fix forms and characters in my mind, and inſtead of copying the lines, try to read the language, and if poſſible find the grammar of the art, by bringing into one focus the various obſervations I had made, and then trying, by my power on the canvas and copper, how far my plan enabled me to combine and apply them to practice.

“ For this purpoſe, I conſidered what various ways, and to what different purpoſes the memory might be applied; and fell upon that which I found moſt ſuitable to my ſituation and idle diſpoſition.

“ Laying it down firſt as an axiom, that he who could by any means acquire and retain in his memory perfect ideas of the ſubjects he meant to draw, would have as clear a knowledge of the figure as a man who can write freely hath of the twenty-four letters of the alphabet and their infinite combinations (each of them being compoſed of lines), and would conſequently be an accurate deſigner.

“ This I thought my only chance for eminence, as I found that the beauty and delicacy of the ſtroke in engraving was not to be learnt without much practice, and demanded a larger portion of patience than I felt myſelf diſpoſed to exerciſe. Added to this, I ſaw little probability of acquiring the full command of the graver in a ſufficient degree to diſtinguiſh myſelf in that walk, nor was I at twenty years of age much diſpoſed to enter on ſo barren and unprofitable a ſtudy as that of merely making fine lines.

“ I therefore endeavoured to habituate myſelf to the exerciſe of a ſort of technical memory, and by repeating in my own mind the parts of which objects were compoſed, I could by degrees combine and put them together. Thus, with all the drawbacks which reſulted from the circumſtances I have mentioned, I had one material advantage over my competitors, *viz.* the early habit I thus acquired of retaining in my mind's eye whatever I intended to imitate. Sometimes, but too ſeldom, I took the life for correcting the parts I had not perfectly enough remembered, and then I transferred them to my compoſitions.”

Such parts only of Hogarth's valuable narrative as are to the preſent purpoſe, are here extracted. Thoſe who would read the whole are referred to “ A ſupplement to Hogarth illuſtrated, compiled from his original manuſcript by John Ireland,” 1798, publiſhed for the author by Nicol, and the Meſſrs. Boydell. Our artiſt proceeds:

“ Inſtead of burthening the memory with muſty rules, or tiring the eyes with copying dry and damaged pictures, I have ever found ſtudying from nature the ſhorteſt and ſafeſt way of attaining knowledge in art.”—“Had I not ſedulouſly practiſed what I thus acquired, I ſhould very ſoon have loſt the power of performing it.”

In a ſubſequent chapter he ſays, “ in purſuing my ſtudies, I made all poſſible uſe of the technical memory which I have before deſcribed, by obſerving and endeavouring to retain in my mind lineally, ſuch objects as beſt ſuited my purpoſe, ſo that be where I would my eyes were open, I was at my ſtudies, and acquiring ſomething uſeful in my profeſſion, and thus the more ſtriking objects, whether of beauty or deformity, were by habit the moſt eaſily impreſſed and retained in my imagination. A redundancy of matter being by this means acquired, it is natural to ſuppoſe I introduced it into my works on every occaſion that I could.

“ By this idle way of proceeding, I grew ſo profane as to admire nature beyond the firſt productions of art, and acknowledge I ſaw, or fancied, delicacies in the life, far ſurpaſſing the utmoſt efforts of imitation.

“ To return, the inſtant I became maſter of my own time, I determined to qualify myſelf for engraving on copper. In this I readily got employment; and frontiſpieces to books, prints to Hudibras, &c. ſoon brought me into the way. But the tribe of bookſellers remained as my father had left them when he died, (about five years before,) which was of an illneſs occaſioned partly by the treatment he met with from this ſet of people, and partly by diſappointment from great men's promiſes; ſo that I doubly felt this uſage, which put me upon publiſhing on my own account. But here again I had to encounter a monopoly of printſellers, equally mean and deſtructive to the ingenious; for the firſt plate I publiſhed, called “ The Taſte of the Town,” had no ſooner begun to take a run, than I found copies of it in the print-ſhops vending at half price, while the original prints were returned to me again, and I was thus obliged to ſell the plate for whatever theſe pirates pleaſed to give me, as there was no place of ſale but at their ſhops. Owing to this and other circumſtances, by engraving until I was near thirty, I could do little more than maintain myſelf.”

At the age of two and thirty, he married the daughter of ſir James Thornhill, and commenced painter of ſmall converſation pieces, which, having novelty, ſucceeded for a few years, but were afterwards not ſufficiently profitable to pay the expences of his family. “ I therefore,” ſays he, “ turned my thoughts to a ſtill more novel mode, *viz.* painting and engraving modern moral ſubjects, a field not broken up in any country or any age.

“ I thought that both writers and artiſts had overlooked that intermediate ſpecies of ſubject, which may be placed between the ſublime and the groteſque; I therefore wiſhed to compoſe pictures on canvas, ſimilar to repreſentations on the ſtage.

“ Ocular demonſtration will carry more conviction to the mind of a ſenſible man than all he would find in a thouſand volumes; and this has been attempted in the prints which I have compoſed.

“ After having had my plates pirated in almoſt all ſizes, I, in 1735, applied to parliament for redreſs, and obtained it in ſo liberal a manner, as hath not only anſwered my own purpoſe, but made prints a conſiderable article in the commerce of this country; there being now more buſineſs of this kind done here, than in Paris or any where elſe.

“ The dealers in pictures and prints found their craft in danger, by what they called a new-fangled innovation. Their trade of living and getting fortunes by the ingenuity of the induſtrious has, I know, ſuffered much by my interference; and if the detection of this band of public cheats and oppreſſors of the riſing artiſts be a crime, I confeſs myſelf moſt guilty.”

The obtainment of this act, which ſecures the copy-right of engravings, was certainly a great benefit, not only to artiſts, but to the public, and even to the print dealers themſelves, who now were ſecured in the poſſeſſion of any engraved property which they might purchaſe. The remainder of Hogarth's narrative chiefly reſpects his profeſſion as a painter, and the incidents of his private life. His reputation was now extending far and wide: he had publiſhed his “ Harlot's Progreſs” in ſix plates, beſide many other prints of leſs importance, which Mr. Ireland has enumerated, and now brought forth his “ Rake's Progreſs” in eight, which are replete with moral leſſon and the moſt pointed ſatire. Swift about this time wrote

> “ How I want thee, hum'rous Hogarth!
> Thou, I hear, a pleaſant rogue art,
> Were but you and I acquainted
> Ev'ry monſter ſhould be painted:
> You ſhould try your graving tools
> On this odious group of fools, (the Legion Club.)
> Draw the beaſts as I deſcribe 'em,
> Form their features, while I gibe 'em.”

In the courſe of the next year he engraved “ The Sleeping Congregation ;” “ The Diſtreſſed Poet,” which in its original ſtate repreſents Pope thraſhing the bookſeller Curl, and “ The Arms of the Undertaker's Company.” He alſo publiſhed a whole length portrait of lady Byron, from a picture of his own, engraved in mezzotinto by Faber.

In the year 1737, he produced only “ The Lecture.” In 1738, he publiſhed “ Morning,” “ Noon,” “ Evening,” and “ Night.” The third plate was engraved by Baron, except the figure of the girl with a fan, which was an afterthought of Hogarth's, and is from his own graver. The “ Saliſbury” flying coach in the engraving of Night, is thought to be a ſatire on a certain peer who delighted to drive his own horſes. He alſo produced this year “ Strolling Actreſſes in a Barn ;” the original picture of which he ſold to Francis Beckford, eſq. for 27*l.* 6*s.* who returned it, though charged at ſo low a price, and it was afterwards ſold to Mr. Wood of Littleton for the ſame ſum.

Until the year 1741, he publiſhed nothing more, when “ The enraged Muſician” made its appearance, in which the principal figure has been ſpoken of as being the portrait of Cervetto, but on better authority, is now ſuppoſed to be that of Feſtin.

In 1742, he engraved and publiſhed the portrait of “ Martin Foulkes, eſq.” “ The Charmers of the Age,” (a ſketch,) and “ Taſte in High Life,” which latter is replete with the moſt pointed ſatire on the reigning follies and faſhions which then prevailed in the higher circles. A more ſophiſticated aſſemblage of objects cannot be imagined, and the elderly lady of the Cheſterfield ſchool, who holds the ſmall Dreſden tea-cup with ſo much exquiſite delicacy of fingering, and a countenance ſo truly expreſſive of the affectation of intenſe enjoyment of its beauties, has never been ſurpaſſed.

From this time, till the year 1745, he was employed on his “ Marriage A-la-Mode,” and only publiſhed three portraits, engraved by other artiſts, from his own pictures. The ſeries of ſix plates of the Marriage A-la-mode were chiefly engraved by Scotin and Baron, who have been already mentioned, and S. Ravenet. Hogarth engraved on the plates from time to time, which has occaſioned thoſe variations which certain adorers of rarity look for with more eagerneſs, than they appear to poſſeſs feeling or judgment in eſtimating the general deſign. This ſeries comprehends indeed maſter-pieces of art in their kind, and places Hogarth's fame on the broadeſt and moſt durable baſis.

In the following year, he etched and publiſhed his characteriſtic portrait of “ Lord Lovat,” which, by thoſe who have ſeen him, has been atteſted to be “ in air, character, and features, a moſt faithful reſemblance of the original.” He is repreſented ſeated in his old faſhioned chair with the lofty back, and in the act of enumerating by his fingers the rebel forces. It is etched with uncommon ſpirit, and what was of more pecuniary importance, (adds Mr. Ireland,) was ſo well timed, that Mrs. Lewis told me, they for many weeks received more than ten pounds a day from the ſale. It was publiſhed the 25th Auguſt, 1746, and the peer was beheaded the 9th April 1747, in the eightieth year of his age. The portrait of Garrick, in the character of Richard III. engraved by Hogarth, and C. Grignion, was alſo publiſhed this year, of which Mr. Grignion, (who has done ſo much for an art which has done ſo little for him, and is ſtill living,) ſays, that Hogarth etched the head and the hands, but eraſed the head twice before he could ſatisfy himſelf. In the courſe of the preſent year Hogarth alſo iſſued the ſubſcription ticket to “ The March to Finchley.”

The ſeries of “ The Idle and Induſtrious Apprentices,” in twelve plates, deſigned and engraved by William Hogarth, were publiſhed in 1747. Of this ſeries, ſo replete with moral leſſon, and heightened with ſuch admirable ſtrokes of humour, Hogarth himſelf has written as follows. “ The effects of idleneſs and induſtry exemplified in the conduct of two fellow-'prentices. Theſe twelve prints were intended for the inſtruction of young people, and, conſidering the perſons they were intended to ſerve, I have endeavoured to render them intelligible and cheap as poſſible :” (the twelve were originally publiſhed at the low price of twelve ſhillings.) “ Fine engraving is not neceſſary for ſuch ſubjects, if what is infinitely more material, *viz.* character, and expreſſion, be properly preſerved.” “ The Stage Coach or Country Inn Yard,” and two portraits of Gibbs the architect, engraved by Baron and Mc. Ardell, he alſo publiſhed in the courſe of this year.

In 1748, he etched a view of Mr. Ranby's houſe at Chiſwick, but nothing elſe of any conſequence. In 1749, was produced “ The Gate of Calais,” or, “ Roaſt Beef of Old England.” It appears that ſoon after the peace of Aix-la-Chapelle, Hogarth went over to France, and as he was ſauntering about at Calais, and contemplating the difference between England and France, he obſerved over the gate of the town ſome appearance of the arms of England ; he was prompted to make a ſketch, and being obſerved, was taken into cuſtody : his own account of this affair is as follows : “ Not attempting to cancel any of my ſketches or memorandums, which were found to be merely thoſe of a painter for his private uſe, without any relation to fortification, it was not thought neceſſary to ſend me back to Paris.” (This word contradicts the aſſertion of thoſe who ſay he never went further into France than Calais.) “ I was only cloſely confined to my own chamber till the wind changed for England ; where I no ſooner arrived, than I ſet about the picture (of roaſt beef) and made the gate my back ground ; and in one corner introduced my own portrait, which has generally been thought a correct likeneſs, with the ſoldier's hand upon my ſhoulder. By the fat friar, who ſtops the lean cook that is ſinking under the weight of a vaſt ſurloin, and two of the military who are bearing off a great kettle of ſoup maigre, I meant to diſplay to my own countrymen the ſtriking difference between the food, prieſts, ſoldiers, &c. of two nations ſo contiguous, that in a clear day one coaſt may be ſeen from the other. The melancholy and miſerable highlander, browzing on his ſcanty fare, conſiſting of a bit of bread and an onion, is intended for one of the many that fled from this country after the rebellion in 1744.” In the courſe of this year, he alſo engraved and publiſhed his own portrait in a cap, with his favourite pug dog and palette, on which is drawn that myſterious “ line of beauty and grace,” which excited, and was meant to excite, the attention of the public in no ſlight degree.

Fourteen years afterwards, Hogarth eraſed his own head from the plate, and in its place engraved a caricature of Churchill as a bear, and inſcribed it, “ The Bruiſer C. Churchill (once the Reverend !) in the character of a Ruffian Hercules,” &c. &c.

In the year 1750, appeared his “ March to Finchley,” which was engraved by Luke Sullivan, and dedicated to the king of Pruſſia. The original picture he preſented to the Foundling hoſpital. “ Gin-lane” and “ Beer-ſtreet” appeared in the following year, of which prints Hogarth himſelf gives the following account. “ When theſe two prints were deſigned and engraved, the dreadful conſequences of gin drinking appeared in every ſtreet. In Gin-lane, every circumſtance of its horrid effects is brought to view *in ter-*

rorem. Idleneſs, poverty, miſery, and diſtreſs, which drive even to madneſs and death, are the only objects that are to be ſeen; and not a houſe in tolerable condition, but the pawn-brokers and gin ſhop."

"Beer-ſtreet," its companion, was given as a contraſt, where that invigorating liquor is recommended in order to drive the other out of vogue. Here all is joyous and thriving, &c. &c."

He alſo now publiſhed his "Four Stages of Cruelty," of which he has thus uſefully, honeſtly, and proudly written. "The leading points in theſe, as well as the two preceding prints, were made as obvious as poſſible, in the hope that their tendency might be ſeen by men of the loweſt rank. Neither minute accuracy of deſign, nor fine engraving, were deemed neceſſary, as the latter would have rendered them too expenſive to the perſons to whom they were intended to be uſeful: and the fact is, that the paſſions may be more forcibly expreſſed by a ſtrong bold ſtroke, than by the moſt delicate engraving." (The artiſt probably meant this obſervation to be applied to the violent, and not to the tender paſſions.) "To expreſſing them as I felt them, I have paid the utmoſt attention, and as they were addreſſed to hard hearts, have rather preferred leaving them hard, and giving the effect by a quick touch, to rendering them languid and feeble by fine ſtrokes and ſoft engraving, which require more care than can often be attained, except by a man of a very quiet turn of mind. Maſſon, who gave two ſtrokes to every particular hair that he engraved, merited great admiration, but at ſuch admiration I never aſpired, neither was I capable of attaining it if I had.

"The prints were engraved with the hope of, in ſome degree, correcting that barbarous treatment of animals, the very ſight of which renders the ſtreets of our metropolis ſo diſtreſſing to every feeling mind. If they have had this effect and checked the progreſs of cruelty, I am more proud of having been the author, than I ſhould be of having painted Raphael's cartoons."

The humorous "Paul before Felix" was alſo the produce of this year, which in the earlieſt impreſſions is ſubſcribed, "deſigned and ſcratched in the true Dutch taſte by William Hogarth," and in the ſubſequent impreſſions (where he has introduced a little fiend ſawing off the leg of the Apoſtle's ſtool,) "deſigned and etched in the ridiculous manner of Rembrandt by Wm. Hogarth." This whimſical little print was originally given with the receipts to the ſubſcription for the ſerious "Paul before Felix," and "Pharoah's Daughter," both of which he produced in the courſe of the enſuing year.

The former of theſe he engraved from his original picture in Lincoln's-inn Hall; another plate of which ſubject, with ſome variations, was publiſhed by Hogarth at the ſame time, (which is remarkable, both being dated Feb. 5,) engraved by Luke Sullivan.

"Moſes brought to Pharaoh's Daughter" is engraved by William Hogarth and Luke Sullivan from the original painting in the Foundling hoſpital, and was alſo publiſhed on the ſame day.

His "Columbus breaking the Egg" was given in the November of this year, with the receipt for "the firſt payment of a ſhort tract in quarto, called the Analyſis of Beauty; wherein forms are conſidered in a new light;" and in the next year came forth his far famed "Analyſis of Beauty, written with the view of fixing the fluctuating ideas of taſte," and embelliſhed with two folded and very curious illuſtrative engravings.

With ſome ſmall literary aſſiſtance from Dr. Hoadly, Mr. Ralph, and Dr. Morell, he here maintained an hypotheſis reſpecting undulating forms as eſſential to grace and beauty, the merits of which have, by ſubſequent writers on the ſubject of taſte, been variouſly eſtimated, but of late have been utterly denied by Mr. P. Knight, who (in his analytical enquiry into the principles of taſte) ſays, that the qualities of eaſe, grace, elegance, &c. do not "conſiſt in any lines of beauty, or depend upon the impreſſions which any ſpecific forms make on the organs of ſight. On the contrary, they ariſe wholly from mental ſympathies and the aſſociation of ideas."

An impreſſion from the firſt plate of the Analyſis of Beauty, which is in the poſſeſſion of Mr. G. Baker, has this ſingularity, that the words "et tu Brute," are engraved on the pedeſtal on which ſtands Quin in the character of Brutus, which were afterwards eraſed.

In the year 1754 his admirable ſatire on parliamentary elections, which was engraved on four plates, began to appear. Of the firſt plate, which is "An Election Entertainment," it has been ſaid that Hogarth completed the engraving without taking from it a ſingle proof by which to aſcertain the progreſs of his work. It might be ſo, but if this were wiſe it would more frequently be practiſed, and Hogarth himſelf is known to have repented of his imprudence when a proof was taken.

This performance, in its original ſtate, is by far the moſt finiſhed and carefully executed of Hogarth's engravings, and he therefore, conſcious of the ſuperior pains which he had beſtowed on it, inſcribed beneath it, "painted, and *the whole* engraved by Wm. Hogarth," but theſe two words were afterwards eraſed, for the number ſold was ſo conſiderable, that by the time the ſecond plate of this ſeries made its appearance, the firſt had been touched and retouched ſo often, that all the original and delicate lines were either hidden by others, or utterly obliterated, and it has been compared, wittily enough, to ſir John Cutler's ſtockings, which, from frequent mending, from ſilk degenerated into worſted.

The ſecond of the election ſeries, of which the ſubject is "Canvaſſing for Votes" is engraved by C. Grignion, and was publiſhed in the year 1757. On which occaſion Hogarth apologized in the public prints for the delay which had taken place, aſcribing it to the difficulty of procuring able hands to engrave the plates. In the early impreſſion this is an excellent engraving.

The third plate of this ſeries is entitled "The Polling," is engraved by Hogarth and Le Cave, and was publiſhed in the following year.

The fourth plate, which completes the ſeries, and is entitled "Chairing the Members," was alſo publiſhed in the courſe of the year 1758, and is engraved by Hogarth and Aveline.

In all theſe plates the ſatire of Hogarth is moſt poignant and abundant; and notwithſtanding the number of portraits our engraver has introduced, his meaning is ſo general, that the election-prints continue to be applicable to the preſent time.

In the year 1758 he alſo engraved and publiſhed "the Bench," with explanations and illuſtrations of the words, "character" and "caricature." The print exhibits the inſide of the court of common pleas, over which is the king's arms, and beneath are the portraits of the following judges, *viz.* honourable William Noel, ſir John Willes; the lord chief juſtice; honourable Mr. juſtice (afterwards lord) Bathurſt, and ſir Edward Clive.

His own portrait, a whole length figure, was alſo the produce of this year, in which plate the face only is engraven by Hogarth. He has here repreſented himſelf in profile, ſitting, with a cap on his head, and engaged, in a very appropriate manner, in painting the muſe of comedy. His analyſis of beauty lies on the floor, and underneath is his title of ſerjeant painter to his majeſty. It may be obſerved of this likeneſs, and that which he has introduced in his "Gate of Calais," that they both correſpond much better with the buſt of Hogarth, which was modelled by Roubilliac, and is now in the collection of M. G. Baker, than the three-quarter face which was publiſhed in 1749, and afterwards metamorphoſed to that of Churchill the poet.

"The Cockpit," deſigned and engraved by W. Hogarth, was produced in 1759. In this engraving is introduced a portrait of Nan Rawlins, a very ugly old woman (commonly called Deptford Nan, and ſometimes the ducheſs of Deptford), who is well remembered at Newmarket. She was a famous cock-feeder, and did the honours of the gentlemens' ordinary at Northampton. The figure with the hump back is that of Jackſon, a once noted jockey, and the blind preſident is lord Albemarle Bertie, who conſtantly attended this refined and elegant diverſion.

In the next three years he produced nothing of his own engraving, though he made ſome deſigns from Triſtram Shandy; one for Brook Taylor's perſpective, and a few others, which were engraved by Woollett, Ravenet, and Grignion: but in 1762, he produced his "Credulity, Superſtition, and Fanaticiſm," which is chiefly meant to ridicule certain methodiſtical ſectaries, and is preferred by lord Orford to all his other works "for deep and uſeful ſatire."

"The Times" was alſo produced in the year 1762. This is a political print, which Mr. Nichols explains as follows: "Europe on fire; France, Germany, and Spain, in flames, which are extending to Great Britain. This deſolation continued and aſſiſted by Mr. Pitt under the figure of king Henry VIII. with bellows encreaſing the miſchief which others are ſtriving to abate. He is mounted on the ſtilts of the populace. A Cheſhire cheeſe depends from his neck with 3,000*l.* on it. This alludes to what he had ſaid in parliament, that he would ſooner live on Cheſhire cheeſe and a ſhoulder of mutton, than ſubmit to the enemies of Great Britain. Lord Bute, attended by Engliſh ſoldiers, ſailors, and highlanders, manages an engine for extinguiſhing the flames, but is impeded by the duke of Newcaſtle with a wheel-barrow full of monitors and North Britons, for the purpoſe of feeding the blaze. The reſpectable body under Mr. Pitt are the aldermen of London worſhipping the idol they had ſet up; whilſt the muſical king of Pruſſia, who alone is ſure to gain by the war, is amuſing himſelf with a violin amongſt his miſerable country women. The picture of the Indian alludes to the advocates for retaining our Weſt Indian conqueſts, which it was ſaid would only increaſe exceſs and debauchery. The breaking down of the Newcaſtle arms, and the drawing up the patriotic ones, refer to the reſignation of that noble duke, and the appointment of his ſucceſſor. The Dutchman ſmoking his pipe and a fox peeping out behind him and waiting the iſſue; the waggon with the treaſures of the Hermione; the unneceſſary marching of the militia, ſignified by the Norfolk jigs; the dove with the olive branch, and the miſeries of war, are all obvious, and perhaps need no explication."

In 1763, he publiſhed a caricature of "John Wilkes," eſquire, drawn from the life, and etched in aquafortis by William Hogarth. To which was ironically added "this is a direct contraſt to the print of Simon lord Lovat."

Of this caricature, Wilkes with his uſual good humour has been heard to ſay, that he was every day growing more and more like his portrait by Hogarth.

In the ſame year was publiſhed alſo, "the Bruiſer C. Churchill," which has been already mentioned, and which neither added to his fame, nor in its conſequences to his happineſs.

"The Bathos," publiſhed in 1764, was his laſt engraving of any conſequence, if not his very laſt work. In the month of October of this year being ſeventy-four years of age, he departed this life, and was buried in the church yard of Chiſwick, where a monument, with an excellent epitaph by Garrick, is erected to his memory.

His engravings, like the tenour of his life, are characterized not by delicacy, but by ſtrength of thought and expreſſion. He did not aim at captivating by the beauty of his art, but at excelling by the power which he poſſeſſed of combining a number of particular and congenial truths into one impreſſive whole: agreeably to his own declarations, we perceive in his prints, that he diſcovers little dexterity in the arrangement of his lines, and ſtill leſs ſolicitude about their beauty: yet in his pictures, and eſpecially in thoſe of the Marriage A-la-Mode, now in the collection of J. J. Angerſtein, eſquire, are ſome paſſages which no Dutch painter and no other painter could have more exquiſitely touched. No artiſt whatever, and ſcarcely any man more than Hogarth, deſerves the praiſe of original and independent thinking. His engravings are in ſome inſtances taken from no pictures, and his pictures from no books. Without having recourſe to hiſtory or poetry he *invented* his ſubjects. The world of moral art "was all before him where to chooſe:" he marked out and took poſſeſſion of an ample province for himſelf, replete with the riches of nature; a province which few have ſince dared to invade, and to which none have diſputed his title.

Luke Sullivan, who has been already mentioned, was Hogarth's moſt valuable coadjutor in engraving. He was a native of Ireland, an eccentric character, and much addicted to women. Whilſt engraving the march to Finchley (according to Mr. Ireland,) "Hogarth held out every poſſible inducement to his remaining at his houſe in Leiceſter-ſquare night and day; for if once Luke quitted it he was not viſible for a month." If Hogarth gave him but one hundred pounds for this plate, as his biographers ſay, Sullivan's inducements to ſtay at home were certainly ſtrong.

Beſide what he did after Hogarth, Sullivan engraved "the Temptation of St. Anthony," after Teniers, and ſeveral garden ſcenes and other landſcapes, which he drew from nature with ſome ability. He alſo painted miniatures with ſucceſs. His own portrait may be ſeen in the character of an angel, in Hogarth's humorous print of "Paul before Felix." He died of a conſumption in the year 1750.

About this time John Pine, whoſe portrait Hogarth painted in the manner of Rembrandt, was in good repute, but the years of his birth and death are uncertain. His chief works are, "the Ceremonies uſed at the revival of the order of the Bath;" "The Deſtruction of the Spaniſh Armada," from the tapeſtry of the houſe of lords; a ſplendid edition of Horace, illuſtrated with copies of antique bas reliefs, gems, coins, &c. and a print of the houſe of commons.

The paſtorals and Georgics of Virgil were publiſhed by his ſon after his death, adorned in the ſame manner as the Horace, but printed with letter-preſs types.

Now alſo flouriſhed Arthur Pond, another native of England. He etched ſeveral portraits with freedom, taſte, and ſpirit, among which are thoſe of Mr. Pope (an excellent likeneſs), lord Bolingbroke, Dr. Mead, and himſelf. He was concerned with the Meſſrs. Knapton in publiſhing the volume of portraits of illuſtrious men which were engraven by Houbraken, Vertue, Gravelot, &c. and in promoting other meritorious works, particularly a ſet of plates from the great Italian maſters in imitation of chalk and biſtre drawings, which he accompliſhed with great ſucceſs. He alſo etched a ſet of caricatures from the chevalier Ghiſſi, and a few landſcapes, chiefly after Rembrandt.

Simon Francis Ravenet was another of Hogarth's occaſional coadjutors. He was a native of France, came into England about the year 1750, and ſettled in London. In the latter part of his life he reſided at Mother Red Cap's, near Kentiſh Town, where he died in 1774. He was of an amiable diſpoſition and much reſpected, and had the honour of inſtructing both Ryland and Hall in the art of engraving.

The ſhadows in his engravings are deep toned, and his ſtyle both of drawing and engraving vigorous, though ſomewhat mannered. Beſide what he produced after Hogarth, the following are eſteemed among his beſt prints: “The Prodigal Son,” (a large upright) from Sal. Roſa; “Lucretia deploring her Misfortune,” from A. Caſali; “The Manifeſtation of the Innocence of the Princeſs Gunhelda,” (its companion) from the ſame; “The Death of Seneca,” (a large plate) from Lucca Giordano; “The Arcadian Shepherds,” from N. Pouſſin; “The portrait of Lord Camden,” from ſir Joſhua Reynolds. He is alſo the author of a conſiderable number of vignettes, book plates, and ſmall portraits.

William Wynne Ryland was born in London in the year 1732. His genius for the fine arts manifeſted itſelf at an early period of his life, and he was accordingly placed under Ravenet. At the expiration of the term of his engagement he went to Paris, at that time the chief ſeminary of engraving, for improvement; and remained there five years.

Under the guidance of Boucher, who at that time led the faſhion in art, he applied with great aſſiduity to the ſtudy of drawing, but did not neglect to improve himſelf alſo in the practical part of engraving. From the deſigns of this principal miſleader of the taſte of France, Ryland engraved ſeveral plates, of which the principal and probably the beſt engraving he ever performed, is rather a large work, of which the ſubject is “Jupiter and Leda.”

He has here diſplayed great power as an engraver in lines. The print has a fine tranſparent tone; he has tempered the flimſy touchineſs of the French taſte with a portion of Ravenet's ſolidity; the ſoft firmneſs of fleſh is ably characterized in the figure of Leda, and the delicacy of the ſwan, and various textures of the ſurrounding objects, are rendered with much feeling and judicious ſubſerviency to the principal parts.

In one of his amatory poems, M'Kenzie emphatically exclaims, “Alas! are there faſhions in love!”—Alas! there are alſo faſhions in fine art. Unmeaning glitter, unprecedented ſoftneſs, unprincipled novelty, ſhall ſometimes ſet aſide for a while the truth and ſimplicity of nature, and the approbation of ages.

It was not, however, the falſe taſte of Boucher that turned aſide Ryland's talents from the mark at which he was evidently and ſucceſsfully aiming, when he produced his “Jupiter and Leda,” but a faſhion of ſtippling which he learned in France, and introduced, with his own modifications, into England. Stippling with the graver had been occaſionally practiſed both by Martin Schoen and Albert Durer in the very infancy of the art: the latter employed it in imitating the ſoft texture of beaver hats, as well as on ſome other occaſions. Perceiving that it was peculiarly expreſſive of ſoftneſs, Agoſtino Veneziano and Boulanger ſometimes ſtippled their fleſh, and Julio Campagnola his back grounds alſo. Almoſt a century afterward it was obſerved by De Marteau, who was now living, that by etching ſome of the dots of which this kind of engraving conſiſts, and engraving others, very ſucceſsful imitations of drawings hatched with chalk, might be produced. But Ryland employed ſtippling, ſo as rather to imitate ſuch drawings as are ſtumped than ſuch as are hatched with chalk, by which means he ſoftened down all energy of ſtyle, and has left poſterity to regret the voluntary emaſculation of the powers he had manifeſted in the engraving, which is the ſubject of the above comments.

Soon after his return to England, he, however, engraved in lines a portrait of the queen, after Coates, and that portrait of his majeſty, after Allen Ramſay, which Strange, from a miſunderſtanding either with the earl of Bute or Ramſay, had declined, but they poſſeſs neither the vigour nor taſte of his “Jupiter and Leda.” From this time he was appointed engraver to the king, and received an annual ſalary.

His ſubſequent engravings, in the chalk manner, are chiefly after Angelica Kauffman, and conſiſt of four half-ſheet circles, of which the ſubjects are, “Juno obtaining the Ceſtus of Venus,” “A Sacrifice to Pan,” “Cupid bound,” and “Cupid aſleep;” “Queen Eleanor ſucking the poiſon from the wounded Edward I.;” (an excellent engraving of the kind;) “Lady Elizabeth Grey ſoliciting the reſtoration of her Lands;” “Maria;” from Sterne's Sentimental Journey, and “Patience,” both upright ovals; alſo “King John ratifying Magna Charta.” The laſt plate being left, by Ryland's unfortunate death, in an unfiniſhed ſtate, has ſince been completed by Bartolozzi. This artiſt alſo engraved in lines, “Antiochus and Stratonice,” from Pietro de Cortona, and “The firſt Interview between Edgar and Elfrida,” from Angelica Kauffman, both large plates.

Ryland's engravings in the novel manner were, for the moſt part, printed in red, and this manner of engraving ſoon obtained the name of “the red chalk manner,” and was run after with avidity by the public. With ſo much heedleſs anxiety was it purſued, that people never ſtopt to conſider whether even red-chalk or ſtumped drawings themſelves, of which theſe prints were profeſſed imitations, were ſo good repreſentations of nature, or afforded a means ſo happy and efficient of transfuſing the ſoul of painting, as the art which previouſly exiſted, of engraving in lines, and which was then exerciſed in high perfection by Bartolozzi, Strange, Vivares, and Woollet: it was enough that it was new and red; Ryland and novelty led the way, and faſhion and the printſellers followed.

The print-dealers, upon miſtaken notions of private advantage, are ever exhauſting the permanent hopes of the art. Like ſavages, who are reckleſs of the future, they cut down the tree in order to obtain its fruit. The novelty of chalk engraving, by calling forth their ignorant exertions, coincided with, and encreaſed, the mania of the public, and except for the landſcapes of Vivares, Rooker, and Woollett, which required and exhibited more vigour and more detail of drawing than ſtippling could beſtow; and that now and then an hiſtorical engraving by Strange and Bartolozzi, and the ſeries from Weſt's hiſtory of England, (of which the death of general Wolfe was the firſt,) atteſted the exiſtence and maintained the dignity of the legitimate art, the engravers of Great Britain were compelled to feel, and ſilently to acknowledge, that

"Since ignorance was bliſs,
'Twas folly to be wiſe."

This mode of engraving, however, has ſince been greatly improved, and this improvement has been effected chiefly by living profeſſors. For an account of its proceſs and ſuſceptibilities, ſee the article Stippling.

Engraving, a mode or ſpecies of ſculpture performed by inciſion. The radix of the word ſhould rather be ſought in the Hebrew, than in the Greek language, becauſe the art itſelf was practiſed by the Hebrews and their Chaldean anceſtors for centuries before Greece had exiſtence.

There are ſeveral words uſed by the ſacred hiſtorian to expreſs or denote the work of the engraver. In the 28th chapter of Exodus, verſe 9, פתח ſignifies to make an opening, or inciſion; and hence come both the noun and its plural, פתוחים engravings.

One of the original ſenſes of the root is *to plough up*, ſo that the engraver is called *the plougher*; and frequently the word אבן, *a ſtone*, is added for the ſake of diſtinction, and both together may be properly tranſlated *the plougher* or *engraver in ſtone*.

Mr. Strutt with much truth obſerves, that "no word can expreſs more perfectly the operation of the engraver on metals of the preſent day (when performed ſimply with the graver) than the verb *to plough*." His line is a furrow, and in cutting it he turns up the copper, or other metal, as the huſbandman turns up the earth. The metal ſo turned up is termed the *burr*, which is afterwards removed with a tool termed by engravers a *ſcraper*.

In the 6th chapter of the firſt book of Kings, the word קלע is uſed to expreſs the hollowing out of the carved work upon the cherubim, palm trees, and open flowering in the ſanctuary, which were afterwards filled up with gold; which word in the Latin Vulgate is rendered *ſculpſit*; by others *cælavit*, and by others *incidit*.

Engraving has been performed in different countries and at different periods of time, on various ſubſtances; chiefly on metals, wood, and the oriental precious ſtones, which are called gems, but with inſtruments that have varied but little ſince they were firſt invented. For the latter arts, ſee Gem *Engraving* and Wood *Engraving*.

The metals upon which engraving is chiefly employed are copper and ſteel, the former for producing impreſſions on paper in various ways; the latter for ſtriking coins, medals, &c.

Engraving on copper, for the purpoſe of producing impreſſions, may be divided into five ſpecies, engraving in aqua-tinta, for which ſee Aqua-tinta; engraving in the chalk manner, for which ſee Stippling; engraving with aqua-fortis, for which ſee Etching; engraving on mezzotinto, for which ſee Mezzotinto *Engraving*, and the original art of engraving *in lines*.

Engraving in lines, for the purpoſe of producing impreſſions on paper, may almoſt be ſaid to be an art of modern invention, for though the ancients ornamented their pateras, armour, metal vaſes, &c. by this means, they appear never to have thought of printing from the inciſions, or lines cut with the graver; nor was it thought of at all until about the middle of the 15th century, for which ſee our accounts of the German and Italian *Schools of Engraving*.

This art is chiefly employed in repreſenting hiſtorical ſubjects, landſcapes, portraits, &c. &c. after pictures, or other deſigns made for the purpoſe.

It is performed, as we have ſtated, with the graver, dry point, or more frequently with the work of both theſe tools, mingled with lines corroded with aqua fortis. For the firſt there need but little apparatus, and few inſtruments. The plate you work on being well poliſhed, (for the method of preparing which, ſee Copper-*plates*,) is covered over with a thin ſkin of virgin-wax, and on this the outline of the draught, or deſign, done in black lead, red chalk, or other ungummed matter, is laid; and rubbed down for the wax to take off. The deſign, thus transferred upon the wax, is traced through on the copper, with a point, or needle; then heating the plate, and taking off the wax, the ſtrokes remain; to be followed, heightened, &c. according to the tenor of the deſign, with the graver, which is to be very ſharp, and well tempered.

The dry point, or needle, which has been of late much uſed in engraving, is a tool like an etching point, which being drawn hard on the copper, cuts a ſtroke, and raiſes a burr; the burr is ſcraped off, and there remains a ſtroke more ſoft and delicate than can be produced in any other way. See Dry *Point*.

In the adroit conduct of the graver and dry point the art chiefly conſiſts; for which there are no rules to be given; all depending on the habitude, diſpoſition, and genius, of the artiſt. However, ſome general obſervations and directions may not be improper. As the principles of engraving are the ſame with thoſe of painting, a perſon cannot expect to attain any conſiderable degree of perfection in this art who is not a good maſter of deſign; and therefore he ought to be well acquainted both with perſpective and architecture: for the former, by the proper degradations of ſtrong and faint tints, will enable him to throw backward, or bring forward, the figures and other objects of the picture or deſign which he propoſes to imitate; and the latter will teach him to preſerve the due proportion of its ſeveral orders, which the painter often entruſts to the diſcretion of the engraver. In order to preſerve equality and union in his works, the engraver ſhould always ſketch out the principal objects of his piece before he undertakes to finiſh them. Care ſhould be taken that the graver be carried level upon the plate, and be preſſed, as occaſion requires, with greater or leſs force, carrying the hand as evenly as poſſible. In engraving ſtraight lines, a leſs degree of preſſure ſerves for thoſe that are finer, and a greater is required to form the broader and deeper lines. In forming circular or curved lines, the hand and graver muſt be held ſteady, and the plate is to be moved upon the cuſhion under the graver. In large works a cuſhion is uſeleſs. The engraved work may be rendered more viſible, by rubbing it over with a roll of felt, dipt in oil, and which is called an oil rubber. The ſtrokes of the graver ſhould never be croſſed too much in the lozenge manner, particularly in the repreſentation of fleſh, becauſe ſharp angles produce the unpleaſing effect of lattice-work, and take from the eye the repoſe which is agreeable to it in all kinds of pictureſque deſigns: we ſhould except the caſe of clouds, tempeſts, waves of the ſea, the ſkins of hairy animals, or the leaves of trees, where this method of croſſing may be admitted. But in avoiding the lozenge, it is not proper to get entirely into the ſquare, which would give too much of the hardneſs of ſtone. In conducting the ſtrokes, the action of the figures, and of all their parts, ſhould be conſidered; and it ſhould be obſerved how they advance towards, or recede from, the eye; and the graver ſhould be guided according to the riſings or cavities of the muſcles or folds, making the ſtrokes wider and fainter in the light, and cloſer and firmer in the ſhades. Thus the figures will not appear jagged; and the hand ſhould be lightened in ſuch a manner, that the outlines may be formed and terminated without being cut too hard: however, though the ſtrokes break off where the muſcle begins, yet they ought always to have a certain connection with each other, ſo that the firſt ſtroke may often ſerve by its return to make the ſecond, which will ſhew the freedom of the engraver.

In engraving the fleſh, the effect may be produced in the lighter parts, and middle tints, by long pecks of the gravers, rather than by light lines; or by round dots, or by dots a little lengthened by the graver, or, beſt of all, by a judicious mixture of theſe together.

In engraving the hair and the beard, the engraver ſhould begin his work by laying the principal grounds, and ſketching the chief ſhades in a careleſs manner, or with a few ſtrokes; and he may finiſh it at leiſure with finer and thinner ſtrokes to the extremities. When architecture is to be repreſented, except it be old and ruinous buildings, the work ought not to be made very black; becauſe, as edifices are commonly conſtructed either of ſtone or white marble, the colour, being reflected on all ſides, does not produce dark ſhades, as in other ſubſtances. Where ſculpture is to be repreſented, white points muſt not be put in the pupils of the eyes of figures, as in engravings after paintings; nor muſt the hair or beard be repreſented as in nature, which makes the locks appear flowing in the air; becauſe in ſculpture there can be no ſuch appearances.

In engraving cloths of different kinds, linen ſhould be done with finer and cloſer lines than other ſorts, and be executed with ſingle ſtrokes. Woollen cloth ſhould be engraved wide, in proportion to the coarſeneſs or fineneſs of the ſtuff; and when the ſtrokes are croſſed, the ſecond ſhould be ſmaller than the firſt, and the third than the ſecond. Shining ſtuffs, which are generally of ſilk or ſatin, and which produce flat and broken folds, ſhould be engraved more hard and more ſtraight than others, with one or two ſtrokes, as their colours are bright or otherwiſe; and between the firſt courſe of lines other ſmaller muſt be occaſionally introduced, which is called interlining. Velvet and pluſh are expreſſed in the ſame manner, and ſhould always be interlined. Metals, as armour, &c. are alſo repreſented by interlining, or by clear ſingle ſtrokes. In architecture, the ſtrokes which form the rounding objects ſhould tend to the point of ſight; and when whole columns occur, it is proper to produce the effect as much as poſſible, by perpendicular ſtrokes. If a croſs ſtroke is put, it ſhould be at right angles, and wider and thinner than the firſt ſtroke. The ſtrokes ought to be frequently diſcontinued and broken, for ſharp and craggy objects. Objects that are diſtant towards the horizon ſhould be kept very tender. Waters that are calm and ſtill are beſt repreſented by ſtrokes that are ſtraight, and parallel to the horizon, interlined with thoſe that are finer; omitting ſuch places as, in conſequence of gleams of light, exhibit the ſhining appearance of water; and the forms of objects, reflected from the water at a ſmall diſtance upon it, or on the banks of the water, are expreſſed by the ſame ſtrokes, retouched more ſtrongly, or faintly, as occaſion may require, and even by ſome that are perpendicular. For agitated waters, as the waves of the ſea, the firſt ſtrokes ſhould follow the figure of the waves, and may be interlined, and the croſs ſtrokes ought to be very lozenge. In caſcades, the ſtrokes ſhould follow the fall, and be interlined. In engraving clouds, the graver ſhould ſport, where they appear thick and agitated, in turning every way according to their form, and their agitation. If the clouds are dark, ſo that two ſtrokes are neceſſary, they ſhould be croſſed more lozenge than the figures, and the ſecond ſtrokes ſhould be rather wider than the firſt. The flat clouds, that are loſt inſenſibly in the clear ſky, ſhould be made by ſtrokes parallel to the horizon, and a little waving; if ſecond ſtrokes are required, they ſhould be more or leſs lozenge; and when they are brought to the extremity, the hand ſhould be ſo lightened, that they may form no outline. The flat and clear ſky is repreſented by parallel and ſtraight ſtrokes, without the leaſt turning. In landſcapes, the trees, rocks, earth, and herbage, ſhould be etched as much as poſſible: nothing ſhould be left for the graver but perfecting, ſoftening, and ſtrengthening. The dry point produces an effect more delicate than the graver can, and may be uſed to great advantage in linen, ſkies, diſtances, ice, and often in water, eſpecially in ſmall engravings. In moſt things it is proper to etch the ſhadows, only leaving the lighter tints for the dry point, graver, &c.

The other inſtruments, beſides the graver and dry point, are, a cuſhion, or ſand-bag, to lay the plate on, to give it the neceſſary turns and motions: a burniſher, round at one end, and uſually flattiſh at the other, to rub out ſlips and failures, and to ſoften the ſtrokes, &c. A ſcraper, to pare off the ſurface, on occaſion, and remove the burr; and a rubber of black cloth, or hat, to fill up the ſtrokes, that it may ſhew how the work proceeds: but the latter ſhould be ſparingly uſed.

ENGRAVING *on ſteel*, is chiefly employed in cutting punches, matrices, and dies, proper for ſtriking coins, medals, and counters.

The method of engraving, with the inſtruments, &c. are the ſame for coins as for medals and counters: all the difference conſiſts in their greater, or leſs relievo; the relievo of coins being much leſs conſiderable than that of medals; and that of counters ſtill leſs than that of coins. The engraver in ſteel uſually begins with punches, or punchions, which are in relievo, and ſerve for making the creux, or cavities of the matrices, and dies; though ſometimes he begins immediately with the creux; but it is only when the intended work is to be cut very ſhallow. The firſt thing is to deſign his figures; then he moulds them in white wax, of the ſize and depth required; and from this wax he graves his punch.

This punch is a piece of ſteel, or, at leaſt, of iron and ſteel mixed; on which, before they temper, or harden it, the intended figure, whether a head, or a reverſe, is cut, or carved, in relievo. The inſtruments uſed in this *graving* in relievo, which are much the ſame as thoſe wherewith the finiſhing of the work in creux is effected, are of ſteel: the principal are, gravers of divers kinds, chiſſels, flatters, &c. when the punch is finiſhed, they give it a very high temper, that it may the better bear the blows of the hammer, wherewith it is ſtruck, to give the impreſſion to the matrice.

What they call *matrice*, or *matrix*, is a piece of good ſteel, of a cubic form, called alſo the *dye*, whereon the relievo of the punch is ſtruck in creux: it is called *matrix*, becauſe in the cavities, or indentures, thereof, the coins, or medals, ſeem formed, or generated, as animals are in the matrix of their mother. To ſoften this ſteel, that it may more eaſily take the impreſſions of the punch, they make it red-hot; and, after ſtriking the punch thereon in this ſtate, they proceed to touch up, or finiſh, the ſtrokes and lines, where, becauſe of their fineneſs, or the too great relievo, they are in any reſpect defective, with ſome of the tools above-mentioned.

The figure thus finiſhed, they proceed to engrave the reſt of the medal; as the mouldings of the border, the engrailed ring, letters, &c. all which, particularly the letters, and graining, or engrailment, are performed with little ſteel punches, well tempered and very ſharp. Add, that as they ſometimes make uſe of puncheons to engrave the creux of the matrix, ſo, on ſome occaſions, they make uſe of the creux of the matrix to engrave the relievo of the punch.

To ſee and judge of the engraving in creux, divers means have been deviſed to take the impreſſions therefrom, as the work proceeds; ſometimes they make uſe of a compoſition of common wax, turpentine, and lamp-black; which, always retaining its ſoftneſs, eaſily takes the impreſſion of the part of the graving it is applied to; but this only ſerving to ſhew the work piece-meal, they have had recourſe to other ways to ſhew the whole figure. The firſt by pouring melted lead on a piece of paper, and clapping the matrice thereon; the ſecond, with melted ſulphur, managed the ſame way; and the third, proper only where the graving is ſhallow, by laying a piece of ſoft paper on the graving, and over the paper a leaf of lead; when giving two or three blows with a hammer on the lead, the paper takes the impreſſion of the work.

When the matrix is quite finiſhed, they temper it, rub it well with a pumice-ſtone, and clean out the ſtone again with a hair-bruſh; and, laſtly, poliſh it with oil and emery: in this condition it is fit for the mill, to be uſed to ſtrike coins, medals, &c.

After the like manner are the matrices for caſting of printing letters engraven. See *Letter* FOUNDERY.

ENGRAVING *of ſeals, ſtamps, puncheons, marking irons, gilding irons*, and other matters, for goldſmiths, pewterers, bookbinders, &c. either in relievo, or indenture, is performed after the manner laſt deſcribed.

ENGRAVING *in wood*. See CUTTING *in wood*, and WOOD *Engraving*.

ENGRAULIS, in *Ichthyology*, a name given, by ſome authors, to the anchovy, called alſo, by ſome, lycoſtomus, and, by others, halecula. See ENCRASICOLUS.

ENGROSSING, the writing a deed over fair and in proper legible characters. Among lawyers it more particularly means the copying of any writing fair upon parchment, or ſtamped paper. See COPY, CALLIGRAPHUS, &c.

ENGROSSING, in *Law*, denotes the getting into one's poſſeſſion, or buying up large quantities of corn, or other dead victuals, with intent to ſell them again. This muſt of courſe be injurious to the public, by putting it in the power of one or two rich men to raiſe the price of proviſions at their own diſcretion. And ſo the total engroſſing of any other commodity, with intent to ſell it at an unreaſonable price, is an offence indictable and fineable at the common law. (Cro. Car. 232.) And the general penalty for this offence, as well as for *foreſtalling* and *regrating* (which ſee), by the common law, (for all the ſtatutes concerning them were repealed by 12 Geo. III. c. 71.) is, as in other minute miſdemeſnors, diſcretionary fine and impriſonment. (1 Hawk. P. C. 235.) Among the Romans theſe offences, and other mal-practices to raiſe the price of proviſions, were puniſhed by a pecuniary mulct. "Pœna viginti aureorum ſtatuitur adverſus eum, qui contra annonam fecerit, ſocietatemve coierit quo annona carior fiat." (Inſ. 48. 22. 2.)

ENGSTLEN, in *Geography*, a remarkable ſpring of Switzerland, in the canton of Berne, in the valley called Gentel. The water flows only from the beginning of May till the latter end of Auguſt, and that twice a day towards eight o'clock in the morning, and towards four in the afternoon. This circumſtance is conſidered as miraculous: the inhabitants fancy that providence purpoſely ſends them this water in the ſeaſon, and at the time when they are to water their cattle. Nothing, however, is more eaſily explained than this phenomenon. Many brooks iſſue from mount Engſtlen, and form a ſmall lake. In the ſummer months, the ſnow water cauſes this lake to overflow; and the melting of the ſnow begins with the day, and ceaſes towards night. F. I. Durand's Statiſtique élémentaire de la Suiſſe, 1795.

ENGUELEGUINGIT, a town of Africa, in the empire of Morocco, not far from Mogador.

ENGUICHE, in *Heraldry*, is applied to the great mouth of a hunting horn, when it has a rim of a different colour from the horn itſelf.

ENGYSCOPE, from εγγυς, *near*, and σκοπεω, *I obſerve*, a machine better known under the name of microſcope. See MICROSCOPE.

ENGYTHECA, from εγγυς, *near*, and θηκη, *repoſitory*, in *Antiquity*, a cup-board, or place where cups and other veſſels uſed to be laid.

ENGYUM, or ENGUYUM, in *Ancient Geography*, a town of Sicily, ſituated near mount Maurus, at the ſprings of Alæſus. Cicero (in Verr.) repreſents it as one of the moſt conſiderable cities of that iſland. It was founded by the Cretans, and famous for a temple dedicated to Ceres, in which, it was conſtantly affirmed, certain goddeſſes, called the "Mothers," appeared from time to time. Plutarch ſays, that this temple was built by the Cretans, and dedicated to theſe goddeſſes ſo called, *viz.* Cybele, Juno, and Veſta. This writer adds, that in the temple were lodged javelins and brazen helmets, which had been conſecrated to the goddeſſes of the place by Meriones and Ulyſſes. The town was ſituated in the interior of the iſland, to the weſt of Hubita.

ENHADDAD, a town of Judea, compriſed in a part of the tribe of Iſſachar.

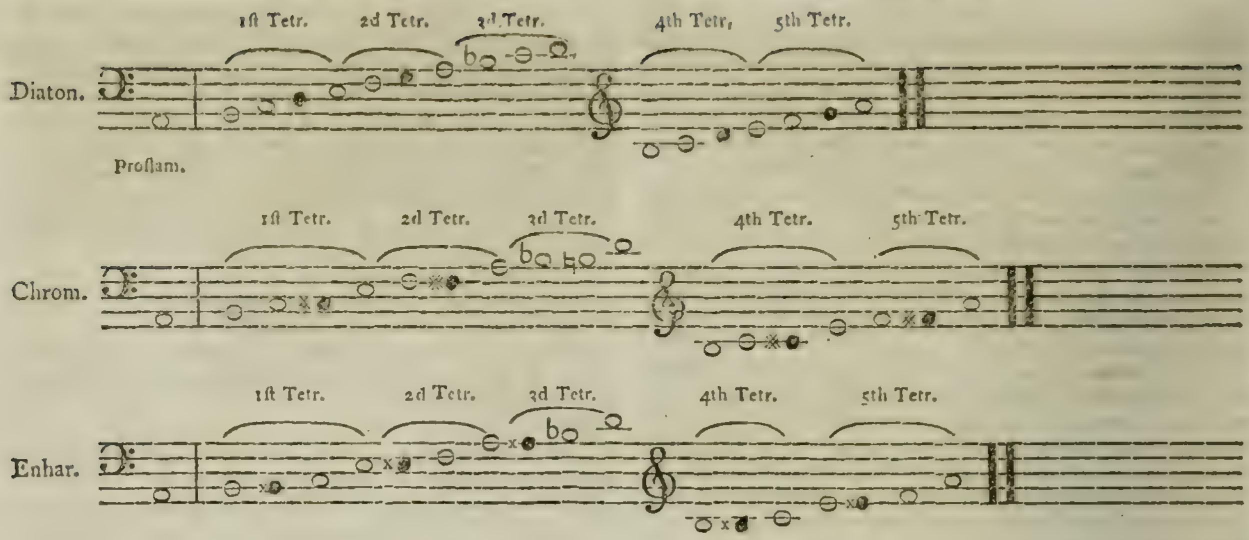
ENHALLOW, in *Geography*, one of the ſmaller Orkney iſlands, between Rowſa and Pomona.

ENHANCE, *To*, in *Law*, is to raiſe the price of goods or merchandize. See ENGROSSING and FORESTALLING.

ENHANCED, in *Heraldry*, a term applied to any ordinary, when removed from its uſual ſituation, and placed higher in the field.

ENHARMONIC GENUS, in the *Ancient Greek Muſic*. The Greeks included all muſical ſounds in three genera or kinds of interval: the diatonic, for tones and ſemi-tones; the chromatic, for ſemi-tones and minor thirds; the enharmonic, for quarter-tones and major thirds. The ſcale of each genus was arranged in tetrachords, or ſyſtems of four ſounds, of which the firſt and laſt were ſtantes, immobiles, or fixed; while the two middle ſounds were termed mobiles, or changeable: and it is by theſe changes that the genera are diſtinguiſhed.

Each of the three genera had ſome ſounds in its ſcale that were peculiar and characteriſtic, and ſome that were in common with the other two. For inſtance, B C E F A Bb and d, were uſed in all the three genera, whereas D G were peculiar to the diatonic, C♯ and F♯ to the chromatic, and B × E × and A × to the enharmonic. A complete ſcale of each genus in modern notes will explain this matter better than words.



This ſubject will be further purſued under the articles *Ancient Greek* Music, Genera, and Tetrachords.

As modern melody is built upon harmony, derived from the harmonics of a fundamental-baſe, we have no inſtruments with quarter-tones, or which can furniſh a baſe to an enharmonic melody, if we had the power of framing and executing it with the voice or violin. We have, therefore, only two genera in our muſic, with all our refinements in melody of nominal enharmonic ſharps, dieſes, double flats, and ſharps, &c.: which two genera, the diatonic, conſiſting of five tones and two ſemi-tones in the octave, ſuch as the key of C natural ſupplies upon keyed inſtruments; and the chromatic, conſiſting entirely of ſemi-tones, twelve in number, ſuch as moving from any given note to its octave by ſemi-tones will furniſh. See Tone, Semi-tone, and *Enharmonic* Sharps or Dieses.

Enharmonic *Dieſis*, is an interval whoſe ratio is $\frac{125}{128} = 21\Sigma + 2\mathrm{m}$. See *Enkarmonic* Diesis.

Enharmonic *Degree of Ariſtoxenus*, otherwiſe his dieſis quadrantalis, was a quarter of the major tone, or $26\Sigma + \frac{1}{2}\mathrm{f} + 2\frac{1}{4}\mathrm{m}$.

Enharmonic *Degree of Euclid*, otherwiſe his dieſis quadrantalis, was three-thirtieths of a minor fourth, or $25\frac{2}{7}\Sigma + \frac{1}{2}\mathrm{f} + 2\frac{1}{5}\mathrm{m}$.

Enharmonic *Ditone of Euclid*, was twenty-four thirtieths of a minor fourth, or $203\frac{1}{3}\Sigma + 4\mathrm{f} + 17\frac{3}{4}\mathrm{m}$.

Enharmonic *Quarter of a tone*, is the ſame with *enharmonic dieſis*, above.

ENHYDRI, in *Chemiſtry*, are ſmall nodules of chalcedony, each containing a drop of water, which are found in the porous trap of the picentine. They are often poliſhed and ſet in rings, rather as an object of curioſity than of much beauty; and after a time the water uſually diſappears by evaporation.

ENHYDRIA, in *Ancient Geography*, a town of Phœnicia, between Caranus and Marathus. Strabo.

ENHYDRIS, the ancient Greek name for the otter.

ENJEDIM, George, in *Biography*, a learned Unitarian divine, who flouriſhed in the 16th century, was a native of Hungary, whence he removed to Tranſylvania, where he became a ſuperintendant of the Unitarian churches. He died in the year 1597, and was regarded as one of the beſt writers in what is called the Socinian cauſe. His principal work was entitled "Explicatio Locorum Scripturæ Veteris et Novi Teſtamenti, ex quibus Dogma Trinitatis ſtabiliri ſolet," 4to. The firſt impreſſion of this work was burnt by the orthodox, but a new edition was afterwards publiſhed in the Netherlands. Moreri.

ENIF, in *Aſtronomy*, a fixed ſtar of the third magnitude, in Pegaſus's mouth.

ENIGMA. See Ænigma.

ENIMIE, Sainte, in *Geography*, a ſmall town of France, in the department of Lozere, 12 miles S.W. of Mende, in a country formerly known by the name of le Gévaudan.

ENINGIA, in *Ancient Geography*, a country or iſland in the north of Europe, in the Serius Codanus or Baltic ſea, according to Pliny; ſuppoſed by ſome to be Finland.

ENIPEUS, or Enipe, a river of Greece, in Triphylia, which ran W. of Heraclea. In the time of Strabo, it was called *Barnichius*.

ENIPPA, or Agonippa, a mountain of Greece, in Bœotia.

ENISEI and Eniseisk. See Yenisei and Yeniseisk.

ENISIPIA, an iſland of the Mediterranean ſea, near Egypt, called *Æneſyppa* by Ptolemy, and *Eneſipaſta* by Strabo.

ENISPA, a town of the Peloponneſus, in Arcadia, called *Eniſpæ* by Seneca the tragedian.

ENIX, in *Geography*, a town of Spain, in the province of Grenada; 8 miles W. of Almeria.

ENIXUM Sal, in *Chemiſtry*, is the ſulphat of potaſh remaining after the preparation of nitrous acid. It is pure, if only nitre and ſulphuric acid have been made uſe of: but as the manufacturers of aquafortis uſually employ green vitriol inſtead of ſulphuric acid, the reſidual ſalt is much mixed with colcothar or oxyd of iron; from which, however, it may be ſeparated by ſubſequent ſolution and cryſtallization.

ENKIANTHUS, in *Botany*, from εγκυος, *pregnant*, and ανθος, *a flower*, "becauſe," ſays Loureiro, "its flowers are pregnant with others." Loureir. Cochinch. 276. Claſs and order, *Decandria Monogynia*. Nat. Ord. ——.

Gen. Ch. *Common Cal.* of ſix roundiſh, concave, pointed, coloured leaves. *Common Cor.* of eight oblong, flat, ſpreading petals, containing five florets, on long reflexed ſtalks.

Perianth of five ſmall, permanent, acute, coloured leaves. *Cor. proper* of one petal, bell-ſhaped; tube wide; limb ſhort, in five rounded ſegments. *Stam.* Filaments ten, awl-ſhaped, tumid at the baſe, hairy, attached to the bottom of the corolla, and ſhorter than its limb; anthers ovate, incumbent. *Piſt.* Germen five-ſided, ſuperior; ſtyle thick, as long as the ſtamens; ſtigma ſimple, coloured, ſhining. *Peric.* Berry ovate-oblong, five-ſided, of five cells. *Seeds* numerous, oblong, ſmall. *Loureiro.*

Eſſ. Ch. Common Calyx to ſeveral flowers; proper one inferior, of five leaves. Corolla bell-ſhaped, five-cleft. Berry of five cells, with many ſeeds.

The ſpecies are two.

1. E. *quinqueflora.* "Calyx containing five flowers. Stem arboreous." Tſiau tſung hōa of the Chineſe. Cultivated at Canton. Its branches laden with red flowers, before the leaves expand, are kept for ſeveral days in china vaſes of water among the opulent Chineſe, and are very ornamental, though deſtitute of ſcent. The *tree* is of a middle ſize, with a ſmooth *bark*, and ſpreading *branches*. *Leaves* crowded, oblong, pointed, entire, ſmooth. *Flower* ſolitary, of a beautiful red, crowned with a white fringe, and containing five florets within.

2. E. *biflora.* "Calyx containing two flowers. Stem ſhrubby." Sāu lièo hōa of the Chineſe. Native of Canton. A *ſhrub* three feet high, with ſpreading *branches*. *Leaves* lanceolate-ovate, entire, hairy, ſmall, crowded, with ſhort footſtalks. *Flowers* ſcarlet, terminal, crowded, ſeſſile. *Common Calyx* of five coloured, ovate, concave, deciduous leaves. *Common Corolla* none. Florets two in each common calyx. *Perianth* ſmall, deeply five-cleft; its ſegments lanceolate, hairy, ſpreading. *Cor.* bell-ſhaped, ſpreading; tube with five furrows or plaits; limb in five deep, ovate, large ſegments. *Filaments* ten, thread-ſhaped, erect, unequal, rather ſhorter than the corolla, inſerted into the receptacle; anthers ovate, incumbent. *Germen* ovate, very hairy; ſtyle thread-ſhaped, longer than the corolla; ſtigma thickiſh, five-cleft, gaping. *Berry?* (not ſeen ripe), ovate, with five cells and many very ſmall roundiſh ſeeds.

The above is Loureiro's account of the genus in queſtion, concerning which we confeſs ourſelves unable to form any decided opinion. His deſcription of the ſecond ſpecies is a little at variance with the generic characters, and what he every where terms a common calyx and common corolla muſt of courſe be bracteas. Some particulars indicate a plant of the *Arbutus* or *Vaccinium* tribe, but others diſagree. Ornamental ſcarlet flowers, ſo well known at Canton, muſt long ago have been introduced to the acquaintance of European botaniſts. This is one of thoſe botanical enigmas with which the good father Loureiro's book abounds, in conſequence of his having ſtudied almoſt entirely without communication with other botaniſts. Hence he took the *Hydrangea* for a *Primula*, and made a new genus of *Argemone mexicana.* See ECHTRUS.

ENKIOPING, or ENDKIOPING, in *Geography*, a ſmall town of Sweden, ſituated on a river cloſe to an inlet of the lake Mæler, and conſiſting chiefly of wooden houſes painted red. It ſtands on a ridge of ground compoſed of ſand and gravel, which once formed the ſhore of the lake; 21 miles S.W. of Upſal.

ENKIRCH, a town of Germany, in the circle of the Upper Rhine, and county of Sponheim; 3 miles N. of Traarbach.

ENKUSEN, a town of the iſland of Borneo.

ENLARGE, in the *Manege*, is uſed for making a horſe go large, that is, making him embrace more ground than he before covered. This is done when a horſe works upon a round, or upon volts, and approaches too near the centre, ſo that it is deſired he ſhould gain more ground, or take a greater compaſs. To enlarge your horſe, you ſhould prick him with both heels, or aid him with the calves of your legs, and bear your hand outwards. If your horſe narrows, he is enlarged with pricking him with the inner heel, and ſuſtaining him with the outer leg, in order to preſs him forwards, and make his ſhoulders go. Upon ſuch occaſions the riding-maſters cry only large, large. See IN.

ENLARGER L'ESTATE, in *Law*. See RELEASE.

ENLARGING STATUTE. See STATUTE.

ENMANCHE', in *Heraldry*, is when a chief has two lines drawn from the middle of the upper edge, to the ſides, the depth of half the chief; the two lines including an obtuſe angle, whoſe vertex is the centre of the top of the chief.

The heralds conceive this, as bearing ſome reſemblance to ſleeves; whence the etymology of the word, from the French *manche*, ſleeve. It differs from chappe, where the lines come from the top to the bottom of the chief.

ENNA, in *Ancient Geography*, now *Caſtro Giovani*, a city of Sicily, ſituated on an eminence in the middle of the iſland, whence, according to Diodorus, it was called the "navel of Sicily." It was one of the ſtrongeſt places in the iſland, and remarkable for its beautiful plains, fruitful ſoil, and the numerous lakes and ſprings which watered its territory; and the waters of which were highly commended for their limpidity and ſalubriouſneſs. Diodorus informs us, that Ceres was born in this diſtrict; and that ſhe firſt taught the inhabitants of Enna the art of agriculture. He adds, that the rape of Proſerpine by Pluto happened near Enna, while the young goddeſs was gathering flowers in a neighbouring meadow. The Enneans ſhewed a large cavern, which, as they believed, opened of itſelf, to make the god a way to his infernal kingdom. Hence originated the worſhip which the Sicilians paid to theſe two divinities; the magnificent temple which Gelo erected to Ceres in this city; and the ſolemn feſtival, which the Syracuſians annually celebrated near the fountain Cyane, ſuppoſed to have ſprung up when the earth opened under Pluto's feet. The temple of Ceres was famous and reſorted to from all parts of Italy, Greece, and Aſia, and was deemed one of the richeſt in Italy.

ENNEACHORD, in *Ancient Muſic*, an inſtrument with nine ſtrings.

ENNEACRUNOS, q. d. *the nine fountains*, in *Ancient Geography*, a fountain of Greece in Attica, at the foot of mount Hymettus, the waters of which were conveyed through nine pipes or channels into the town, conſtructed by order of Piſiſtratus.

ENNEACTIS, in *Natural Hiſtory*, a name given by Linkius to a ſort of ſtar-fiſh, of the more branched or aſtrophyte kind, which has only nine rays, where they firſt part from the body, but theſe divide into a vaſt number of others afterwards.

ENNEADECATERIS, in *Chronology*, a cycle, or period, of nineteen ſolar years.

The word is formed of εννεα, *nine*; δεκα, *ten*; and ετος, *year*.

Such is the lunar cycle invented by Meton, at the end whereof the moon returns nearly to the ſame point from which it departed. Whence the Jews, Athenians, and other nations, who were diſpoſed to accommodate the lunar months to the ſolar years, made uſe of the enneadecateris; allowing to ſeven of the years thirteen months apiece, and to the reſt twelve. See CYCLE, and EMBOLISMIC.

ENNEADECATERIS, *the Jewiſh*, is properly a cycle of 19 lunar years, beginning from *molad tohu*, and returning again and again; whereof every 3d, 6th, 8th, 11th, 14th, 17th, and 19th, are emboliſmic, or of 383 days 21 hours apiece; the reſt common, or of 354 days 8 hours apiece. See YEAR.—Conſequently, the Jewiſh enneadecateris is 6939 days 18 hours.

ENNEAGON, in *Geometry*, a figure of nine angles, and nine ſides.

The word is formed of εννεα, *nine*; and γωνια, *angle*.

ENNEAGON, in *Fortification*, denotes a place with nine baſtions. See FORTIFIED *Place*.

ENNEAHEDRIA, derived from the Greek εννεα, *nine*, and ἑδρα, a *ſide*, in *Natural Hiſtory*, the name of a genus of ſpars.

The bodies of this genus are ſpars, compoſed of nine planes, in a trigonal column, terminated at each end by a trigonal pyramid. Of this genus there are four known ſpecies. Hill's Hiſt. of Foſſ. p. 208.

ENNEANDRIA, in *Botany*, from εννεα, *nine*, and ανηρ, *a man*, the ninth claſs of the ſexual or artificial ſyſtem of Linnæus, conſiſting of plants with nine ſeparate or diſtinct ſtamens in the ſame flower with the piſtil or piſtils. It contains three orders, *Monogynia*, of which the valuable genus *Laurus*, including the Cinnamon, Caſſia, one ſort of Camphor, Sweet Bay, &c. is an example, and there are ſome other fine plants in this order; *Trigynia*, of which *Rheum* or Rhubarb, nearly allied to *Rumex*, is the only inſtance, and *Hexagynia*, conſiſting of *Butumus umbellatus* alone. Hence it appears that nine is an unuſual number in the parts of flowers, though not quite ſo uncommon as ſeven.

ENNEAPYRGÆ, in *Ancient Geography*, a town of Greece, in Attica, 7 or 8 leagues from the promontory of Sunium.

ENNEATICAL DAYS are every ninth day of a ſickneſs; which, ſome imagine, naturally occaſion a great alteration, either for the better or worſe.

ENNEATICAL *Years* are every ninth year of a man's life. See CLIMACTERIC.

ENNEBACKA, in *Geography*, a town of Norway; 26 miles S.E. of Chriſtiania.

ENNEEMIMERIS is one kind of the cæſura of a Latin verſe, where, after the fourth foot, there is an odd ſyllable ending a word, which helps to make the next foot with the following word; as in this inſtance,

> "Ille latus niveum molli fultus hyacintho,"

where all the four kinds of the cæſura occur.

ENNEL-LOUGH, in *Geography*, a lake of the county of Weſtmeath, Ireland, near Mullengar.

ENNEOPHTHALMOS, from εννεα, *nine*, and οφθαλμος, *eye*, in *Zoology*, a name given by ſome to the lamprey.

ENNERIS, in the *Ancient Ship-Building*, a name given to thoſe galleys, or veſſels, which had nine tires of rowers. Theſe were of a very conſiderable ſize; though Meibom has found ſo convenient a method of placing the rowers that he has taken off very much from that immenſe height others ſuppoſed they had above the water. We read of the teſſaracontes, and other amazing veſſels of this fabric; and that of Philopater having forty rows of oars, and that of Ptolemy Philadelphus, thirty; and ſome others which are ſpoken of, twenty. It has been diſputed by many, whether ſuch large veſſels as theſe were ever actually built, or uſed; but Meibom gives great reaſon to believe that they really were, though he, at the ſame time, alleges againſt Salmaſius, and the more ſanguine admirers of the works of the ancients, that very few veſſels were built larger than theſe enneres, or nine tiered ones, and proves it from Livy and Plutarch, and from Polybius. We are apt to admire, in many caſes, what we ought alſo to imitate, but never attempt it. This is the caſe in theſe galleys; and Meibom, who has given the rules of this ancient naval architecture, is of opinion, that by imitating it at preſent, modern galleys and galleaſſes might be built much more conveniently both for ſtrength and celerity, and alſo at leſs expence, than they are at preſent. Meibom. de Trirem.

The modern form is indeed allowed to be better than theirs; but if in the ſtructure, the proportion of the long ſhips of the ancients were obſerved, they might be greatly improved: in the modern way of five men ſitting at one oar in the galleaſſes, much ſtrength is waſted to no purpoſe, becauſe they ſit too near to the fulcrum, or ſtay, whereas a ſmaller number of rowers, at a greater diſtance from the ſtay, would give more ſtrength, and throw the veſſel along much more ſwiftly, and would require leſs charge. Galleys of this ſort, thus managed at a ſmall expence, would be found of great uſe in the large rivers, and in the ſhallow ſeas, and therefore convenient for the Baltic, the Britannic, and the Mediterranean ſeas, and would be the moſt uſeful of all veſſels for tranſporting great numbers of forces.

ENNEZAT, in *Geography*, a ſmall town of France, in the department of the Puy de Dôme, chief place of a canton in the diſtrict of Riom, with a population of 2393 individuals. The canton contains 8 communes and 9168 inhabitants, on a territorial extent of 142½ kiliometres.

ENNIS, a poſt-town in the county of Clare, Ireland, of which it is the capital. It is large and populous, and has the advantage of a ſmall port at Clare, which is ſituated a few miles lower on the river Fergus; the tide bringing up large boats thence to Ennis. There are at this town the remains of one of the fineſt abbey-churches in Ireland, built in an elegant ſtyle of Gothic architecture. It is a borough town, and ſends one member to the united parliament. It is 112½ Iriſh miles S.W. by W. from Dublin, and 17 N. by W. from Limerick. W. long. 8° 54'. N. lat. 52° 49'.

ENNISCORTHY, a poſt-town of the county of Wexford, Ireland. It is ſituated on the river Slaney, which is navigable for ſmall ſloops to this town. Its ſituation is agreeable and pictureſque; and there are the remains of a conſiderable caſtle built by the firſt Engliſh ſettlers. It is the eſtate of the earl of Portſmouth. Enniſcorthy has a manufacture of coarſe woollen-cloth, and is a thriving town. Near it are lead mines, which are very productive. Vinegar-hill, near this town, was a ſtrong hold of the inſurgents in 1798; and the loyal inhabitants were great ſufferers at that eventful period. Enniſcorthy was repreſented in parliament before the union. It is 60 miles S. from Dublin, and near 12 N. from Wexford.

ENNISKILLEN, a poſt-town of the county of Fermanagh, Ireland, and the place where the aſſizes are held. It is built in an iſland, formed by the river which unites the two lakes, and is the ſingle paſs of communication between the parts of the county which theſe waters ſeparate. The ſtrength of its ſituation pointed it out as a military poſt; and when the adherents of James II. excited a juſt alarm throughout the country, numbers flocked to this place, where they bravely reſiſted a much ſuperior force, and even gained ſeveral important victories. Theſe valiant men were formed into a regiment, which rendered effectual ſervice to king William; and to this day the 27th regiment glories in the name of the *Enniſkilliners*. There is a ſchool here, founded by James I. on the plantation of Ulſter, the income of which, by the great riſe in the value of lands, has become very conſiderable. Enniſkillen returns one member to the imperial parliament. Diſtance from Dublin N.W. 79 miles.

ENNISTYMOND, or Innistymond, a ſmall poſt-town of the county of Clare, Ireland; ſituated 118 miles W. by S. from Dublin, and 13 W. from Ennis.

ENNIUS, Quintus, in *Biography*, an ancient poet, was born at Rudiæ, a city of Calabria, near Tarentum, about the year of Rome 514, B. C. 237, and flouriſhed about the cloſe of the firſt Punic war. According to Silius Italicus, he ſerved as a centurion in Sardinia, when that iſland was ſubdued by T. Manlius, and diſtinguiſhed himſelf by his valour. After the war he probably remained in Sardinia; for Cornelius Nepos informs us, that Cato, the cenſor, when prætor, brought back with him from his government of Sardinia, the poet Ennius, who muſt at this time have been in his 35th year. Another of his patrons was Scipio Africanus the elder, who made him his companion in moſt of his campaigns. This fact we learn from Claudian. He was alſo intimate with Scipio Naſica. The notice taken of him by theſe eminent perſons affords favourable teſtimony to his general character and manners; although Horace (Epiſt. xix. l. 1.) repreſents him as warming his heroic vein by liberal potations. The gout, with which he was afflicted, and his depreſſed circumſtances, were probably owing to his intemperance. Theſe evils, however, he bore with great equanimity; and his life was prolonged to the age of 70. He is ſaid to have been the father of epic or heroic poetry among the Latins, though the Greek was his mother-tongue. He was diſtinguiſhed by that ruſtic vigour, which is the uſual characteriſtic of genius in an unpoliſhed age. Thus Ovid repreſents him;

> "Ennius ingenio maximus, arte rudis."

Lucretius mentions his having firſt brought the muſe to Latium; and Virgil has tranſcribed into his works many whole or half lines from Ennius, thus teſtifying his eſteem of him. The events of Roman hiſtory formed the leading ſubjects of a large performance entitled "Annals," ſubſequently divided into eighteen books. On certain days he was accuſtomed to recite portions of this poem. He alſo compoſed tragedies, comedies, epigrams, and ſatires; and alſo ſome didactic works. By his life of Scipio Africanus, he engaged the affection of the Cornelian family, who manifeſted their gratitude to him even after his death, depoſiting his aſhes in the ſame tomb with thoſe of Scipio, and erecting a marble ſtatue to him near that of this great commander. The poet Nævius, who was his contemporary, after having made ſome campaigns in the firſt Punic war, wrote the hiſtory of that war in verſe, according to the taſte of thoſe times. Fragments only of the works of Ennius remain; theſe have been publiſhed ſeparately, Amſt. 4to. 1707, and alſo in Mattaire's Corpus Poetarum.

ENNODIUS, Magnus Felix, biſhop of Pavia in the ſixth century, was born of illuſtrious parents about the year 473. His education and maintenance devolved upon an aunt, by whoſe death, before he was ſixteen years of age, he was reduced to diſtreſſing circumſtances, but afterwards, by a fortunate marriage, he attained to a ſtate of affluence. Notwithſtanding this union, he had a ſtrong inclination for the eccleſiaſtical profeſſion, and obtained his wife's conſent to enter into holy orders, whilſt ſhe at the ſame time embraced a religious life. He was ordained a deacon by Epiphanius, biſhop of Pavia, with whom he lived in habits of the ſtricteſt intimacy and friendſhip. He had an early taſte for literature, which he cultivated in connection with his theological ſtudies, with ſo much ſucceſs as obtained for him the reputation of an excellent ſcholar. On the death of his friend Epiphanius, he was admitted among the deacons of the church of Rome, and for ſome ſervices done for the popes and church, he was promoted to the ſee of Pavia about the year 510, and appointed on the commiſſion for negociating a re-union between the eaſtern and the weſtern churches. The only reward for his ſervices in this reſpect, was drawing down upon his head the reſentment of the emperor Anaſtaſius, who, after much ill treatment, diſmiſſed him home in a ſhattered veſſel, with a ſtrict prohibition of never again landing at any port in Greece, by which his life was expoſed to the moſt imminent danger. He arrived ſafe in Italy, but died as he was on his journey to Pavia, in the 48th year of his age. His works are numerous, and have been frequently printed; they were publiſhed, with many uſeful explanatory notes, at Paris, in the year 1611. Moſheim Eccl. Hiſt. Moreri.

ENNUI, a French term which is ſometimes uſed to denote a kind of liſtleſſneſs or unaptneſs for mental exertion; or which may be more ſcientifically defined to mean the uneaſineſs that prevails during the abſence of mental impreſſions. The averſion from *ennui*, or the deſire of intellectual emotion, is deſcribed by Helvetius, in his work "On Mind," as a very powerful and general ſpring of conduct, and he aſcribes to this law of the mind, perhaps, a greater degree of influence than that which properly belongs to it, conformably to the avowed ſentiments of a writer, who maintains that "to judge is to feel," (juger c'eſt ſentir.")

ENO, in *Geography*, a town of European Turkey, in the province of Romania; the ſee of a Greek archbiſhop; 28 miles N.W. of Gallipoli.—Alſo, a river of America, in North Carolina, which unites with Little and Flat rivers in Orange county, and forms the Negus, about 17 miles below Hillſborough.

ENOCH, in *Biography*, the ſon of Jared and father of Methuſelah, was the ſeventh in lineal deſcent from Adam, and born in the year B. C. 3382. Eminently diſtinguiſhed by his piety and virtue in a corrupt age, he was tranſlated to heaven in the 365th year of his age, without undergoing the pains of diſſolution. An apocryphal book, entitled "The Book or Prophecies of Enoch," has been aſcribed to this celebrated antediluvian, and is cited, as ſome ſay, by Jude in his epiſtle, and more certainly by Irenæus, Clement of Alexandria, and other ancient fathers. But this book was probably forged in the ſecond century. The Mahometans mention Enoch under the appellation of Edriſs, or Idriſs, and record many fables concerning him, which it is needleſs to mention.

Enoch, in *Ancient Geography*, a city ſaid to have been built by Cain in the land of Nod, where he had his family ſettled, and called after the name of his ſon Enoch. (Gen. iv. 16, 17.) Moſes places it, according to our tranſlation, on the eaſt of Eden; and Ptolemy mentions a city called Anuchtha in Suſiana, or Chuſiſtan, a country lying eaſtward from Chaldæa, which the learned Huet ſuppoſes to have been the ſame with that built by Cain. But it ſeems very improbable, that the city of Enoch, built before the flood, ſhould either withſtand the deluge or retain its ancient name, after ſo great a change in the ſurface of the earth. Beſides, Suſiana being a very fertile and pleaſant country, it is not likely that Cain ſhould be baniſhed thither, but rather to ſome barren and deſolate land, remote from the place of his nativity, and ſeparated by mountains, or other natural impediments, from intercourſe with his relations. As there was another Enoch (ſee the preceding article) beſides the ſon of Cain, it is not improbable that the city Anuchtha mentioned by Ptolemy, might have taken its name from him, whoſe memory would be held in veneration, or from ſome other Enoch or Anoch, who might have lived after the flood. Grotius and Junius are of opinion, that the country into which Cain retired was the deſart of Arabia; but as this country lies on the weſt, and not on the eaſt of Eden, it is ſaid, that the words which we tranſlate "on the eaſt" of Eden ſignify no more than "before" or "over-againſt" Eden, according to the tranſlation of the Septuagint. According to this opinion; the land of Nod muſt have been Arabia Deſerta, or ſome part of it, and not Suſiana. Wells's Geog. vol. i.

ENODIS, Culmus, in *Botany*, a culm or ſtraw deſtitute of any knot, joint, or prominent tranſverſe interruption. See Culmus.

ENOLA, in *Geography*, a town of Naples, in the province of Lavora; 4 miles N. of Fundi.

ENOLMIS, Ενολμις, in *Antiquity*, a deſignation given to Apollo's prieſteſs at Delphi, becauſe ſhe ſat on the tripod which was called olmos, ολμος. Hence alſo Apollo is called Enolmos, Ενολμος. Pott. Archæol. Græc. lib. ii. cap. 9. tom. i. p. 275.

ENOMTEKIR, in *Geography*, a town of Swediſh Lapland; 150 miles N. of Tornea.

ENON, in *Ancient Geography*, a place of Judea, ſituated near Jordan in the half-tribe of Manaſſeh; which was the place in which John baptized, (John iii. 23.) becauſe there was abundance of water. This place was between Shalim and Jordan, about 8 miles from Scythopolis.

ENOPA, a town of the Peloponneſus, in Meſſenia, ſituated on an eminence at a ſmall diſtance N. of Cardamyla.

ENORAINE, in the *Manege*, a wither-wrung horſe, or one that is ſpoiled in the withers. The word is obſolete.

ENORCHIS, in *Natural Hiſtory*, the name given by many authors, to that ſpecies of ætites, or eagle-ſtone, in which the callimus, or internal nucleus, is not looſe, ſo as to rattle in it when ſhaken, but remains fixed to one ſide. The Germans call this *hodenſtein*. The outer cruſt is uſually of a whitiſh colour, and the internal nucleus is yellowiſh or browniſh, and it is uſually of the ſize of a pigeon's egg, and of the ſhape of the human teſticle; whence the name.

ENORMOUS, ſomething exceſſive, or monſtrous, eſpecially in bulk. The coloſſus of Rhodes was of an enormous ſtature.

The word is formed of the privative *e*, and *norma*, *rule*; q. d. *void of, or contrary to, rule or meaſure; contra normam.* In the corrupt ages of Latinity, they uſed *innormis*, and *inormis*.

In the French juriſprudence, *læſio enormis*, *enormous damage*, is that which exceeds half the value of the thing ſold.

ENOTAEVSK, in *Geography*, a town of Ruſſia, in the government of Caucaſus, on the Volga; 72 miles N.N.E. of Aſtrachan.

ENOUREA, in *Botany*, (a barbarous name, from the Caribæan word *Enourou*.) Aublet Guian. v. 1. 587. t. 235. Juſſ. 249. The only ſpecies is E. *capreolata*, a climbing ſhrub, with ſomething of the habit of a *Paullinia*, furniſhed with circularly-turned tendrils, pinnated leaves, ſpiked flowers, and a remarkable globular capſule of three valves, containing a globular ſeed imbedded in farinaceous pulp. Juſſieu has copied its characters from Aublet, but Schreber has paſſed it by.

ENQUEST, or Inquest, in *Law*, denotes an inquiſition of a jury by hearing of witneſſes.

This is the moſt uſual manner of trial, in all cauſes, both civil and criminal, within this realm. In civil cauſes, after proof is made, on either ſide, of ſo much as each party thinks good for himſelf; if the doubt be in the effect, it is referred to the diſcretion of twelve indifferent men, impanelled by the ſheriff for that purpoſe; and as they bring in their verdict, ſo judgment paſſeth: for the judge ſaith, *the jury findeth the fact thus.* See Writ *of Enquiry.* For the enqueſt in criminal cauſes, ſee Jury.

ENRICHED Column. See Column.

ENRICHING Plants, a term uſed, by the Engliſh farmers, to expreſs ſuch plants as are found to do good to land, rather than to exhauſt it, and in conſequence of which the ſame piece of land will produce a good crop of corn, though it would, without the aſſiſtance of their having been planted on it, have yielded a very poor one. The myſtery of this difference between plants, ſome of which are found to burn up, that is, impoveriſh lands, while others enrich it, and leave it fitter for ſucceeding crops than they found it, is explained by Mr. Tull. This author having obſerved, that breaking the earth, by digging, or horſe-hoeing, between the plants, gave them great increaſe, found that it was this practice that enriched the earth: and that, while corn and ſuch plants as ſtand cloſe, and cannot be hoed between, impoveriſh the ground, and ſuffer no means of enriching it again to be uſed, there were ſome other things, the crops of which being planted thinner, gave room to the earth to be ploughed, dug, or hoed between, and that theſe were the plants which were called the enriching kind by the farmers; and the whole ſecret lay in this, that the hoeing, ploughing, or otherways breaking the earth between them, in order to kill the weeds, enriched the ground greatly more, in proportion, than theſe plants exhauſted it; and the conſequence was, that though they had thriven very well, yet the earth was left richer than before, notwithſtanding all that they had imbibed from it. Tull's Horſehoeing Huſbandry, p. 37.

On this obſervation, this excellent author ſeems to have founded the ſyſtem of what he calls horſe-hoeing huſbandry, concerning which he has written a large and uſeful treatiſe. He found that this ſtirring up of the earth enriched it ſo greatly, that, where it was uſed in a proper manner, the kind of plant need not be changed, but that the ſame earth would yield a ſucceſſive ſeries of crops of the ſame plant, and that even without dunging, or ever lying fallow, and every crop, for a long time, would be better than the former ones. The method of ſowing, to this purpoſe, is not by ſcattering the corn with the hand, but ſowing it in rows, and leaving large intervals between, the naked earth of which might be turned up by the hoe. See Alley and Hoeing.

ENROL, in *Military Matters*, ſignifies the regiſtering of ſuch perſons as, being inliſted, or appointed, are placed upon the rolls, or ſtrength, of any particular regiment, troop, company, or portion of the military eſtabliſhment. The act of enrolment ſeems to be held neceſſary in proof of a ſoldier's having become a ſervant of the ſtate; equally ſo with the circumſtance of his having received pay, or ſome money, however trifling, in advance. For it does not appear reaſonable, that a ſoldier ſhould be puniſhed for abſenting himſelf from that employ in which he has not received either pay, or ſubſiſtence. It is not, however, to be underſtood, that, after being duly inliſted in the preſence of a magiſtrate, the recruit is at liberty to quit the party by whom he has been entertained: far otherwiſe; for though we hold a decided opinion regarding the devices often practiſed, to enſnare young men from their homes and families, we conſider it indiſpenſible that the ſacred engagement ſhould remain purely inviolate, after being once legally acknowledged by the party to be enrolled. See Inlist and Entertain.

In regiſtering, that is to ſay in enrolling, a recruit, it is uſual to be very exact in aſcertaining the place of his nativity, his religion or ſect, his age, his ſtate of health, eſpecially whether he be ſubject to fits, or be ruptured; while, for the purpoſe of apprehending him in caſe of deſertion, his height, complexion, general figure, the colour of his hair, and of his eyes, together with any particular diſtinguiſhing marks, whether natural or accidental, are all noted; compriſing, in the aggregate, what is called "deſcription roll," of which a tranſcript is ſent with each ſoldier, whenever draughted from one company or regiment to another.

Although a recruit is bound to the ſervice after being examined and deemed competent to ſerve, by the inſpecting ſurgeon, and the ſuperviſor of the recruiting ſervice of the diſtrict reſpectively, and after having acknowledged his being duly inliſted in preſence of a magiſtrate, by whom the oath of allegiance ſhould be tendered as ſpeedily as convenience might admit, he is not ſaid to be enrolled until he is efficiently placed upon ſome liſt, whether under the recruiting officers, or in any particular regiment, troop, or company. In ſome inſtances, eſpecially in the ſervice of the Eaſt India Company, the whole of the recruits are lodged at a general depot, under the charge of officers fixed thereat, but without being attached to any particular regiments until their arrival in India: in the mean while they are formed into ſquads, under the immediate controul of non-commiſſioned officers, by whom they are trained in the rudiments of military diſcipline. We cannot with ſtrict propriety ſay, that ſuch men are enrolled; nor, indeed, do we hold the term to be applicable until they are in a certain degree fixed in ſome particular company, and entered upon its muſter-roll, as well as upon the long-roll of the regiment.

ENROLLMENT. See Inrollment.

Clerk of the Enrollment *of fines*. See Clerk *of the Inrollments*.

ENS, in Latin *Aniſia*, *Anaſum*, or *Enſia*, in *Geography*, a town of Auſtria, in the province called Upper Auſtria, or the country above the Ens, in the diſtrict of Traun. It is ſituated on an eminence in the river Ens, which, not far from this place, falls into the Danube, 15 miles S. E. of Lintz, and 108 miles W. of Vienna. N. lat. 48° 11′. Its origin dates from the year 900, and it is built on the ſame ſpot where ſtood the Laureacum of the Romans, one of their colonies, which was deſtroyed by the Huns about the year 450. Ens is ſtrongly fortified; its citadel is called *Enſeek*, or the corner of Ens.

Ens, in Latin *Aniſus*, or *Anaſus*, a river of Germany, which has its ſource in the mountains of the former biſhopric, now grand duchy of Saltſburg, flows through Upper Auſtria, and falls into the Danube near the town of Ens.

Ens, *Entity*, *Being*, in *Metaphyſics*, is applied, in a general ſenſe, to every thing which the mind any way apprehends, and whereof it affirms, denies, proves, or diſproves, any thing. This other philoſophers call cogitable, and intelligible; and the logicians, thema.

Ens, in a leſs general ſenſe, ſignifies ſomething that is, or exiſts, ſome way farther than by being conceived, or being capable of being conceived, in the mind. This is particularly called ens poſitivum, or reale; poſitive, or real, being. In oppoſition to which ſtands non ens.

Ens, in its proper, or reſtrained ſenſe, is that to which there are real attributes belonging, or that which has a reality, not only out of the intellect, but in itſelf. This is what is properly meant by *res*, thing; and what we otherwiſe call ens reale, and alſo ſubſtance.

Ens *rationis*, is that which depends wholly on the mind, or which exiſts only in the imagination: of which they diſtinguiſh three kinds: ens rationis affectivum, which is done or produced by the mind, as knowledge; ens rationis ſubjectivum, which is received into the mind, as ſcience; and ens rationis objectivum, which is repreſented by the mind, as a chimera, a golden mountain, or the like. Which laſt, if it have no other manner of being, i. e. if it be preſented ſo as it does not, or cannot be, is what we moſt properly call ens rationis. The generality of ſchool philoſophers, and the Peripatetics among the reſt, aſſert, that there are of theſe entia rationis objectiva. Others deny there are, or can be, any ſuch things.

Ens, or Ens *primum*, in the *Ancient Chemiſtry*, denotes the moſt efficacious part of any natural mixed body, whether animal, vegetable, or foſſile, wherein all the qualities or virtues of the ingredients of the mixed are comprehended in a ſmall compaſs.

Paracelſus pretends to have been able to ſeparate the ens primum from bodies, and with it to effect prodigious things towards the renovation and reſtoration of youth; but his proceſſes are ſo obſcurely delivered, that no body has been induced to try them.

Ens *primum ſalium*, a name given by Paracelſus to a preparation of ſea ſalt, which he calls alſo a perpetual oil, and *ſal circulatum*, which ſee.

Ens *martis*, and *Ens veneris*. If the filings of iron or of copper be mixed with ſal ammoniac and ſtrongly heated, a decompoſition, greater or leſs in proportion to the quantity of metal employed, will take place: the ammonia will be liberated in the form of gas, while the muriatic acid will combine with the metal. The metallic muriat thus formed will ſublime at nearly the ſame heat as the undecompoſed reſidue of the ſalt, whence will reſult an accurate mixture of the two in the form of flowers, or a cruſt of a red colour: if iron filings have been uſed, and of a green colour if copper has been employed. The former of theſe is ens martis, the latter, ens veneris.

ENSATÆ, in *Botany*, from *enſis* a ſword, alluding to their ſword-ſhaped leaves, a name very happily applied by Mr. Gawler to the natural order of *Irides* of Juſſieu, it being deſirable that, if poſſible, every natural order ſhould have an expreſſive name, independent of any particular genus it may contain; or at leaſt that its name ſhould not be a mere unchanged repetition of that of any ſuch genus. This order is illuſtrated by the able botaniſt above-mentioned, in Sims and Konig's Annals of Botany, v. i. 219, and eſpecially in Curtis's Botanical Magazine.

ENSCONCED, in the *Military Art*. See Insconced.

ENSEELED, in *Falconry*, a term uſed for a hawk which has a thread drawn through her upper eyelids, and made faſt under her beak, to obſcure her ſight.

ENSEINT, in *Law*, a term uſed to denote a pregnant woman.

ENSEMBLE, a French term, ſometimes uſed in our language, literally ſignifying *together*, or *one with another*; being formed from the Latin, *in*, and *ſimul*.

In *Architecture*, we ſay, the enſemble, or tout enſemble of a building; meaning the work or compoſition, conſidered together, and not in parts; and ſometimes alſo the relative proportion of the parts to the whole. All thoſe pieces of building make a fine enſemble.

To judge well of a ſtatue, or other work of ſculpture, one muſt firſt examine whether the enſemble be good.

The tout enſemble of a painting, is that harmony which reſults from the diſtribution of the ſeveral objects of figures whereof the whole is compoſed. This picture is good, taking the parts ſeparately: but the tout enſemble is bad.

Ensemble, *Fr.* together. This adverb, uſed ſubſtantively, and received in the French muſical technica, is, according to Rouſſeau, inveſted with a very extenſive ſignification. To regard an object in its enſemble or totality, is to conſider the effect which the ſeveral parts produce, when united in a whole.

It is only in the execution of a piece of muſic, that this term is applicable, when the performers are ſo perfectly together in time and tune, ſeeming to be all ſo much animated by one ſoul, that they communicate exactly to the ear, all that the eye can ſee in the ſcore.

The being together does not merely depend on the accuracy with which each reads his part, but in the intelligence with which he feels its peculiar character and connection with the whole; whether in the exactitude of phraſeology, the preciſion of the movements, or ſeizing the inſtant and degree of pianos and fortes; or finally in the nice attention to ſuch ornaments, which the author has thought ſo neceſſary as to be indiſpenſible. It is in vain for muſicians to have abilities, they can never be together without an intelligence of the author's deſigns, and perfectly underſtanding each other: for it would be impoſſible to keep together a band of performers that are deaf, nor in the execution of muſic in a ſtyle with which they are totally unacquainted. It belongs to the maſters, conductors, and leaders of an orcheſtra, to guide, check, or accelerate individual performers, and to keep them together in the aggregate, which is always the office of a judicious firſt violin: who, by a certain firmneſs and energy in his manner, ſtrongly impreſſes the character of the piece in every ear. The vocal part is ſubordinate to the baſe and the time; the firſt violin ought to watch and follow the voice; the repienos ſhould liſten to and be guided by the firſt violin: and, finally, the harpſichord or piano forte, at an opera where the compoſer is ſuppoſed to ſit, ſhould be the principal and moſt important guide of the whole. In general, the more character there is in the ſtyle, periods, phraſes, melody, and harmony, the more eaſy it will be to ſeize the enſemble; becauſe the ſame idea, ſtrongly impreſſed on all minds, will preſide in the whole execution. On the contrary, when the muſic ſays nothing, and nothing is heard but a ſucceſſion of notes without meaning: then as there is no whole to which each performer can refer his part, the enſemble goes ill.

This (ſays M. Rouſſeau) was the reaſon why French performers could never be together.

ENSENE′, called alſo *Inſiné*, *Scheick Abadè*, and by the Arabs *Enſiné*, in *Geography*, a town of Egypt, ſituated towards the middle of the Said, eaſt of the Nile, and dependent on the province of Achmounain, which is on the other ſide. Abulfeda repreſents it as an ancient city, ſurrounded by a well cultivated country, abounding in fruits and harveſts. But theſe fertile plains have diſappeared with their inhabitants, and given place to ſands and deſerts. See Antinoe.

ENSHEMESH, i. e. *the fountain of the Sun*, a town or fountain, which lay on the frontiers of Judah and Benjamin. (Joſh. xv. 7.) The Arabians give this name to the ancient metropolis of Egypt, which the Hebrews called *On*, and the Greeks *Heliopolis*.

ENSIFORM, in *Anatomy*, a term equivalent to xiphoid, and meaning dagger-ſhaped. It is applied to the cartilage placed at the lower end of the ſternum. See Trunk.

Ensiform *Leaf*, in *Botany*, a vertical two-edged leaf like a ſword, as in many ſpecies of Iris. See Leaf.

Ensiform *Cartilage*. Dr. Hunter remarks, that, "if this cartilage be forced inwardly by a blow, it will occaſion vomiting and violent pains, by preſſing againſt the pylorus: in this caſe, it would be proper to lay it bare and elevate it." However, the ſame eminent writer admits, that as part of the diaphragm ariſes from the cartilage, the latter would be likely to be drawn out of its proper ſituation again by the action of ſo powerful a muſcle.

ENSIGN, in *Military Affairs*, is an officer whoſe duty it is to carry the colours; hence, when a youth firſt obtains a commiſſion in the infantry, he is ſaid to "receive a pair of colours." This is the firſt gradation above the rank of cadet, or volunteer, but is the loweſt of all the ranks in which commiſſions are held, and though obtainable by purchaſe, cannot be realized without ſatisfactory recommendations, and the approval of the commander of that regiment to which the nomination is to be made. From this, of courſe, ſome deviations are occaſionally admitted; but the neceſſity for aſcertaining that none but proper perſons be included within the circle of commiſſioned officers, occaſions conſiderable ſtrictneſs to be obſerved in this particular; notwithſtanding which, inſtances have occurred of men, by no means eligible to ſo honourable a diſtinction, having obtained commiſſions even in ſome of what are technically termed "crack regiments."

The duty of an enſign requires much attention, and at times ſome ſhare of bodily ſtrength; for, on a windy day, when the colours are fully diſplayed, a puny perſon might ſuffer conſiderable inconvenience; and, indeed, at all times, though ſupported in a ſling, the colours are rather oppreſſive; eſpecially to thoſe unaccuſtomed to carrying them. With regard to the ſtation of the enſign when acting with his company, or when bearing the colours, we refer to the head of Evolution; where the various changes of locality to which this officer is ſubject will be exhibited.

It is proper to remark, that although there are two ſtands of colours to each regiment, only one of them is properly called "the enſign." The flag, conſiſting of the union only, is called the king's colour, and always takes poſt of the other, which being in general of the ſame colour as the facings of the corps, and bearing any device or motto, by which it is diſtinguiſhed, is appropriately called "the regimental enſign."

In caſe of defeat, the enſigns bearing the colours muſt be very careful to collect as many of the fugitives as poſſible for the purpoſe of rallying the corps, or, at leaſt, of preventing it from being further diſgraced by the loſs of their facings, which formerly was an inſeparable conſequence annexed to the loſs of the colours. This regulation certainly muſt often produce conſiderable enthuſiaſm; and we may reaſonably conclude, that the attack made by a regiment under ſuch a privation, (which could only be remedied by its taking the colours of their opponents,) muſt be of the moſt arduous deſcription. In truth, we find in every walk of life, that where an imputation is to be removed, conſiderable energy is created by the exiſting diſgrace; and, that the moſt determined reſolution is formed not only to remove it, but to obtain a claim to pre-eminent conſideration in future.

The pay of an enſign in the Guards is five ſhillings and tenpence daily; in the line, only four ſhillings and eightpence: a ſum by no means adequate to the maintenance of a young gentleman in ſuch ſtyle as is at preſent too generally prevalent in almoſt every regiment. So far is this carried, that many young men of conſiderable merit are often compelled to exchange, or even to ſell out; becauſe their finances are inadequate to bearing a ſhare in the meſs expences. Nor is it unuſual for a notice to be given by the agent, or other perſon, to the candidate for a pair of colours, that ſuch a certain ſum annually will be needful, beyond his pay, to enable his keeping on a par with his brother officers. We are credibly informed, that in ſome regiments it is actually impoſſible for an officer to aſſociate with his peers, unleſs he may poſſeſs from 500 to 1000*l.* income, over and above his allowances!

When we analyſe this, we cannot but conſider it to be a national evil, and that too of no ſmall extent. We are far from wiſhing to ſee the reſpectability of our officers, in the ſmalleſt degree, tarniſhed; but it certainly cannot fail to ſtrike, even the moſt ſuperficial obſerver, that ſuch an exceſs of expence amounts nearly to a prohibition of the middling claſſes, and operates in the ſame manner, though not ſo avowedly, as the ancient regime of France, which proſcribed all but thoſe of noble family, or of eſtabliſhed deſcents through generations devoid of mercantile ſpeculation, from entering within the military pale. The very dreſs of ſome corps muſt coſt ſo much as to preclude the poſſibility of moderate fortunes being admitted. What ſhall we ſay to the charges made on a young gentleman's purſe, when it is ſtated, that in ſome regiments of horſe, full ſix hundred pounds may be required to equip him as a cornet! While an equal ſum per annum, will be *in requiſition* (here the term ſeems peculiarly appropriate) to enable him to eat, drink, and appear in the ſame company with his brother officers. Nor is this all; for the commiſſion may coſt a large ſum, ſuch as added to the other items would form a capital wherewith the youth might purchaſe an annuity, far exceeding the pay he would be likely to receive, for at leaſt ten or twelve years. We believe the Scotch regiments are no ſlouches in the field, and that they bear as many good characteriſtics as any in our ſervice; yet their dreſs is generally very plain, and their fare very far from ſumptuous. They are born economiſts; and from being brought up in a hardy, active routine, are capable of enduring great fatigue, and of putting up with various privations, which, to a perſon brought up with leſs ceremony, and habituated to the enjoyment of various luxuries, might be at leaſt unpleaſant, if not abſolutely diſtreſſing.

The Turkiſh enſigns are horſes' tails; the number of which diſtinguiſhes the rank of their commanders; the ſultan has ſeven, the grand vizier only three, &c. Thoſe of the Europeans are pieces of taffety, with divers figures, colours, arms, and devices, thereon. Xenophon tells us, that the enſign borne by the Perſians was a golden eagle on a white flag; the Corinthians bore the winged horſe, or Pegaſus; the Athenians, an owl; the Meſſenians, the Greek letter M; the Lacedæmonians, the A.

The Romans had a great diverſity of enſigns; the wolf, minotaur, horſe, boar, and at length the eagle. See Signa.

A military enſign, on a medal of a Roman colony, denotes it a colony peopled with old ſoldiers.

Ensign, in *Naval Affairs*, is the large flag hoiſted at the ſtern of a ſhip, whether of war or in the merchant ſervice, and denotes the country to which ſhe appertains, or the government under whoſe protection and authority ſhe is navigated. Of the ſeveral diſtinguiſhing enſigns, a more ample deſcription will be found under the head Flag: we ſhall briefly obſerve in this place, that this, as well as moſt of the colours of ſhips, whether *jacks* or *pennants*, are commonly conſtructed of bunting, and, that it is uſual to make them ſo ample as to occupy two-thirds of the flag-ſtaff in height, and to give them depth enough juſt to touch the ſurface of the water, when in a quieſcent ſtate. All enſigns are hoiſted with their unions, or diſtinguiſhing cantons, uppermoſt, next to the truck on the head of the flag-ſtaff: when hoiſted in the ſhrowds with the union, or diſtinguiſhing canton, lowermoſt, ſo as to reverſe all the figures, decorations, or inſcriptions, it is indicative of diſtreſs. The liberality of ſome nations has been conſpicuous in forbearing from making prizes of veſſels ſo circumſtanced, provided their commanders have engaged to return to the neareſt port, without intermediately offering any violence to ſuch as they might meet, there to remain in ordinary until the concluſion of the war.

The diſplay of an enſign in preſence of a ſtrange ſail is generally conſidered a mark of civility during times of peace, and in times of war ſerves to diſtinguiſh between friends and foes. During the latter period, ſuch veſſels as do not hoiſt their enſigns may be reaſonably ſuſpected to be privateers, or to be deſirous of evading every kind of communication. So long as the enſign remains hoiſted, during an engagement, the ſhip is to be conſidered in a ſtate of defiance; but when it is lowered, ſhe is ſaid to ſtrike; that is, to give up the conteſt, and to ſubmit, as a prize to her opponent. It occaſionally happens that a ſhip's enſign ſtaff, or the haulyards by which the enſign is hoiſted to the mizen-peak, is ſhot away; this does not indicate ſubmiſſion; on the contrary, the annals of warfare exhibit many inſtances of extraordinary courage in individuals, who, at ſuch moments, have ran aloft, or even ſtood on the poop, there to ſuſtain a portion of the enſign as a token of the moſt determined oppoſition. In the Britiſh ſervice we have three enſigns, namely, the white, the red, and the blue; the firſt is divided into equal portions, by a broad St. George's croſs of red, of which the upper canton, or quarter, is filled up with the union. The ſecond and third are both plain, with the exception of the union in the ſame canton. Theſe ſeveral enſigns indicate the rank of the admiral under which a ſhip of war is commiſſioned, or employed. Thus, an admiral of the white bears a white, or, as it is commonly called, a St. George's enſign, at the main top-gallant maſt head; a vice admiral of the white has one at the fore top-gallant maſt head; and a rear admiral one at the mizen top-gallant maſt head; the ſame rules of precedence obtain, with the admirals, vice-admirals, and rear-admirals of the red and blue reſpectively; each bearing a flag of his proper colour at that maſt head correſponding with his rank. When fleets are ſeparated into ſquadrons or diviſions, each ſhip aſſumes for the time the enſign of that admiral who commands the ſquadron, or diviſion, in which it acts. The ſame is obſerved by all veſſels acting under any particular port-admiral; all under his authority invariably bearing an enſign conformable to his deſignation, whether of the white, red, or blue.

ENSIGNCY, denotes the rank of that officer who bears the enſign or colours of a regiment of foot; and correſponds with that of "cornet" in the cavalry, and of "ſecond-lieutenant" in the artillery. It is, perhaps, one among the curious anomalies which pervade many parts of our ſyſtem, that an enſigncy ſhould exiſt in the engineer department, there being no colours to be carried in that corps, while the colours of the artillery battalions are borne by the ſecond lieutenants.

An enſigncy in a marching regiment may generally be obtained for about three hundred pounds, when ſerving within the realm: but in various ſituations abroad, eſpecially in the Eaſt Indies, where an increaſe of pay is given, the price is uſually much higher. See Ensign, *military*.

ENSISHEIM, in *Geography*, a handſome town of France, in the department of the Upper Rhine, in the diſtrict of Colmar, with a population of 1809 individuals. It is ſituated on the river Ill, 12 miles N. of Mulhauſen, 12 miles S.W. of Briſack, 294 miles S. by E. of Paris. N. lat. 47° 52′, and is the chief place of a canton, which has a territorial extent of 257½ kiliometres, 17 communes, and 10,122 inhabitants.

ENSTASIS, Ενστασις, of εν and ἵστημι, *ſtatuo*, in *Logic*, a manner of replying to an opponent, either by confuting his argument, or denying the juſtneſs of his concluſion. Voſſ. Rhet. lib. iii. p. 380.

Enstasis, in *Medicine*, a term uſed to expreſs the ingreſs of moleculæ into the vacuity of the pores which obſtruct them, and thereby cauſe diſeaſes. It is a word familiar with Eraſiſtratus and Aſclepiades, who was a follower of Democritus, and taught that moſt diſeaſes were cauſed by ſuch an ingreſs of matter into the pores. Thus Aſclepiades defined a phrenzy to be ſuch an enſtaſis in the membranes of the brain. Plutarch, in his precepts of Health, alſo mentions this enſtaſis: and Galen and Caſſius, who is ſuppoſed to have been of the ſect of the Rationaliſts, expreſſes the ſame ſenſe by the ſame word.

ENSTORF, in *Geography*, a town of Germany, in the circle of Bavaria and Upper Palatinate; 22 miles N. of Ratiſbon.

ENT, *Sir* George, in *Biography*, an eminent phyſician, was born at Sandwich, in the county of Kent, on the ſixth of November, 1604. After going through the uſual courſe of claſſical inſtruction, he was ſent to Sidney college, in Cambridge. He afterwards travelled to the foreign ſeats of learning, received the degree of doctor of phyſic at Padua, and on his return was incorporated in the univerſity of Oxford, on the ſeventh of November, 1638. During the uſurpation of Cromwell he ſettled in London, where he obtained conſiderable eminence in the practice of his profeſſion: he was elected a fellow, and afterwards preſident of the College of Phyſicians; and at length his merits were rewarded with the honour of knighthood by king Charles II. He enjoyed for a long period the eſteem and confidence of the public, and died at the age of eighty-five, on the 13th of October, 1689. He was buried in the church of St. Lawrence in the Jewry. He was a very intimate friend of the celebrated Dr. Harvey, and wrote a defence of his great diſcovery, entitled "Apologia pro circulatione ſanguinis contra Æmilium Pariſanum," which was publiſhed in 8vo. in the year 1641, and again in 4to. in 1685. About 1651 he prevailed with Dr. Harvey to conſent to the publication of his "Exercitationes de generatione animalium," which he ſuperintended, and preſented to the College of Phyſicians in a ſenſible and elegant dedication. He likewiſe publiſhed a treatiſe of his own in 1679, which was reprinted in 1682, entitled, "Animadverſiones in Malachiæ Thruſtoni, M. D. diatribam de reſpirationis uſu primario," in 8vo. His works were collected, and publiſhed in one volume 8vo. at Leyden in 1687, under the title of "Georgii Entii Opera omnia Medico-Phyſica, &c.:" and after his death, his "Obſervationes ponderis teſtudinis, cum in autumno terram ſubiret, cum ejuſdem ex terra verno tempore exeuntis pondere comparati, per plures annos repetitæ," were printed in the Philoſophical Tranſactions, N° 194, anno 1691. See Eloy Dict. Med. Biog. Dict.

ENTABLATURE, in *Architecture*, is that part of an order of column which is over the capital, comprehending the architrave, frize, and corniche.

The word ſeems formed of *tabulatum* or *intabulamentum*.

The entablature is alſo called the *trabeation*, and by Vitruvius and Vignola *ornament*. It is different in the different orders; indeed, it conſiſts of the three grand parts or diviſions above-mentioned, in all; but thoſe parts conſiſt of a greater or leſs number of particular members or ſubdiviſions, as the orders are more or leſs rich.

Vignola makes the entablature a quarter of the height of the whole column, in all the orders.

In the Tuſcan and Doric, the architrave, frize, and corniche, are all of the ſame height; in the Ionic, Corinthian, and Compoſite, the whole entablature being fifteen parts, five of them are allowed for the architrave, four for the frize, and ſix for the corniche. See Ionic, Corinthian, &c. and Column.

Entablature, or *Entablament*, is ſometimes alſo uſed for the laſt rows of ſtones on the top of the wall of a building, whereon the timber and covering reſt.

As this is frequently made to project beyond the naked of the wall to carry off the rain, ſome authors call it in Latin *ſtillicidium*, or *drip*. Such an entablature does not ſtand out far enough; it lets the water fall on the foot of the wall.

ENTABLER, in the *Manege*, is ſaid of a horſe whoſe croupe goes before his ſhoulders, in working upon volts; for, in the regular manege, one-half of the ſhoulders ought to go before the croupe. Thus we ſay, your horſe entables; for, in working to the right, he has an inclination to throw himſelf upon the right heel; which fault you may prevent, by taking hold of the right rein, keeping your right leg near, and removing your left leg as far as the horſe's ſhoulder. A horſe cannot commit this fault without committing that called aculer; but aculer may be without entabler.

ENTAIL, in *Law*, ſignifies fee tail, or fee entailed, that is, abridged, curtailed, or limited to certain conditions. For the docking of an entail, ſee Docking and Recovery. See Tail and Estate, &c.

ENTALIUM, the *pipe-ſhell*, in the *Materia Medica*, a ſhell of the ſame genus with the dentalia, being a ſpecies of the tubuli marini. It is frequent in the Eaſt Indies, and ſometimes is found on our own ſhores. The virtues aſcribed to it are the ſame with thoſe of the dentalium; but neither of them have any title to more than thoſe of alkaline abſorbents, like the other teſtaceous powders.

ENTE', in *Heraldry*, literally implies *engrafted*, and is uſed by foreign heralds to expreſs a method of marſhalling, little known among us; yet we have an inſtance of it in the fourth grand quarter of his majeſty's royal enſign, whoſe blazon is Brunſwick and Lunenburgh, impaled with ancient Saxony, *enté in pointe*.

ENTELECHIA, Εντελεχεια, of εντελεχης, *perfect*, a Greek term, by which Ariſtotle defines the ſoul; and which, not occurring in any other author, has given the critics and philoſophers infinite perplexity to diſcover its true meaning. See Soul.

Hermolaus Barbarus is even ſaid to have conſulted the devil about it; after which, in his paraphraſe on Themeſtius, whether from the devil or himſelf, we know not, he renders it by *perfectihabia*, which is not a whit the clearer.

Cicero, whoſe interpretation ſhould be preferable to that of any modern, defines entelechia (Tuſc. Queſt. lib. i. cap. i.) to be, "a certain, continued, and perpetual motion;" whence it ſhould ſeem, that Ariſtotle took the ſoul for the mode of the body; a continuous motion being, doubtleſs, a mode of body.

The common Peripatetics hold entelechia to ſignify act, and under it ſuppoſe the form of the compound or animal to be underſtood.

Laſtly, others, and thoſe the lateſt Peripatetics, agree, that the act, or entelechia, whereby Ariſtotle meant to explain

plain the nature of the ſoul, is either ſome mode of the body, as motion, or it is nothing.

ENTENDEMENT, in *Law*. See Intendment.

ENTER, *To, a Hawk*, among *Sportſmen*, is uſed of a hawk when ſhe begins to kill.

Enter, *To, a Hound*. See Entrance *of Hounds*.

ENTERADENES, of εντερον, *inteſtine*, and αδην, *gland*, in *Anatomy*, a name by which many authors have called the inteſtinal glands.

ENTERENCHYTÆ, of εντερα, *the viſcera*, and εγχυω, *I infuſe*, in *Medicine*, a name given by authors to the ſeveral inſtruments contrived for throwing clyſters into the bowels; ſuch as the bladder and pipe the ſyringe, and the like, for liquid clyſters; and the box with the double pipe for conveying the ſmoke of tobacco. See Clyster, and Fumigator.

ENTERFERING, in the *Manege*. See Cutting.

ENTERITIS, in *Medicine*, from ἔντερον, *inteſtine*, ſignifies an inflammation of the inteſtines. The diſeaſe has been variouſly denominated *ileus*, εἰλεος, *iliac paſſion*, *chordapſus*, &c.

The ſymptoms of inflammation of the bowels generally come on ſuddenly. An acute and fixed pain, with a ſenſe of heat in the abdomen, more eſpecially about the umbilicus or navel, often with a feeling of twiſting in that part, attacks the patient; this pain is increaſed by preſſure. Previouſly to its occurrence, or together with it, the uſual ſymptoms of fever come on, ſuch as rigor or ſhivering, followed by fluſhes of heat, thirſt, and dryneſs of the tongue; the pulſe becomes frequent, hard, and commonly ſmall; conſiderable anxiety enſues; the bowels are obſtinately coſtive; the ſtomach is ſoon deranged; and eructations, nauſea, and vomiting ſucceed. As the diſorder advances, the pain becomes more acute, without any diſpoſition to evacuation; the abdomen becomes diſtended with flatulence, and more tender under preſſure; and the urine is often voided with difficulty and pain. If the inflammation be not alleviated, gangrene generally enſues, often within twenty-four hours from the commencement of the diſeaſe, and terminates the life of the patient.

The occurrence of gangrene is indicated by a ſudden remiſſion of the pain, while, at the ſame time, the ſtrength fails, the pulſe ſinks, the voice grows feeble, the countenance ſhrinks, and aſſumes even a cadaverous aſpect, yet the diſtenſion of the belly is not diminiſhed, but often increaſed. This tendency to terminate ſpeedily in mortification conſtitutes the great danger of inflammation of the inteſtines. Sometimes the diſeaſe terminates in ſuppuration, which, though leſs rapidly fatal, moſt commonly wears out the patient's ſtrength and life in a lingering manner; but occaſionally this condition ends in recovery. The formation of pus is indicated in this diſeaſe, as in other internal inflammations, by the remiſſion, but not total ceſſation of the pain, and by the occurrence of frequent fits of rigor, and ſometimes by a purulent diſcharge by ſtool. But the diſeaſe, eſpecially when the aid of medicine is early and actively obtained, frequently terminates favourably, by reſolution, as it is called; *i. e.* by a gradual diminution and ceſſation of the ſymptoms. If the pains abate gradually, and the tenderneſs and diſtenſion of the abdomen leſſen, while the pulſe becomes ſofter and fuller, natural evacuations of fæculent matters are paſſed, and a free general perſpiration breaks out, this favourable termination may be anticipated. Whereas, the continuance of the conſtipation, and of the fixed pain, the increaſe of the ſickneſs and vomiting, the occurrence of the ſymptoms juſt deſcribed as indicative of gangrene, eſpecially if accompanied with hiccup and cold ſweats, are among the unfavourable prognoſtics.

The principal ſource of miſtake, into which the practitioner is likely to fall in treating this diſeaſe, is in confounding it with *colic*; a ſpaſmodic diſorder, which requires a treatment eſſentially different, but which, nevertheleſs, occaſionally terminates in enteritis. The diagnoſtic ſymptoms of the two complaints have been already ſtated at length, under the former article. See Colica.

Enteritis occurs moſt commonly in perſons ſomewhat advanced in life, generally after the age of forty, or fifty; and it ſeems to be moſt frequent in plethoric habits, and in thoſe particularly who indulge in indolence and full living. In ſome individuals there appears to be a conſtitutional irritability of the inteſtines, which renders them liable to attacks of inflammation, upon the application of ſlight cauſes.

The *exciting cauſes* of enteritis are various; among the moſt common are obſtructions in the bowels, which neceſſarily retain the fæces, until theſe, by their quantity or quality, become extremely irritating, and excite inflammation. Theſe obſtructions to the paſſage of the ſtools through the inteſtinal canal are occaſioned by different circumſtances. A ſpaſmodic contraction of any part of the canal, as in colic, if it continue for any conſiderable time, is liable to induce inflammation: a ſtricture, occaſioned by a chronic thickening of the coats of the bowels, ſometimes brings it on: *intro-ſuſception*, or the inverted paſſage of one part of the gut into the adjoining part, produces a ſimilar effect; as well as the ſtrangulation of the inteſtine from *hernia*, or rupture: the formation of calculus in the inteſtinal canal, which, though a rare occurrence, ſometimes takes place, may alſo occaſion a ſimilar obſtruction, and conſequent inflammation. Enteritis is likewiſe excited by irritating ſubſtances conveyed into the inteſtines, which, by their bulk, ſhape, or indigeſtibility, or by their chemical or ſpecific acrimony, produce much excitement in the canals. Thus, the ſwallowing of hard kernels, ſeeds, or ſtones of fruit, of pieces of metal, &c. has often induced the diſeaſe; and the preſence of *ſcybala*, or hardened fæces, and of calculous concretions, operates partly by the immediate irritation which they occaſion. Thus alſo, ſtrong concentrated acids or alkalis, ſpirituous liquors, high ſeaſoned food in large quantities, draſtic purgatives, worms, &c. in the inteſtinal canal, have excited inflammation in it in different inſtances. Hence the diſeaſe has ſometimes been the immediate effect of repletion, or of a fit of intoxication: and even a mild cathartic, when the bowels were loaded with much hardened fæces, which the medicine was incapable of removing, has, in ſome rare caſes, produced inverted motion and *intus-ſuſception*, terminating in enteritis. A very common cauſe of inflammation in the bowels is the application of cold to the legs and feet, or to the abdomen itſelf, eſpecially if ſudden or long continued. The retroceſſion of gout, rheumatiſm, eryſipelas, or chronic eruptions, from the external parts, is ſometimes followed by ſymptoms of inteſtinal inflammation.

In the *cure* of enteritis, as in all other acute inflammatory diſeaſes, the leading object is to remove the inflammation, from which all the other ſymptoms of the diſeaſe originate. This, though apparently an identical propoſition, cannot be too ſtrongly inculcated, in the treatment of enteritis; becauſe the exceſſive conſtipation of the bowels, which, in common with the reſt of the ſymptoms, is in general merely an effect of the inflammatory condition of the bowels, in ſome part, is often attacked by the inattentive practitioner with active purgative medicines, as if it were the primary object, and the ſource of all the miſchief. The inflammation is to be ſubdued by blood-letting, from a large orifice, to an extent which muſt be various according to the conſtitution of the patient, and the violence of the ſymptoms. This depletion may be aided in its effects by the application of leeches, and afterwards of a bliſter to the abdomen; and by the ſtricteſt abſtinence from all ſtimulating and nutritious aliment. The blood-letting muſt be repeated in a ſhort time, if the ſymptoms do not abate, and the ſtrength of the patient is ſufficient to ſupport the evacuation; which can only be determined by the obſervation and experience of the practitioner. If the pulſe ſhould become fuller and leſs wiry after the operation, it will afford a ſtrong reaſon for the repetition of it, ſhould the continuance of other ſymptoms appear to require it. The uſe of emollients externally was in great vogue among the ancients; and fomentations, or, what is better, the warm bath, may be reſorted to with advantage. Celſus recommends the uſe of warm cataplaſms, frequently changed, and covering the greater part of the trunk, "à mammis uſque ad inguina et ſpinam," and alſo a bath of warm oil;—"demittere totum hominem in calidum oleum." De Medicinâ, lib. iv. cap. 13. The dirty applications of living animals, or the ſkins of thoſe recently killed, can only operate as emollients, and are neceſſarily leſs effectual than fomentations; they are at preſent, therefore, fallen into diſuſe. Sydenham recommended the application of a live whelp to the abdomen in theſe caſes. Opera, ſect. i. cap. 4. p. 77. Edit. Lugd. 1726.

It muſt be obvious, that before the inflammation of the inteſtines is leſſened or removed by theſe meaſures, any additional irritation to the membranes, already in an acute ſtate of ſenſibility, whether by the immediate ſtimulus of a cathartic medicine, or by the contents of the bowels being forced forwards to the inflamed part, muſt tend to aggravate the diſorder, rather than to relieve it. In fact it is uſually found, that purgatives, given by the mouth, are not ſucceſsful, where this previous diminution of the inflammation has not been effected. And when this has been accompliſhed, ſome of the milder purgatives, as the neutral ſalts, ſhould firſt be adminiſtered, the action of the inteſtines downwards being at the ſame time ſolicited by emollient glyſters, which alſo contribute to the ſame relaxant purpoſes as the external fomentations. Dr. Gregory uſed to remark, in his lectures, that a purgative medicine had often been known to operate as ſoon as a bliſter, applied to the belly, began to riſe, which had not acted previouſly: and this obſervation is ſtill more commonly verified, after a free evacuation by blood-letting. See Edinburgh Med. and Surg. Journal, vol. i. p. 64. Some practitioners have attempted to open a paſſage for the fæces, by mechanically diſtending the large inteſtines, by throwing up five, ſix, or ſeven pints of warm water with an injecting ſyringe. This expedient may be uſeful in ſpaſmodic colic; but it is objectionable, in enteritis, on ſeveral grounds. Such diſtenſion can only be accompliſhed in the colon, or great gut; whereas the obſtruction by inflammation is commonly in ſome portion of the ſmall inteſtines, and therefore out of the reach of the enema. In the next place, any forcible diſtenſion of an inflamed and thickened canal, if it could be accompliſhed, would rather conduce to an increaſe of the inflammatory condition, than to leſſen it by the removal of fæces. In a word, all meaſures applied to the inflamed inteſtine ſhould be mild; ſince forcible ones cannot but augment the inflammation, upon which the impeded function of the organ depends. By way of glyſter, therefore, a little common ſalt, magneſia vitriolata, or infuſion of ſenna, with gruel or warm water, will probably anſwer every good purpoſe that can be expected from ſuch an expedient. Tobacco ſmoke has been often injected when milder means have failed, or infuſions of tobacco; but their ſucceſs, we believe, has not been often experienced. Indeed tobacco injections are liable to produce great ſickneſs and irritation, if that herb be not uſed in very ſmall quantities.

The extreme ſickneſs which often accompanies enteritis, and by which every thing that is taken into the ſtomach, whether liquid or ſolid, is rejected, renders it difficult, in ſome caſes, to produce any effect upon the bowels by internal medicine. In this caſe, the irritability of the ſtomach may be quieted by the ſaline effervеſcing draught, or by a ſmall opium pill, or, if this be rejected, by an opiate given in a glyſter; after which the neceſſary laxative medicines may be retained, and accompliſh the intended object. It ſhould be obſerved, however, that the ſtimulus of opium will prove rather injurious than uſeful, while the inflammation is unſubdued.

Where the inflammation has ariſen from ſtrangulated hernia, the operation, by which the ſtrangulation is removed, and the inteſtine returned into its place, can alone ſave the life of the patient. See Hernia.

We have already had occaſion to allude to a remedy for conſtipation of the bowels, which has been recommended as a laſt reſource, namely, a quantity of crude quickſilver; and to point out the abſurdity of the hypotheſes, which have led to its uſe, as well as ſome of the ill conſequences of it. Sydenham reprobates the practice, which appears to have been firſt adopted about his time. Loc. cit. p. 76. See Constipation.

When the inflammation of the inteſtines has been ſubdued, the utmoſt caution ſhould be employed, with a view to the prevention of a relapſe, to which the convaleſcent from enteritis is extremely liable. A thin, ſpare, and laxative diet, conſiſting of vegetable ſubſtances, of gruels, or barley water, or theſe mixed with milk, muſt be adhered to moſt rigidly for a conſiderable time after recovery; and all acrid, ſtimulating ſubſtances, or thoſe which are difficult of digeſtion, ſhould be moſt ſcrupulouſly avoided. The moſt fatal effects have been obſerved to take place, in ſome inſtances, from returning too ſoon to ordinary diet, after the removal of inflammation of the bowels. In order to guard againſt a future recurrence of the diſeaſe, the application of cold to the abdomen and feet ſhould be prevented by warm cloathing; and the occurrence of coſtiveneſs at all times avoided, by laxative diet or medicine, ſo that no accumulation of fæces can take place, and the ſteady action of the bowels be conſtantly preſerved.

ENTERMEW. See Falcon.

ENTEROCE'LE, (from εντερον, *an inteſtine*, and κηλη, *a tumour*, or *rupture*,) in *Surgery*; a hernia is ſo termed, when its contents are entirely compoſed of inteſtine.

ENTERODYNIA, from ἔντερον, *inteſtine*, and ὀδύνη, *pain*, in *Medicine*, a term uſed by ſome writers, as nearly ſynonymous with colic, but expreſſing a minor degree of pain; ſuch, for inſtance, as ariſes from the irritation of vitiated bile, loaded bowels, worms, &c. and which, therefore, laxative medicines generally relieve.

ENTERO-EPIPLOCE'LE, (from εντερον, *an inteſtine*, επιπλοον, the *omentum*, and κηλη, *a tumour*,) in *Surgery*, a term applied to a hernia, which contains both a portion of the bowels, and a piece of the omentum.

ENTERO-HYDROCE'LE, (from εντερον, *an inteſtine*, and ὑδροκηλη, *a dropſy of the ſcrotum*,) a ſcrotal hernia, containing a good deal of fluid.

ENTEROLOGY, from εντερον, *inteſtinum*, *a gut*, and λογος, *ſermo*, *diſcourſe*,) is properly a treatiſe of the bowels. Though the word is generally underſtood to include the contents of three cavities, head, breaſt, and all the viſcera or belly.

ENTERO'MPHALOS, (from εντερον, *an inteſtine,* and ομφαλος, the *navel,*) a hernia at the navel, and containing inteſtine.

ENTERORA'PHE, (from εντερον, *an inteſtine,* and ραφη, *a ſuture,*) a ſuture of the bowels.

ENTERO'SCHEOCELE, (from εντερον, *an inteſtine,* and οσχεοκηλη, *a rupture, or hernia ſituated in the ſcrotum,*) a ſcrotal hernia, the contents of which are entirely compoſed of inteſtine.

ENTERPEN, *To,* in *Falconry,* is a term applied to a hawk, when her feathers are wrapped up, ſnarled, or entangled.

ENTERPLEADER, in *Law.* See INTERPLEADER.

ENTERPRISE, denotes an undertaking attended with ſome difficulty and danger.

ENTERPRISE, in *Military Affairs,* appertains rather to thoſe deſultory expeditions which often prove of conſiderable importance in their conſequences; though, perhaps, apparently trivial, when compared with thoſe great events that ſometimes characterize a campaign. In ſome inſtances we ſee the moſt decided effects produced by the operations of enterpriſing partiſans, who, excluſive of the quantity of forage, and the intelligence they generally afford, diſtreſs the enemy ſeverely, by compelling him to act with ſuch circumſpection, and ſo to ſtrengthen his poſitions, as inevitably muſt weaken his other operations, as well as create conſiderable alarm among his troops, eſpecially when detached in expoſed ſituations.

In ſome countries, detached enterpriſes ſeem to conſtitute the chief incidents in warfare; thus, we find that irregular corps commanded by baron Trenck were peculiarly active, and haraſſed the enemy beyond meaſure! Thus, alſo, the Croats, the Pandours, and the Pindaries, of the Mahratta empire, the Sooties under the late Tippoo, and various other ſuch predatory eſtabliſhments, commanded by officers of a ſuitable diſpoſition, have ever been famous for annoying, and for cutting off the ſupplies of their adverſaries.

No enterpriſe, whether military or naval, ſhould be entruſted to the charge or conduct of an individual deficient in any one of the requiſites for ſuch a reſponſible, and, indeed, ſo arduous an appointment. In the firſt place, a knowledge of the geography of that country he is to infeſt, and of the language of its inhabitants, is indiſpenſably requiſite. His character for marked perſonal courage, and for the prompt application of ſuitable remedies againſt every ſpecies of diſaſter, or of diſappointment, ſhould be conſpicuous. He ſhould poſſeſs that kind of deportment which preſerves the ſtricteſt ſubordination, while it ſecures the affection, and excites the admiration, of all under his command. He ſhould be expert in all military exerciſes, and poſſeſs both an active mind, and the soundeſt conſtitution. With ſuch valuable gifts, added to a certain conciliatory mode of conduct towards the peaſantry, &c. of the diſtrict in which he is to carry on his enterpriſes, a partiſan may perform wonders, and far outdo all the exploits an equal number of regulars could achieve under a leſs capable leader. The truth is, that, generally ſpeaking, ſoldiers and ſailors are mere automatons, acting under the direction of an expert machiniſt, whoſe character is ever appreciated according to the ſucceſs of his movements. How far permanent reputation may be eſtabliſhed by the commander of ſuch an auxiliary force, may be collected from that dread which was created by the Tarleton legion among the Americans, during their ſtruggle with the mother country. That legion, even at this day, are ſpoken of in terms of admiration, by the very people who ſuffered ſo ſeverely from the exertions and abilities of its commander.

It being obvious that, on many occaſions, an army muſt depend greatly for ſupplies on the activity and talents of a partiſan, we cannot too forcibly point out the peremptory neceſſity which exiſts, for the rejection of all who may be deficient in the above qualities, without which, it is unreaſonable to expect that any enterpriſe of moment ſhould ever be ſafe to thoſe who might be employed; much leſs could it be of ſervice to thoſe in whoſe behalf it might be undertaken. Naval enterpriſes require no leſs attention in ſome caſes; though, for the moſt part, we find them rather indebted for ſucceſs to undaunted bravery, and a moderate portion of judgment. Theſe ordinarily are made under cover of, or ſupported by, ſome ſufficient force; whereby, in caſe of defeat, they are reſcued from total ruin: whereas, the military partiſan rarely has ſuch protection at hand.

ENTERSOLE. See MEZANINE.

ENTERTAIN. This term has, no doubt, crept into military phraſeology in conſequence of the entertainment afforded at public-houſes, &c. to ſuch candidates as prefer a ſcarlet coat and a muſket, to a frock and a pitch-fork. We cannot ſufficiently expreſs our regret, that no better mode has been ordinarily brought into practice, than that of plying men with liquor for the purpoſe of inducing them to inliſt. We are, indeed, rather infidels on the ſubject of any numerous acceſſions to the real ſtrength of our armies, in conſequence of this cuſtom: for we have had occaſion to learn, that a very large portion of the recruits obtained in conſequence of inebriety, either abſcond at ſome favourable moment, or prove to be the worſt ſoldiers in their regiment. If drunkenneſs has been habitual to them, they rarely relinquiſh their addictedneſs to liquor; and if, on the contrary, they had, until the moment of being inliſted, been of a ſober diſpoſition, their peace of mind is totally deſtroyed, and they ſerve without alacrity, without zeal, and generally, too, without health: they are often known to fall a prey to remorſe!

We are ſenſible that, ſpeaking abſtractedly, the affording of entertainment to perſons who appear deſirous of inliſting, may be defended under the plea of ſtate neceſſity; but it becomes a very ſerious queſtion, whether the nation does not pay conſiderably more in conſequence of the monies expended in this way? alſo, whether it is ſound policy to allow military perſons to be in any ſhape concerned in overwhelming the ſenſes of that man, who is to be for life aſſociated with them, and who will not always be unmindful of the condition to which they may have brought him? To condemn a practice, ſaid to be ſo neceſſary towards our ſafety as an independent nation, without offering a ſubſtitute of a more favourable deſcription, might, perhaps, juſtly ſubject us to the imputation of preſumptuouſly branding the exiſting cuſtom with obloquy; we ſhall, therefore, briefly remark, that, in all probability, not only as many, but more, valuable recruits would be obtained by deſiſting from what is vulgarly called *entertaining* the candidates; and from expending a very large portion of his bounty in liquor, raree-ſhows, and ſuch diſſipations as "make him poor indeed!" In place of this, let the whole of his bounty-money be given to the pariſh from which he may have been taken, for the ſupport of his family; and let the recruit himſelf be ſubſiſted and cloathed entirely at the expence of the ſtate. Should the recruit have no family ſubject to parochial aid, or likely to be ſo, let his bounty money be reſerved until he ſhould have ſerved a certain time, and then to be given to him in inſtalments; ſo that he might not diſſipate the whole adventitiouſly,

ventitiouſly, and that he ſhould be enabled, from time to time, to provide himſelf with various articles of apparel, or of comfort, ſuited to his profeſſion.

We cannot cloſe this ſubject without ſtrongly reprobating the practice of ſtopping certain ſums, for off-reckonings, and neceſſaries. If the ſoldier is to pay for them, let it be by a plain and peremptory reduction of his pay, in exchange for which he ſhould receive certain articles from government; but let there be no account-current between the ſoldier and his officer, for feathers, lace, buckles, canteens, knapſacks, and ſuch like: this kind of dealing ſets aſide that reſpect which the former ought always to entertain for the latter, and, not unfrequently, occaſions a certain kind of ſuſpicion by no means tending to promote either eſteem or ſubordination. While reform ſeems to be the order of the day, it may, perhaps, be at leaſt faſhionable, if not praiſeworthy, to point out this as an inſtance in which much melioration might be very eaſily, and ſafely, effected.

ENTERTAINMENTS, *epulæ*, among the ancients, were of various kinds, as, 1. Funeral entertainments, *epulæ funebres*. 2. Entertainments given by the huſband on bringing home his wife, called *epulæ geniales*. 3. Thoſe beſtowed on the ſoldiers, called *epulæ militares;* which was done before or after an engagement, or on occaſion of proclaiming the general imperator. 4. Birth-day entertainments, *epulæ natalitiæ*.

There were many other kinds, denominated either from the place where, the perſons by whom, or the occaſion for which they were given.

ENTERVIEW, in *Falconry*, a term uſed for the ſecond year of a hawk's age.

ENTHALIUM, in *Natural Hiſtory*, a name given by ſome to a ſpecies of the tubuli marini, more uſually known by the name of penicillum marinum, and pinceau de mer. See Penicilli *Marini*.

ENTHUSIASM, Ενθουσιασμος, a poetic, or prophetic rage or fury, which tranſports the mind, inflames and raiſes the imagination, and makes it conceive and expreſs things extraordinary and ſurpriſing.

The word is derived from the Greek, ενθεος, or ενθους, a man animated in an extraordinary manner with the ſpirit of God; in whom God is, or whom God animates. Whence the verb ενθουσιαζω, or ενθουσιαω, and the noun ενθουσιασμος, *enthuſiaſm:* and ενθουσιαστης, *enthuſiaſt*, a perſon ſubject to ſuch tranſports.

M. de Piles defines enthuſiaſm to be a tranſport of the mind, whereby it is led to think and imagine things in a ſublime, ſurpriſing, yet probable manner.

The ſublime he thinks a neceſſary ingredient in the definition, as being the proper effect and production of enthuſiaſm.

This is the enthuſiaſm felt in poetry, oratory, muſic, painting, ſculpture, &c. (ſee the next article); but this enthuſiaſm which belongs to the works of art, is very different from that attributed to the ſibyls and prieſteſſes of the oracles, and heathen gods, which was little elſe but fanaticiſm, and conſiſted principally in grimace, and contortions of the body. See Oracle and Pythian.

There is a degree of aſſent, ſays Mr. Locke, which, with ſome men, has the ſame authority as either faith or reaſon; and that is enthuſiaſm, which, laying by reaſon, would ſet up revelation without it; whereby, in effect, it takes away both reaſon and revelation, and ſubſtitutes in the room of it the ungrounded fancies of a man's own brain, and aſſumes them for a foundation, both of opinion and conduct.

Immediate revelation being a much eaſier way for men to eſtabliſh their opinions, and regulate their conduct by, than the tedious labour of ſtrict reaſoning; it is no wonder, that ſome have been very apt to pretend to it: eſpecially in ſuch of their actions and opinions as they cannot account for by the ordinary methods of knowledge and principles of reaſon. Hence we ſee, that in all ages men in whom melancholy has mixed with devotion, or whoſe conceit of themſelves has raiſed them into an opinion of a greater familiarity with God than is allowed others, have often flattered themſelves with the perſuaſion of an immediate intercourſe with the Deity, and frequent communications with the Divine ſpirit.

Their minds being thus prepared, whatever groundleſs opinion comes to ſettle itſelf ſtrongly upon their fancies, is an illumination from the ſpirit of God; and, whatſoever odd action they find in themſelves an inclination to do, that impulſe is concluded to be a call or direction from heaven, and muſt be obeyed.

This we take to be properly enthuſiaſm; which, though riſing from the conceit of a warm and over-weening brain, works, where it once gets footing, more powerfully on the perſuaſions and actions of men than either reaſon or revelation, or both together; men being moſt forwardly obedient to the impulſes they receive from themſelves.

When men are once got into this way of immediate revelation, of illumination without ſearch, and certainty without proof, reaſon is loſt upon them; they are above it; they ſee the light infuſed into their underſtanding, and they cannot be miſtaken: like the light of bright ſun-ſhine, it ſhews itſelf, and needs no other proof but its own evidence; they feel the hand of God moving them within, and the impulſes of the ſpirit, and cannot be miſtaken in what they feel. But, of this ſeeming and feeling, it is a perception of an inclination to do ſomething, or of the Spirit of God moving that inclination: theſe are two very different perceptions, and ſhould be carefully diſtinguiſhed.

If they know the thing to be a truth, they muſt do it, either by its own ſelf-evidence, or by the rational proofs that make it out to be ſo: if they know it to be a truth, either of theſe two ways, they in vain ſuppoſe it to be a revelation; for thus, all truths, of what kind ſoever, which men uninſpired are enlightened with, come into their minds. If they ſay, they know it to be true, becauſe it is a revelation from God, the reaſon is good; but then it will be demanded, how they know it to be a revelation from God? If they ſay, by the light it brings with it, they ſhould conſider, whether this be ſaying any more than that it is a revelation, becauſe they believe it to be true; for all the light they ſpeak of is but a ſtrong perſuaſion of their own minds that it is a truth, which is a very unſafe ground to proceed on, either in our tenets or actions. True light in the mind is nothing elſe but the evidence of the truth of any propoſition; and if it be not ſelf-evident, all the light it can have is from the clearneſs of thoſe proofs upon which it is received. See Evidence.

God, when he makes the prophet, doth not unmake the man; he leaves his faculties in their natural ſtate, to enable him to judge of his inſpirations, whether they be of divine original or not. If he would have us aſſent to the truth of any propoſition, he either evidences that truth by the uſual methods of natural reaſon, or elſe makes it known to be a truth which he would have us aſſent to by his authority; and convinces us that it is from him, by ſome marks which reaſon cannot be miſtaken in. Eſſay on Hum. Underſt. book iv. chap. 19.

The holy men of old, who had revelations from God, had ſomething elſe beſides internal light, of aſſurance in their own minds, to teſtify to them that it was from God; they had outward ſigns to convince them of the Author of thoſe revelations; and when they were to convince others, they had a power given them to juſtify the truth of their commiſſion from heaven; and by viſible ſigns, to aſſert the divine authority of the meſſage they were ſent with. Moſes ſaw the buſh burning without being conſumed, and heard a voice out of it. God, by another miracle, of his rod turned into a ſerpent, aſſured him likewiſe of a power to teſtify his miſſion, by the ſame miracle repeated before thoſe to whom he was ſent.

Enthuſiaſm is defined by Dr. Hartley (Obſ. on Man) to be a miſtaken perſuaſion in any perſon, that he is a peculiar favourite with God; and that he receives ſupernatural marks thereof. The vividneſs of the ideas of this claſs eaſily generates this falſe perſuaſion in perſons of ſtrong fancies, little experience in divine things, and narrow underſtandings, (and eſpecially where the moral ſenſe, and the ſcrupuloſity attending its growth and improvement, are but imperfectly formed,) by giving a reality and certainty to all the reveries of a man's own mind, and cementing the aſſociations in a preternatural manner. It may alſo be eaſily contracted by contagion, as daily experience ſhews; and indeed more eaſily than moſt other diſpoſitions, from the glaring language uſed by enthuſiaſts, and from the great flattery and ſupport which enthuſiaſm affords to pride and ſelf-conceit. The ingredients, ſays lord Lyttelton in his "Obſervations on the Converſion, &c. of St. Paul," of which enthuſiaſm is generally compoſed, are great heat of temper, melancholy, ignorance, credulity, and vanity, or ſelf-conceit.

The true ſources of enthuſiaſm, ſays Mr. Hume in his "Eſſay on Superſtition and Enthuſiaſm," are hope, pride, preſumption, a warm imagination, together with ignorance. From the influence of theſe cauſes ariſe raptures, tranſports, and ſurpriſing flights of fancy; and whilſt confidence and preſumption ſtill increaſe, theſe raptures, being altogether unaccountable, and ſeeming quite beyond the reach of our ordinary faculties, are attributed to the immediate inſpiration of that Divine Being, who is the object of devotion. In a little time the inſpired perſon comes to regard himſelf as a diſtinguiſhed favourite of the Divinity; and when this phrenſy once takes place, which is the ſummit of enthuſiaſm, every whimſy is conſecrated. Human reaſon, and even morality, are rejected as fallacious guides; and the fanatic madman delivers himſelf over, blindly, and without reſerve, to the ſuppoſed illapſes of the ſpirit, and to inſpiration from above.

Devotion, undirected, or unreſtrained by reaſon, degenerates into enthuſiaſm, or a religious phrenſy, founded in an apprehenſion of a preſent Divine energy on the mind, to which all its powers are ſuppoſed to be ſubject, and by which a perſon is carried on without attention to any thing elſe as his guide, and producing not only great perturbation of mind, but moſt amazing agitations of body. Many inſtances of this kind occur, both in ancient and modern times, to the diſgrace and injury of rational religion.

Mr. Hume (ubi ſupra) makes ſeveral reflections concerning the different influences of enthuſiaſm and *ſuperſtition* (which ſee) on government and ſociety. He obſerves, *firſt*, that ſuperſtition is favourable to prieſtly power, and enthuſiaſm not leſs, or rather more, contrary to it than ſound reaſon and philoſophy. He obſerves, *ſecondly*, that religions, which partake of enthuſiaſm, are, on their firſt riſe, more furious and violent than thoſe which partake of ſuperſtition; but in a little time become more gentle and moderate. When enthuſiaſm riſes to that height as to inſpire the deluded fanatic with the opinion of divine illuminations, and with a contempt for the common rules of reaſon, morality, and prudence, it produces the moſt cruel diſorders in human ſociety; but its fury is like that of thunder and tempeſt, which exhauſt themſelves in a little time, and leave the air more calm and ſerene than it was before. When the firſt fire of enthuſiaſm is ſpent, men naturally, in all fanatical ſects, ſink into the greateſt remiſſneſs and coolneſs in ſacred matters; there being no body of men among them, endowed with ſufficient authority, whoſe intereſt is concerned to ſupport the religious ſpirit: no rites, no ceremonies, no holy obſervances, which may enter into the common train of life, and preſerve the ſacred principles from oblivion. For the influence of ſuperſtition, ſee that article. He obſerves, *thirdly*, that ſuperſtition is an enemy to civil liberty, and enthuſiaſm a friend to it.

Enthusiasm, in *Poetry*, *Eloquence*, and *Elocution*, is a ſpecies of rapturous elevation and fervour, which tranſports the writer or ſpeaker beyond the limits of apparent rule, and mere methodical propriety. Like genuine ſublimity, to which it is very nearly allied, and with which it occaſionally co-operates, in producing the higheſt impreſſions that can reſult from human eloquence, it defies, perhaps, the exactneſs of logical definition; its very eſſence conſiſting in a ſtate of feeling, at once ſo potent and ſo evaneſcent, as to elude the cautious touch of analyſis. It belongs, therefore, only to perſons of ſuperior genius, and by ſuch alone muſt be attempted; ſince, like all ſuperlative excellencies, it verges for ever on the brink of abſurdity; and criticiſm has never yet been able to erect a ſufficient barrier to defend its utmoſt limits. Like every other paſſion, it muſt be felt before it can be expreſſed; and the mind of the writer or the ſpeaker muſt be well fortified with knowledge on the ſubject he is handling, and the judgment well exerciſed in the nice diſcriminations of taſte, of feeling, and of decorum, before he ventures to indulge it in compoſition or in delivery, if he addreſſes himſelf to the enlightened or educated portions of the community, or he will be worſe than diſappointed of his object. In circles of a different deſcription, however, it is evident that the mere ſemblance of enthuſiaſm, unaided by theſe preliminary qualifications, ſeldom fails of a very powerful effect: and, by this quality alone, bigotry and fanaticiſm frequently accompliſh their end, and maintain abſolute dominion over the minds of their ignorant votaries. It is therefore ſufficiently obvious, that it is a quality the orator, if he be ſuſceptible of it, ſhould never fail to cheriſh; and if he be not ſuſceptible of it, he is but a fragment of an orator. As for poetry, enthuſiaſm is admitted to be its very ſoul and eſſence. In the delivery of eloquence, or the recitation of poetry, genuine enthuſiaſm is expreſſed by a deep and powerful aſpiration, by an increaſe of quantity in all the ſyllables principally produced by the prolongation and increaſe of the power of the voice on the liquids and liquifiable conſonants; a reſtrained vehemence, which, without any of the diſguſting effects of vociferation, ſpreads the undulations of ſound through an extended circle. It is generally accompanied by a conſiderable dilatation of the noſtrils, a protruſion of the eye-balls, and great tenſion and rigidity of the whole muſcular ſyſtem. Shakeſpeare, who felt its influence ſo frequently, has finely deſcribed its operation in the ſpeech of Henry V. before Harfleur:

> "Now ſet the teeth, and ſtretch the noſtrils wide,
> Hold hard the breath, and bend up every ſpirit
> To its full height."

The whole ſpeech is one of the fineſt effuſions of enthuſiaſm ever penned, and requires in the reciter all the inſpiration of that powerful feeling.

ENTHUSIAST, Ενθυσιαστης, a perſon poſſeſſed with enthuſiaſm. See Enthusiasm, Fanatic, &c.

The word is generally underſtood in an ill ſenſe. It was applied by the ancients to a ſect of heretics, called alſo Maſſalians and Euchites; who, as Theodoret expreſſes it, were denominated enthuſiaſts, becauſe being poſſeſſed by the devil, they believed themſelves divinely inſpired. See Massalians and Euchites.

Among us, enthuſiaſt is ſometimes of like import with fanatic, and is applied to the Quakers, and ancient Anabaptiſts, and modern prophets, from their pretences to extraordinary lights, revelations, viſions, impulſes, &c. from heaven.

ENTHYMEME, in *Logic* and *Rhetoric*, an argument conſiſting only of two propoſitions, an antecedent, and a conſequent deduced from it.

The word is Greek, ενθυμημα, formed of the verb ενθυμεισθαι, to think, conceive, a compound of εν and θυμος, *mind*.

Ariſtotle calls it the rhetorical or probable argument; the ſchools, the imperfect ſyllogiſm, in contradiſtinction to the perfect, which conſiſts of three propoſitions, and is called the dialectical argument.

It muſt be obſerved, however, that the enthymeme is really a perfect ſyllogiſm in the mind, and only imperfect in the expreſſion, becauſe one of theſe premiſes is ſuppreſſed, as being ſufficiently clear and obvious, and eaſily ſupplied by the underſtanding of thoſe with whom we diſcourſe.

Thus, in every right-lined triangle, the three angles are equal to two right ones; and conſequently, they are ſo in an iſoſceles triangle, is an enthymeme; the propoſition, that an iſoſceles triangle is a right-lined triangle being omitted, as being ſufficiently known and granted.

The enthymeme is the moſt ſimple and elegant of all argumentations; being what a man, in arguing cloſely, commonly makes, without attending at all to the form. Thus, that verſe remaining of Ovid's tragedy, entitled Medea, contains an enthymeme: "Servare potui, perdere an poſſum rogas:" "I was able to ſave you; conſequently, to have deſtroyed you." All the beauty would have been loſt, had all the propoſitions been expreſſed; the mind is diſpleaſed with a rehearſal of what is no ways neceſſary.

Sometimes, alſo, the two propoſitions of an enthymeme are both included in a ſingle propoſition, which Ariſtotle calls an enthymematical ſentence, and gives this inſtance thereof: "Mortal, do not bear an immortal hatred." The whole enthymeme would be, "Thou art mortal; let not, therefore, thy hatred be immortal."

ENTIER, in the *Manege*, is uſed for a ſort of reſty horſe, that refuſes to turn, and is ſo far from following or obſerving the hand, that he reſiſts it. If your horſe is entier, and refuſes to turn to what hand you will, provided he flies, or parts from the heels, you have a remedy by putting the Newcaſtle on him; that is a caveſſon, made after the duke of Newcaſtle's way.

The word is French, and is alſo uſed among them to denote a ſtone-horſe.

This term, in its common acceptation, is applied to a horſe that refuſes to turn, and whoſe refuſal proceeds from the awkwardneſs and ſtiffneſs of the body and limbs, and ſometimes from malice and bad habits. In ſome caſes, a hurt in his foot, leg, or ſhoulder, may be the cauſe of his refuſing to turn to that ſide where he feels any pain. A hurt in his reins or haunches, a curb or ſpaving, which, by hindering him to bend and reſt upon his hocks, may make him guilty of this diſobedience. Theſe are evils which art can do little towards curing. The term entier, in its figurative ſenſe, in which it is always to be underſtood in horſemanſhip, means a ſtiff horſe, or one that is not ſuppled, and therefore refuſes to turn, from the pain and difficulty which he finds in putting himſelf into a proper poſture. Accordingly the Italians, from whom the terms of horſemanſhip are chiefly taken and adopted, or naturalized by other nations, figuratively call a ſtiff and undiſciplined horſe, a whole, entire, or unbroken horſe; which, from the ſtiffneſs and tightneſs of his joints and muſcles, is not able to bend himſelf, but in turning moves all of a piece, like a beam, or bar of iron; while the active and ſuppled horſe, who can bend himſelf readily, and becomes part of the circle he deſcribes in turning, may be ſaid, like a chain, ſo to looſen and ſhift his limbs, as to break and divide himſelf, as it were, into parts; whence, perhaps, the term "horſe-breaker," for one who forms the paces, and qualifies horſes for being rode. Berenger's Hiſtory and Art of Horſemanſhip, vol. ii.

ENTIERTIE, from the French *entier*, is uſed in our *Law-books*, in contradiſtinction to moiety, and denotes the whole. Thus a bond, damages, &c. are ſaid to be entire, when they cannot be divided or apportioned.

ENTIRE Leaf, in *Syſtematic Botany*, *folium integerrimum*, a leaf whoſe edge is not cut or toothed; the term has no reference to *folium integrum*, an undivided leaf, which laſt is deſtitute of lobes or ſegments, without regard to its margin.

Entire *Tenancy*, in *Law*, is contradiſtinguiſhed to *ſeveral tenancy*, and ſignifies a ſole poſſeſſion in one man; whereas the other denotes a joint, or common one, in ſeveral. See Tenant and Joint-tenant.

Entire *Arms*. See Arms.

ENTITATIVELY, Entitative, implies an abſtraction, or ſeparation of all the circumſtances, from a thing under conſideration.

Thus, a thing is ſaid to be taken or conſidered entitatively, or ſecundum entitatem, when conſidered nakedly and preciſely, according to what it is in itſelf, without any thing extrinſic. *E. gr.* Peter entitatively taken, is Peter, as a thing, a ſubſtance, a man, &c. without any regard to his being a lord, a huſband, learned, &c.

ENTITY, in the *School Philoſophy*, a phyſical ens, or being, conſidered according to what it is in its natural capacity.

Some dealers in diſtinctions give us ſeveral kinds of entity.

Or, entity denotes the actual eſſence or exiſtence of any thinking thing. See Ens.

ENTLIBUCH, in *Geography*, a village of Switzerland, in the canton of Lucern, the principal place of a bailliage, which extends from the Emme-thal in the canton of Bern to the bridge near Wertenſtein, about 15 miles in length and 9 in its greateſt breadth; and contains 11,000 perſons. It is governed by a bailiff, who is always a ſenator of Lucern; he continues in office two years, and generally reſides in that capital. The bailliage is divided into three diſtricts; the upper, or Eſchliſmat, the middle, or Shuepfen, and the lower, or Entlibuch; each of which has its ſeparate courts of juſtice, from which an appeal lies to Lucern. The valley of Entlibuch is watered by ſeveral rivulets, winding for ſome way between two ridges of well-wooded hills, and abounding in pictureſque ſcenery. It contains ſeveral villages, of which the principal are Eſchliſmat, Shuepfen, and Entlibuch, which takes its name from the river Entle, and gives it to the whole diſtrict. The inhabitants chiefly follow

low agriculture; they rear large quantities of horned cattle, ſheep, goats, and ſwine; they alſo make and export cheeſe in great abundance. The peaſants of Entlibuch are much eſteemed for their independent ſpirit, vigour, and ſtrength; and are remarkable for keenneſs and vivacity, for great quickneſs in repartee, for a peculiarity of garb, and for many ſtriking cuſtoms, which diſtinguiſh them from the natives of circumjacent diſtricts. The valley of Entlibuch may be conſidered as one of thoſe parts which unite with the mild and cultivated the wild and rugged ſcenery of Switzerland; its acclivities gradually aſcend and terminate in mount Pilate, whoſe barren top is ſeen towering above the fertile and well-wooded hills. In the 13th century, Entlibuch was ſubject to the counts of Wolhauſen, and came by purchaſe, in 1299, to the emperor Albert. In the following century it was held as a fief from the houſe of Auſtria by ſeveral ſucceſſive counts; till the nation, grievouſly oppreſſed by Peter of Torrenberg in 1386, threw itſelf under the protection of Lucern. That republic continued to poſſeſs Entlibuch, as a feudal tenure under the houſe of Auſtria, till the year 1405; when the archduke Frederic renounced all the rights of ſovereignty. For above a century and a half, the inhabitants, inflamed with a deſire of independence, and excited by the example of the popular cantons, frequently roſe in arms, and attempted to eſtabliſh a democracy, but without ſucceſs. Their laſt inſurrection broke out in 1653; ſince which time they have continued in a ſtate of perfect tranquillity under the adminiſtration of Lucern, enjoying, with contentment, the privileges with which they are endowed. The peaſants of Entlibuch were diſtinguiſhed by their attachment to the government, and by their decided oppoſition to French principles, during the late revolution. Coxe's Travels in Switzerland, vol. i.

ENTOGANUM, in *Botany*, Gærtn. t. 68. See Melicope.

ENTOMOLITHUS, in *Natural Hiſtory* and *Mineralogy*, is the name of a genus of the animal order of remains (*reliquia*, or relicts) of a former race of beings, which inhabited the earth or its waters, and includes the different kinds of inſects found in a foſſil ſtate. According to Mr. William Martin (Outlines of the Knowledge of extraneous Foſſils, p. 191), the eſſential characters, or diagnoſtics of the permanent ſpecies in this genus, are to be ſought, in "the upper external covering of the thorax, united to that of the abdomen;" the temporary ſpecies of this genus are to compriſe the detached head, thorax, abdomen, limbs, &c. of foſſil animals, reſembling the recent ſpecies of inſects. See Reliquia.

ENTOMOLOGY, the ſcience of inſects, or, as literally rendered from the Greek, a *diſcourſe on inſects*; the term by which the ſtudy of theſe animated beings is expreſſed.

Inſect, from *inſectum*, Latin, is of later origin than ἔντομα, the term made uſe of by Ariſtotle, who flouriſhed in the fifth century, before the Chriſtian era, and was invented much earlier than the time of that celebrated philoſopher. Ariſtotle defines it to ſignify an animal which by inciſions is nearly ſevered into two or more parts, and the Latins, long before the time of Pliny, (who lived in the reign of Titus,) employed the word *inſectum*, from *inſecor*, which preciſely bears the ſame interpretation.

The inſect race conſtitutes the moſt conſiderable portion of the whole claſs of organized bodies poſſeſſing the vital principle of life. The number of aquatic beings concealed from our reſearch in the depths of the ocean cannot be within the reach of human eſtimate; it is to the terreſtrial tribes, or thoſe which inhabit the ſurface of our globe, that we alone allude; and the entire amount of theſe, including every order, is confeſſedly inferior in point of number to the ſingle claſs of inſects. Among the larger animals the diſcovery of a few new ſpecies, or of individuals not correctly aſcertained before, is eſteemed of conſequence; but ſo extenſive are the limits of entomology, that the diſcovery of a multitude of inſects under the ſame circumſtances fail to excite aſtoniſhment, though it may awaken curioſity; and, indeed, its frequency ſeems calculated to confirm the commonly received opinion, that the inſect race, in the diverſity of ſpecies, much more in the number of its individuals, muſt be almoſt boundleſs.

In this view the ſcience of entomology becomes one of the moſt important that can engage the mind of the natural philoſopher. It is the difficulty of diſcriminating the particular affinities and characters of theſe beings, ariſing from their amazing number and variety of form, in addition to their minuteneſs, that more ſtrongly enforces their claim to his conſideration. The naturaliſt who neglects the ſtudy of inſects, cannot deſerve our reſpect as a general obſerver of nature. His views are partial; his enquiries circumſcribed; he regards only an inconſiderable portion of animated nature; and his remarks are confined chiefly to thoſe which, from their magnitude and diſtinctneſs of character, preſent the leaſt obſtacle to inveſtigation.

The ſtudy of every claſs of animals is indiſputably attended with peculiar advantages; and in none is this aſſurance more clearly manifeſted than in the tribe of inſects. In the mazy labyrinths of entomology, the naturaliſt will find abundant ſcope for the exerciſe of his zeal and application, and in the courſe of his enquiries the full exertion of his penetration will be oftentimes required to the aſcertainment of truth. The amazing number of ſpecies it embraces; their forms ſo extraordinary; ſo infinitely varied; and yet ſo gradually approximating through an endleſs ſeries of tranſitions from one ſpecies to another; the diverſity of ſtructure obſervable in their antennæ, their limbs, bodies, wings, and every other particular which conſtitute the eſſential differences of their orders, genera, and ſpecies; added to the ſurpriſing changes in form which the generality of inſects undergo at ſtated periods of their life:—theſe are circumſtances which contribute to render them objects of the moſt curious ſpeculation to the naturaliſt, and we ſhall venture to affirm, that it is from a knowledge of theſe, their characters, tranſitions, metamorphoſis, and the various modes of life theſe little beings are deſtined to purſue, that he will obtain a more intimate acquaintance with the great laws of animated nature, than can poſſibly be derived from the contemplation of any other tribe in the creation.

As inſects ſurpaſs all other animals in their number, variety, and ſingularity, ſo alſo it is a natural inference that they muſt deſerve the greateſt ſhare of attention. The hiſtory of theſe creatures abound with the moſt valuable information in a philoſophic view, and ſtrongly recommend the ſtudy to the attention of every curious obſerver. Entomology poſſeſſes many other attractions, ſome at leaſt of which have not been well conſidered. The only one to which we ſhall particularly advert at this moment, is the beauty of inſects in general, a point on which there can be no difference of opinion. Theſe little creatures are rendered engaging from the gaiety of their natural hues: from combining oftentimes with the moſt graceful forms a diſplay of colouring very far excelling in ſplendour, vivacity, delicacy, and harmony of diſpoſition, that beſtowed by the hand of nature on her other works. One defect in their appearance muſt be nevertheleſs conceded; and this may be regarded in point of beauty as a material deficiency indeed: they are not always ſo conſiderable in magnitude, as to become, even with theſe embelliſhments, ſtrikingly attractive: were they only equal in ſize to the minor tribes of birds and animals, their unrivalled elegance would certainly render them objects of high eſteem in the general opinion of mankind.

But the diminutiveneſs of inſects ought to operate in a contrary manner on the mind of the philoſopher. While this cauſe oppoſes the greater difficulty to the ſtudy, it ſhould more ſtrongly incite inveſtigation. This we are aware is not always conſidered as an inducement, and the diminutiveneſs of theſe creatures has been ſometimes urged as a reaſon that they do not merit the attention beſtowed upon them. However injudicious this opinion ought in candour to be conceived, it has obtained the countenance of many; and among the number, of ſome men at leaſt who, from their ſuperiority of talent, might be deemed incapable of advancing ſuch an argument againſt the ſtudy of any department of natural ſcience. Thus the ingenious Buffon, whoſe attention, as is well known, was reſtricted to the larger tribes of animals, intimates its inferiority in language ſufficiently pointed. "Who (ſays this lively author) gives us the grandeſt and moſt magnificent ideas of the creator of the univerſe? he who repreſents him in the plenitude of his power, directing the formation of ſuns and of planets, and guiding the revolutions of worlds, or he who diſcovers him buſied in regulating the economy of a hive of bees, or deeply engaged in folding the wings of a beetle?"

How different is this from the ſentiments expreſſed by other philoſophers, who, with more enlarged and liberal views, have held every branch of natural ſcience in its proper eſtimation! There are many who even aſſign a higher degree of perfection to the inſect race than to other claſſes of animals. We learn the opinion of Pliny from his own words. "In his tam parvis tamque fere nullis quæ ratio! quanta vis! quam inextricabilis perfectio!" Boyle declares, that for his own part his wonder was more excited by the contemplation of a mite than an elephant; and Reaumur ſpeaks more decidedly to the ſame effect, in language worthy of repetition. Pourquoi, (ſays this author,) craindrions-nous de trop louer les ouvrages de l'Etre Suprême? Une machine nous paroît d'autant plus admirable, et elle fait chez nous d'autant plus d'honneur à ſon inventeur, que, quoiqu' auſſi ſimple qu'il eſt poſſible par rapport à la fin à laquelle elle eſt deſtinée, il entre dans ſa compoſition un plus grand nombre de parties, et de parties très-différentes entre elles. Nous avons une grande idée du génie de l'ouvrier qui a ſu réunir et fait concourir à la même fin, autant de parties différentes et néceſſaires. Celui qui a fait, les machines animées que nous appelons des inſectes, n'a aſſurément fait entrer dans leur compoſition que les parties qui devoient y être. Combien, malgré leur petiteſſe, ces machines nous doivent-elles paroître plus admirables que celle des grands animaux, s'il eſt certain qu'il entre dans la compoſition de leur corps beaucoup plus de parties qu'il n'en entre dans celle des corps énormes des élephans et des baleines! Pour faire paroître au jour un papillon, une mouche, un ſcarabée, en un mot, tous les inſectes, qui ont à ſubir des transformations, il a fallu au moins faire l'equivalent de deux animaux, faire une chenille dans laquelle le papillon prit tout ſon accroiſſement, faire des larves dans leſquelles la mouche et la ſcarabée puſſent croître". Swammerdam is impreſſed with the ſame idea. "After an attentive examination (ſays this writer) of the nature and anatomy of the ſmalleſt as well as the largeſt animals, I cannot help allowing the leaſt an equal or perhaps a ſuperior degree of dignity to the former. If, while we diſſect with care the larger animals, we are filled with wonder at the elegant diſpoſition of their parts, to what an height is our aſtoniſhment raiſed, when we diſcover all theſe parts arranged in the leaſt, in the ſame regular manner! Notwithſtanding the ſmallneſs of ants, nothing prevents us from preferring them to the larger animals, if we conſider either their unwearied diligence, their wonderful ſtrength, or their inimitable propenſity to labour."

Another objection, for we ſhall not term it argument, has been advanced againſt this ſtudy, the validity of which cannot be ſo thoroughly examined in this place as we could wiſh; it has been ſtated, that becauſe inſects furniſh few of the articles of life they deſerve no conſideration. This is the language of ignorance, and ſuch as we could eaſily ſhew to be of the moſt futile kind. The ſtudy of theſe creatures is as replete with utility; and the knowledge of them as eſſential to the benefit of mankind, as moſt other branches of ſcientific purſuit; nor ſhall we ſcruple to aver, that in this particular reſpect entomology claims a decided ſuperiority over every other department of zoology. But the fact is evident, that the importance of this ſcience, at leaſt in Britain, has never been duly appreciated, and this ariſes from the moſt obvious of all cauſes, that it has not been ſufficiently explained.

Inſects may properly be divided into two kinds, thoſe which are either directly or remotely beneficial, or injurious to the purpoſes of mankind. Many inſects, it is true, do not ſeem to affect us in any manner; but appearances in this reſpect, let it be obſerved, are not always to be relied upon. Others, and the number of thoſe is very great, moſt aſſuredly fall within the denomination of one or other, and even both the firſt mentioned kinds, and for this reaſon ought ſurely to demand our attention. In the ordinary concerns of life it is deemed of as much, if not greater conſequence, to know our enemies, and aſcertain the powers of annoyance they poſſeſs, as it is to learn what benefit we may be able to derive from our friends: let us apply this plain and rational argument to the ſtudy of inſects, and we think it will appear equally conſiſtent, when we aſſert that it is as important to know thoſe which are injurious to our intereſts, as thoſe which contribute to our advantage. When we are convinced in what reſpects particular inſects have the means of doing us injury, we may guard againſt their attacks, or apply a remedy to the evil, and if we neglect to obtain thoſe ſervices from the beneficial kinds which they are deſigned by nature to afford us, it can be no proof of our wiſdom.

Leſt, to the ſuperficial obſerver, our alluſion to the utility of inſects ſhould appear theoretical, while the noxious propenſities of others may be too fully experienced in the affairs of agriculture, horticulture, and throughout the various branches of domeſtic economy, to admit of doubt, we ſhall be more explicit in this obſervation. The ravages of inſects upon vegetation are detrimental to us; but let it be remembered alſo, that even in theſe depredations they ſometimes repay the injury they commit. The locuſt itſelf, the moſt deſtructive of all inſects, and whoſe myriads ſpread deſolation through the vegetable world, are not unproductive of advantage, except on ſome very extraordinary occaſions, when their multiplication exceeds all bounds. At other times they deprive mankind of a certain portion of his vegetable food, and, in return, their bodies afford him animal nutriment of a wholeſome and palatable kind, and in infinitely greater abundance. The various ſorts of locuſts are the common food on which the inhabitants of many parts of the world, at particular ſeaſons, chiefly ſubſiſt. The honey of bees, both of the wild and domeſtic kinds, conſtitute another primary article of food in many warm countries, in the preſent as in ancient times. The hydromel of the Ruſſians, an excellent and delicious drink, is prepared from honey, as our beverage is from malt. The various tribes of ſilk worms, (for of this kind there are ſeveral ſpecies,) furniſh materials for the raiment univerſally worn by all ranks in the eaſtern parts of the world, and hence in thoſe countries the ſilky produce of theſe induſtrious little beings is of as much real conſequence to them, as the fleecy coat of the ſheep is to us the ſtaple article of clothing; as an object of traffic, ſilk is one of the utmoſt importance in China and Tartary, and in thoſe parts the paper in common uſe is alſo manufactured from the refuſe of the ſame material. The extenſive uſe of wax in all ages is well known; but it is leſs generally underſtood that wax is not the produce of the bee alone; the wax inſect of China is a very different creature, a ſpecies of cicada in the larva ſtate, and which, with the addition of a vegetable oil, forms the mixture of which the candles of that country conſiſt. (Donov. Inſ. China.) Certain inſects are employed with ſucceſs in medicine, and a further number might be applied to the ſame purpoſe; many others might be alſo rendered uſeful in the arts, and laſtly, we need only advert to the valuable properties of the different ſpecies of cochineal in the art of dyeing, to prove the abſurdity of an opinion very generally prevalent among us, that inſects are a race of creatures too inſignificant to deſerve the notice of mankind!

But, were all theſe benefits unknown; and allowing that the ſtudy of inſects did not ſeem to be productive of any ſubſtantial advantages, how abſurd would it ſtill be to treat ſuch a fair and extenſive portion of the creation with neglect. The objection that they are in no manner conducive to our intereſts, even if founded in truth, would be no evidence of the frivolity of the ſcience itſelf, unleſs we are to conclude that the only enquiries which merit the rational attention of mankind, are thoſe which tend to the gratification of ſelfiſhneſs. If this be admitted as a plauſible objection, how many objects of philoſophical inveſtigation muſt be rejected as frivolous!

From the earlieſt period of which any authentic records remain, this race of animals has obtained the attention of every civilized age. The ſtudy of theſe creatures has not aſſuredly been cultivated with equal ardour at all times, nor has every country produced entomologiſts of conſiderable talent. It will be ſufficient to ſhew, that the ſcience itſelf has never remained in utter neglect, from the remoteſt period in which the light of natural knowledge dawned upon the intellectual horizon of man. The experience of all ages diſtinctly proves the charge of frivolity to be inapplicable to this ſtudy: many advantages, beſides thoſe above enumerated, have been, and continue ſtill to be, derived from this ſource; and it is furthermore deſerving of our obſervation, that among the number of its votaries in diſtant periods of the world, we trace the names of the moſt diſtinguiſhed characters that adorn the page of hiſtory. Perhaps we are at this moment addreſſing, among the circle of our readers, ſome at leaſt who, nurtured in habitual indifference towards the ſubject under diſcuſſion, have incautiouſly fallen into the error of conſidering it as a trivial purſuit. But we are not without expectation, that even the ſlight obſervations which the limits of our paper allow, will direct their attention with more liberality towards this ſubject, and we ſhall not heſitate to think in the reſult of this, they will eaſily conceive much ſtronger arguments in its favour than we have adduced. To the idle, or the thoughtleſs confirmed in prejudice, it would be in vain to offer any reaſon in its behalf, and to thoſe we ſhall obſerve with brevity, that whatever opinion they may be inclined to entertain of its frivolity, the ſcience of entomology will be found in every civilized age and country to have engaged the ſtudy of men endowed with talents as ſplendid and judgment as refined, as the moſt exalted for ability among thoſe who affect to treat it unworthily.

Theſe obſervations opportunely introduce to our conſideration a review of thoſe writings which have contributed to enlighten the paths of ſcience in this particular ſtudy. The number of theſe; the value and intereſt which muſt unavoidably attach to their contents; and the names of thoſe illuſtrious characters by whom many of them were produced, will fully ſanction, it is preſumed, the aſſurances before advanced. Theſe works, even in point of number alone, we have no doubt will be found infinitely more conſiderable than moſt imagine; and this circumſtance, independently of any other, tends to prove that we are not ſingular in our commendation of entomology either as an inſtructive or uſeful ſcience; as morally, and intellectually beneficial; for thoſe who write on any ſubject like the preſent, muſt be impreſſed with ſome idea of its importance, and theſe opinions may be collected uniformly from the labours of writers on the ſtudy of inſects.

As we deem this ſubject of conſequence, it is our decided wiſh, even in the curſory view to which our limits are reſtricted, not to omit the mention of any work, however ſlight, that has been productive of material information. Our ſtrictures, it will be underſtood, are confined to thoſe we have had ſufficient opportunity to conſult with ſome attention; for this we conſider due, in candour, to the reſpective writers whoſe labours are devoted to the elucidation of ſcience. Sometimes we may be inclined to expreſs ourſelves with warmth in favour of merit, neglected, forgotten, mouldering in decay, or which, from latent motives, has never been ſufficiently appreciated by later authors. If we err in this, let it be remembered, that in the truth of criticiſm we oftentimes evince more judgment in beſtowing praiſe, than awarding cenſure. But we wiſh it to be explicitly underſtood, that we do not conſider it within our province, at preſent, to enter at large upon a critical analyſis of the multitude of writings before us. Our only object is to point out the exiſtence of the moſt valuable works that are extant within our own knowledge, deſcribing at the ſame time the leading intention of their authors reſpectively: the collateral remarks can be only thoſe immediately incidental to ſuch inveſtigation. The ſeveral works enumerated will be adverted to, as nearly as poſſible, according to the order in which they appeared before the world; and hence our review, however curſory, will be attended with this peculiar advantage, that it will ſerve to point out the progreſſive improvements the ſcience has derived from the labours of each ſucceeding author, in a more perſpicuous form than could perhaps be accompliſhed in any other manner. It will alſo by this means be found calculated to afford the general reader

An Hiſtorical view of the Riſe, Progreſs, and Preſent State of Entomology.

The deſtruction of the great public libraries of antiquity has for ever deprived us of the means of aſcertaining preciſely to what ſtate of perfection this branch of ſcience had attained, till within about two thouſand years of the preſent period. Of thoſe times a few ſcanty memorials alone remain, ſufficient, however, to teſtify that the ſtudy of inſects had then made ſome progreſs, and was held in eſtimation. Whatever may be our ideas with regard to ſtill earlier times, it would be needleſs to obtrude them in this place. We ſhall obſerve only, that ſome books muſt have been written on the ſubject before the exiſtence of thoſe which have deſcended down to us: the reputation of ſuch writings is preſerved, and in certain inſtances the names of authors recorded in the very earlieſt of thoſe works at preſent extant, which clearly demonſtrates the truth of this opinion. Time has not ſpared the labours of any writer on this ſubject of more remote date than the third, fourth, and fifth century before the Chriſtian era, and the amount of thoſe which have ſurvived is ſmall indeed ; but inconſiderable as they are, in point of number, we may, notwithſtanding, collect from them that the ſtudy of inſects, in thoſe days, held a rank among the liberal purſuits of their philoſophers.

We may, indeed, proceed ſtill farther in this retroſpect, if the ſacred writings of the Hebrews be conſidered. Theſe abound with paſſages relating to particular kinds of inſects, as the locuſt, the caterpillar, flies, and vermin. Moſes, the earlieſt of the inſpired writers, had probably acquired ſome knowledge of this ſubject, in common with the other ſciences, from the ſages of Egypt ; and among the books of Solomon, now loſt to the world, it is recorded that he treated on inſects, or "creeping things."

Hippocrates flouriſhed in the 80th Olympiad, or fifth century before the Chriſtian era ; he wrote on inſects, as we are told by Pliny, in whoſe time ſome remains of the entomological obſervations of this celebrated character were probably extant. The writings of the early Greek and Latin writers, quoted by Pliny, afford extracts from this production of his labour.

The ſucceeding age gave birth to that diſtinguiſhed natural hiſtorian and philoſopher Ariſtotle : the production of whoſe labour, his hiſtory of animals, is worthy of the patronage beſtowed on its author by the conqueror of the univerſe. No one can impartially peruſe this ineſtimable treaſure of antiquity without confeſſing the intimate knowledge its writer muſt have poſſeſſed of the great arcana of nature.

This work of Ariſtotle is rather of an elementary kind, embracing a general, wide, and comprehenſive view of the animated creation, and does not, except on particular occaſions, deſcend to the deſcription of individuals or ſpecies. The inſect tribe is treated under different points of compariſon and view in ſeveral parts of the work. In the ſeventh chapter of his firſt book, he informs us, that the name ἔντομα is generic, or that of a family, and that they conſtitute one of his four orders of exſanguineous animals, and points out with great accuracy in what reſpect they differ from the molluſca, cruſtacea, and teſtacea, the other three families of this claſs of animals. By exſanguineous he means only that they have no red blood, for he ſpeaks generally to their bodies being retained in a ſtate of moiſture by other fluids. The firſt chapter of the fourth book affords a definition of the eſſential character of inſects, which conſiſts in the inciſions or cuts either on the back or belly, and ſometimes on both, by which their bodies appear to be almoſt divided into two or more parts. But that portion of his work which is more particularly devoted to inſects, is entitled Περι τῶν ἐκτὸς χο ρίων τῶν ἐν τόμων. In this he more fully deſcribes inſects to conſiſt of three parts, the head, trunk, and belly or abdomen ; the ſecond part, or trunk, is denominated an intermediate portion, correſponding with the back and breaſt in other animals ; and he alſo mentions as a character of inſects that they are furniſhed with feet.

The ſubſequent paſſages deſcribe different genera, or, as termed, tribes of inſects, in which he treats of thoſe which fly and thoſe which walk. Among thoſe furniſhed with wings, he ſpeaks of ſome having theſe parts entirely naked, and others that have them protected by a ſheath, or covering, as in the beetle kind : as he furthermore ſtates, that in ſome beetles theſe ſheaths divide or open when the inſect flies, and that in others they are inſeparably united. The inſects which have naked wings, he obſerves, poſſeſs either four, as in the bee, or two, like the muſca or common fly. Some of thoſe with four naked wings have ſtings at the end of the body, while beetles, and inſects with two naked wings, are deſtitute of this apparatus ; but ſome of the latter, he tells us, have a proboſcis or inſtrument at the mouth, by means of which they draw blood from other animals. The horns before the eyes (by which he means the antennæ) attract his obſervation, and thoſe of the papiliones and grylli are particularly deſcribed. In his remarks on the different ſtructure of the feet, thoſe formed for leaping are exemplified by thoſe of the locuſt, and are compared to the poſterior feet of ſpringing animals. The humming noiſe of certain inſects in flight, the eruca, and various other circumſtances relative to this claſs of animated beings, have intereſted the philoſopher in this chapter.

The attentive entomologiſt will feel deeply ſenſible of the accuracy of every expreſſion, thought, and ſentiment, implied in the above-mentioned paſſages. He will be ſurpriſed at their conſiſtency. Their accordance with the entomological definitions of the beſt modern ſyſtematiſts will excite farther compariſon ; and in the reſult of this inquiry it muſt be obvious, that with the acquired knowledge of two thouſand years ſince his time, ſo far as he does proceed, we cannot materially amend his obſervations. This will be admitted ; and at the ſame time we believe even a curſory peruſal of the whole work will ſerve to ſhew, that whatever might be the merits of Ariſtotle, and we allow them to be tranſcendent, theſe writings evince too much acquaintance with the ſcience of nature, to be the produce of any individual genius ſhining with unborrowed light. When we reflect upon the ſlow and gradual progreſs with which all human knowledge is developed, we are really convinced that the ſcience of nature muſt have made ſome conſiderable advancements before his time ; and that he has derived many eminent advantages from conſulting the works of more ancient naturaliſts : men whoſe original labours have been loſt to poſterity for ages, and the only traces of which at preſent extant are to be found embodied in his pages.

Ælian, in his work on animals, ΠΕΡΙ ΖΩΩΝ ΙΔΙΟΤΗΤΟΣ, appropriates ſeveral detached chapters to particular kinds of inſects, without entering in a methodical manner into the hiſtory of the tribe. Thoſe he does include are deſcribed with attention : as, for inſtance, the ſcorpions, Σκορπίων ; ants, Μυρμήκων ; ſpiders, Ἀράχνα ; crickets, Τεττίγων ; the generation of waſps, Περὶ τῆς Σφηκῶν γενέσεως ; of cantharides, τῶν καλεῖων Κανθαρίδων, &c.

The Greek poet Phile, called alſo, from his ſuperior knowledge of natural hiſtory, "Phile Sapientiſſimi," introduces ſome pleaſing poetical effuſions relative to inſects among his poems on animals. The manners of the cicadæ, and the bees, τεττίγων, and μελισσῶν, are very prettily deſcribed in verſe by this writer. He entertains the ſame idea as Ælian, that the cicadæ, by which he means the cricket, (not the inſect named cicada by Linnæus,) lived on dew ; and that the female was mute, while the male "enchanted the grove with the harmony of ſong." He ſpeaks alſo of the lampyris, and various other inſects. The beautiful ode of Anacreon to the cicada is familiar to many.

Among the Greek writers who immediately, or within a few centuries after, followed Ariſtotle in treating upon inſects, were Democritus, Neoptolemus, Ariſtomachus, Philiſtus, Nicander, Menecrates, Dionyſius Mago, Empedocles, Callimachus, Attalus, Apollodorus, Eriphilus, Eraſiſtratus, Aſclepius, Themiſo, Poſidonius the ſtoic, Meander of Priene, Euphronius of Athens, and Meander of Heraclea, Theophraſtus, and Heſodius. Theſe were authors after the time of Ariſtotle, and preceding or contemporary with Pliny. The Latin writers, during the ſame interval, were alſo numerous, and appear to have been influenced to purſue this ſtudy in imitation of the Greeks, or were inſenſibly led into it from attending to the culture of bees. The moſt eminent among the latter were M. Varro, Hyginus, Scropha, Sarcana, Celſus Cornelius, Æmilius Macer, Virgil, Columella, Julius Aquila, Tarquilius, Umbritius, Cato Cenſorius, Domitius, Calvinus, Trogus, Meliſſus, Favonius, Fabianus, Mutianus, Nigidius, Manilius, and Opius. The cultivation of bees was attended to in thoſe times with the moſt enthuſiaſtic ardour, and their hiſtory detailed by many eminent writers. We are told that Ariſtamachus of Soli wrote upon this ſubject, from the reſult of ſixty years experience; and that Philiſcus the Thaſian acquired the name of Agrius, from having employed his whole life in foreſts and deſerts, attending to theſe inſects. The culture of ſilk-worms was another favourite object with the ancients, as we learn from Pliny, who relates that in his days garments of ſilk were greatly admired by the fair ſex, becauſe, from the delicacy of its texture, it diſplayed the beauty of their perſons almoſt as diſtinctly as though they were naked.

The eleventh book of Pliny treats of inſects, as the moſt ſubtle of all animals in nature. He ſpeaks of thoſe which fly; ſome with naked wings, and others with wings protected by a covering, as Ariſtotle had previouſly obſerved. The bees, waſps, hornets, ſpiders, graſshoppers, locuſts, ants, &c. are among the number of inſects deſcribed by this writer.

From the time of Pliny till the overthrow of the Roman empire, a period of ſeveral centuries, the ſcience of inſects ſeems to have made ſome progreſs, though to what extent we may probably never learn. The names of writers in thoſe times, and ſome few ſcattered memorials of their labours, are to be found recorded in the voluminous works of authors that appeared at the revival of learning in the ſixteenth and following century. The number of theſe could not have been very inconſiderable: among the principal of them were Ætius, Paulus Ægineta, Alexander, Trallian, and Oribaſius.

The laſt-mentioned authors lived between the fourth and ſeventh century. After this time, through the dark ages, while ignorance in every ſcience prevailed nearly over the whole world, this ſtudy might have been little attended to. But we are not to conclude that even during this time it was utterly neglected. Learning had then taken a retrograde courſe from Greece and Rome towards thoſe eaſtern regions, from whence they had originally emanated; and the ſciences, during this interval, were cultivated with ſome ſucceſs in Arabia. The advancement made by the Arabians in the ſtudy of botany, between the ninth and twelfth century, is known to have been rather conſiderable. Among the entomologiſts of thoſe ages we recognize ſome of thoſe Arabian botaniſts; ſeveral of whom were diſtinguiſhed for their acquaintance with plants, as Rhazes, Avicenna, Avenzoar, and Averrhoes, each of whom wrote on inſects.

From the twelfth to the fifteenth century, a darker period than the preceding, there are few writers on this ſubject. The principal of thoſe, at leaſt within our knowledge, during this period, are Myrepſus, Hildegardis, Platerus, Arnoldus de Villa Nova, and Petrus Creſcentienſis. There are a few others, but they are too obſcure to deſerve mention.

Some part of the general zoological work of Albertus Magnus, "De Animalibus," &c. relates to inſects. Its author was biſhop of Ratiſbon, and died in 1280; but his work, which is written in the Latin tongue, and was printed at Venice, did not appear till the year 1519.

In 1549, the work of Agricola, entitled, "De Animantibus ſubterraneis," made its appearance; and in this we find one of the earlieſt ſyſtematic arrangements of inſects extant. This author reduces all inſects to three principal claſſes, namely, * thoſe which walk, ** thoſe which fly, and *** thoſe which ſwim; and under each claſs deſcribes a number of ſpecies.

About the middle of the ſame century, Edward Wotton, a doctor of medicine in London, publiſhed "De Differentiis Animalium;" a work relating, among other tribes of animals, to that of inſects, a ſcience in which its author excelled. This work is in folio, and bears date 1552; from which it muſt have appeared three years before the author's death, which happened in 1555.

The work of Rondeletius of Montpellier, "Libri de Piſcibus Marinis," publiſhed in 1555, or rather earlier, treats, as the title intimates, on fiſhes, and other aquatic animals; to which, however, it is not entirely confined; for he alſo ſpeaks of inſects, and even accompanies ſome of his deſcriptions of theſe inſects with figures cut on wood. Leſſer mentions that in the library of the Jeſuits at Ratiſbon, there is a copy of this work in two volumes; on the margins of the leaves of which are large notes, ſaid to be in the hand-writing of Geſner. Whether theſe notes have in any manner appeared before the public we know not: the circumſtance is repeated only for the purpoſe of inquiry. If Leſſer afforded any intimation of the nature of thoſe notes, we might aſcertain whether they are the ſame with the obſervations of Geſner on Rondeletius, in his "Hiſtoria Animalium," an edition of which we ſuſpect was printed ſoon after the work of Rondeletius appeared.

Conrad Geſner, eſteemed the moſt diligent inquirer into nature which his age produced, and who, in reward for his aſſiduity, obtained the title of the German Pliny, has treated ſlightly on inſects in that part of his work which relates to the nature of ſerpents, "De Serpentium Natura," &c. printed in 1587. His diſcourſe is chiefly concerning the ſcorpion tribe. Some tracts of this author appear to have been publiſhed ſo late as 1620: neither of theſe, however, are on the ſubject of entomology.

A far more voluminous work than either of the foregoing was produced by the induſtrious and learned Aldrovandus, in 1602; a folio volume of ſeveral hundred pages, with the title "De Animalibus Inſectis," and forming part of his grand work on animals. Aldrovandus has not eſcaped cenſure. In the "Amœnitates Academicæ," Forſkal conſiders him as an indefatigable compiler, celebrated for the number of his works, but who thought he had acquitted himſelf in collecting together the undigeſted obſervations of the ancients. We cannot avoid expreſſing other ſentiments; and notwithſtanding that he has fallen into many errors of his predeceſſors, this work entitles his memory to reſpect. Aldrovandus was not merely a compiler; he availed himſelf of the labours of former writers, and in this reſpect with leſs ſervility, and certainly with more candour, than many who advance this objection againſt him: for he generally refers to his authorities. Aldrovandus was profeſſor of medicine in the univerſity of Bologna, and, according to his biographers, the ſtudy of inſects was his favourite object. In this purſuit he expended large ſums of money, travelling for information, and in the employment of artiſts; as he was unfortunately, like ſome other eminent naturaliſts, himſelf deficient in the talent of drawing. During the ſpace of thirty years, he paid two hundred florins annually to a painter, ſolely occupied in the delineation of inſects for him. From the fatigue of his reſearches, this indefatigable naturaliſt was unhappily deprived of ſight in his old age.

In his claſſification of inſects, he divided all theſe animals into two primary orders, the terreſtrial and the aquatic; the firſt called favica, the other non-favica. Theſe two claſſes are ſubdivided into many orders; the characters of which are determined by the number, nature, and poſition of the wings and feet.

The repreſentations of the inſect tribes, from their inferiority of ſize, added to the general minuteneſs of their characters, are rather more rudely expreſſed in the work of Aldrovandus, than the figures of the larger animals, which theſe volumes contain. A defect of this kind is leſs excuſable, becauſe from the liberality of Aldrovandus towards his artiſt it might not be expected; and furthermore, becauſe about that period a better taſte, and a deſire for more expenſive embelliſhments in works of this deſcription, began to prevail. The graphic art, or engraving on copper, though ſcarcely emerged from infancy, was now introduced in aid of this ſcience, in preference to cuts on wood, and with no ſmall ſucceſs, as we obſerve in the works of Hoefnagle, Hollar, and others of that period, whoſe labours are well known. Thoſe embelliſhments, though greatly admired in their time, were, however, too coſtly to be introduced into works of the ordinary kind; they were confined to the more expenſive productions, and, indeed, almoſt excluſively to thoſe produced by artiſts themſelves; for we ſeldom meet with them in any work of which the artiſt is not alſo the author. The beſt book of that period in our own country, for ſuch we conſider Mouffet's "Inſectorum Theatrum," affords only cuts on wood, an inſtance ſufficiently corroborative, as this work was printed in 1634. Even for the ſpace of nearly a century after this, copperplate engravings were ſparingly introduced. The learned Liſter, in his edition of the works of Geodartius, ſo lately as 1682, laments the great expence of engravings, at the ſame time that he expreſſes his conviction that they are indiſpenſable in works of this kind. "I have taken great care of the deſigns," ſays this writer, "in tranſferring them upon copper-plates, which I dare promiſe are exquiſitely performed by the beſt of our Engliſh artiſts, which was at my expence; and the bookſellers were not willing to reimburſe me."—"And upon this occaſion I muſt needs ſay, that natural hiſtory is much injured, through the little encouragement which is given to the artiſt, whoſe noble performances can never be enough rewarded; being not only neceſſary, but the very beauty and life of this kind of learning." But, to reſume the courſe of our ſubject in hiſtoric order, the next work immediately in ſucceſſion to Aldrovandus is that of Wolfang Frenzius, publiſhed in 1612, and called "Hiſtoria Animalium Sacra," a valuable work, as containing much original obſervation. After the manner of Agricola, he diſtributes all inſects into three claſſes, which he names aërea, aquatica, and terrea et reptantia. A ſmall octavo, printed three years after, though a ſlight production, ſhould be mentioned in this place; it is a treatiſe on ants, a pamphlet of about one hundred pages, and is written in Latin; the title "De formica," &c. by Jeremiah Wilde. The work of Fabius Columna, "Aquatilium et Terreſtrium aliquot Animalium Obſervationes," printed at Rome in 1616, relates alſo, in ſome degree, to inſects; and finally, in point of precedence to Hoefnagle, we have to notice another, a work of ſome moment, that appeared ſoon after, from the pen of Archibald Simpſon: this was publiſhed in North Britain, and from the motives of the author and ſingularity of its contents claims explicit mention. From the title of this book, which is ſufficiently explanatory, it will be perceived that entomology was only a remote object in the mind of the writer. The work derives its greateſt ſhare of intereſt, in our preſent view, from being one of the firſt publications connected with the ſtudy of inſects printed in Britain. This book, which is in quarto, was printed at Edinburgh in the year 1622, and bears the following title: "Hieroglyphica Animalium terreſtrium, volatilium, natatilium, reptilium, inſectorum, vegetivorum, metallorum, lapidium, &c. quæ in Scripturis Sacris inveniuntur et pluriorum aliorum, cum eorum interpretationibus."

At length our enquiry arrives at that particular period when the painting of inſects was eſteemed ſuitable and worthy of the pencil of the moſt ſkilful artiſts of the age, the painters retained with magnificent ſalaries in the courts of princes, and in the moſt poliſhed ſtates of Europe. Under the foſtering influence of ſuch patronage, it ought not to excite ſurpriſe that ſome advancement was made in this branch of the art. For our own part, we are not impreſſed with any very high opinion of the talents evinced in depicting theſe pleaſing objects, at leaſt by ſome of the artiſts thus employed. With ſuch inducements for the exertion of genius, and with the reward and credit naturally attached to their productions, they ought certainly to have ſucceeded better. But though the arts derived no very material advancement from their attention to this ſubject, to the cauſe of ſcience their aſſiduities were productive of infinite benefit. The cultivation of exotic plants, which about that time began to be held in proper eſtimation, afforded an ample field to thoſe artiſts whoſe labours were dedicated to the taſk of pourtraying theſe pleaſing objects. Their great forte prevailed in painting flowers, and though inſects offered ſo many charms of attraction, they appear at firſt to have been only introduced occaſionally, and as ſecondary objects, to their pictures. Theſe embelliſhments were attended with ſucceſs in proportion to their fidelity, force, and truth. In a ſtate of nature theſe lively creatures are conſtantly ſeen ſporting about the unfolding bloſſoms of the vegetable creation in ſearch of their nectareous ſuſtenance, and their introduction could not fail to infuſe a ſpirit of ideal animation into their beſt performances. Hence it ſeems, that inſects were afterwards repreſented in their compoſitions with a leſs ſparing hand; and, in the courſe of time, became with many artiſts the principal, inſtead of ſecondary object of imitation. Thus alſo, from caſual obſervers, thoſe artiſts were progreſſively led to a more intimate acquaintance with theſe creatures, and to an inquiry into their hiſtory, the novelty of which may be perceived to have amply gratified their curioſity, and rewarded their application. Their example fortunately inſpired a congenial taſte among their patrons, and hence, in the ſpace of a few years, a new and more propitious era ſeemed to dawn upon the ſcience of inſects. The ſtudy was by this means promoted, and rendered an object of attention among the higher orders connected with the moſt enlightened courts of Europe; as for inſtance, that of France, the imperial court of Germany, and thoſe of the princes of the empire.

An obſervation of the celebrated Juſſieu in the beginning of the laſt century is altogether applicable to this inveſtigation. "The arts and ſciences," ſays this writer, "owe their perfection to circumſtances which may appear the effect of chance," and the truth of this remark is completely verified in this particular inſtance; for, it muſt be recollected that the art of embroidery, a mechanical proceſs, and which in our days is ſuperſeded by the more dignified production of the pencil, is that which called forth the talents of the painter to the delineation of natural objects in the age adverted to. It was to the improvement of embroidery that his merits were at firſt ſubſervient; or at all events to a peculiar train of circumſtances ariſing originally from this cauſe, that we are to aſcribe the progreſs made in this branch of the profeſſion, from the cloſe of the ſixteenth till the middle of the ſucceeding century. About the reign of Henry IV. and Lewis XIII. of France, embroidery was in the zenith of faſhion, for the decoration of magnificent furniture, and drawings of the moſt beautiful plants were made expreſsly for the embroiderer's imitation. The obligation which botany lies under to this cauſe is well known, and that of entomology during the ſame period, if attentively conſidered, will be found no leſs conſpicuous.

The painters eminent for their abilities in this line, were Hoefnagle, Robert, Aubriet, De Bry, Vallet, and Robin. There were others to whom we ſhall advert more particularly afterwards. In order to demonſtrate the benefit which botany derived from the labours of ſuch artiſts, it need only be mentioned, that the celebrated Tournefort founded and arranged his ſyſtem of plants upon the drawings made by Robert and Aubriet for the royal library of France. The other artiſts alluded to were ſtill more converſant with the ſcience of inſects than the former, and the labours of their pen have contributed, in uniſon with their pencil, to promote this ſpecies of knowledge. Some eſpecially were very ſucceſsful in this reſpect.

Merian, Admiral, Schwertz, and Goedart, and alſo our own countryman Albin, were among the number of thoſe moſt eminent for their acquaintance with the hiſtory of inſects; and, were this liſt to be augmented with the names of other artiſts of ſomewhat later date, who have likewiſe diſtinguiſhed themſelves in the ſame manner, the reſult would teſtify that entomology, like many other branches of natural hiſtory, is greatly indebted for its advancement to this claſs of authors. It is from the works of the artiſt, or of thoſe who by their application have rendered themſelves competent to delineate the objects they deſcribe, that the moſt valuable information has been obtained. The works of Röſel will ſufficiently teſtify the truth of this obſervation, but were any other confirmation neceſſary, we would advert to Lyonet who, though not an artiſt by profeſſion, felt proudly conſcious of his ſuperiority as a naturaliſt, becauſe from perſeverance he had acquired the talents of an artiſt. Are they not the imitative labours of this claſs that furniſh ample materials for the productions of thoſe who are mere deſcribers: writers, who oftentimes like hornets enter the hives of induſtry, and plunder without moleſtation?

The work of Hoefnagle, a thin volume in 4to. was publiſhed in 1630, under the title of "Diverſæ Inſectorum volatilium icones ad vivum depictæ per D. J. Hoefnagle, typiſque mandatæ a Nicolao Joannis Viſcher."

The plates altogether contain figures to the amount of three hundred and twenty-ſix. The execution of theſe acquired the artiſt no ſmall ſhare of celebrity, yet it muſt be acknowledged that they are not invariably deſerving of approbation; ſome at leaſt are very indifferent. Hoefnagle does not adopt any particular mode of arrangement, and he contented himſelf with repreſenting the inſects in the ſtates in which chance preſented them, without always following them through their progreſſive changes.

Only four years elapſed after this volume of Hoefnagle's plates were brought forward, before another production of infinitely greater conſequence as a work of ſcience appeared in our own capital, namely, the entomological work of Thomas Moufet. This, as it profeſſes to be, is an improvement on the work of Dr. Wotton, begun in the year 1550, about five years before his death: it was continued by Conrad Geſner, was afterwards enriched, as it is expreſſed by Thomas Penny, and at length aſſumed the improved form in which it was publiſhed in 1634, from the hands of Moufet. This laſt mentioned editor reviſed the order of its arrangement, corrected and enlarged the deſcriptive matter, and embelliſhed its pages with nearly five hundred wood-cuts, the greater portion of which, though rudely executed, are not deſtitute of merit. The work is intitled "Inſectorum ſive minimorum animalium theatrum: olim ab Edoardo Wottono, Conrado Geſnero, Thomaque Pennio inchoatum; tandem Tho. Moufet Londinâtis operâ ſumptibuſque; maximis concinnatum auctum, perfectum: et ad vivum expreſſis iconibus ſupra quingentis illuſtratum." This author divides his work into two parts, the firſt containing twenty-nine chapters, the latter forty-two, under which he reſpectively deſcribes the ſeveral tribes of inſects, known among the early writers by the names of veſpis, muſcis, papilionibus, cicindela, blattis, cantharide, bupreſti, meloe, &c. terms familiarized to the Linnæan ſcholar, but which are not always applied by Linnæus to the particular tribes of inſects, deſignated by theſe names in the work of Moufet and his predeceſſors: a fault we truſt to ſee one day amended.

Hollar gained conſiderable reputation by his iconical work, "Muſcarum, Scarabeorum Vermiumque variæ figuræ et formæ omnes primo ad vivum coloribus depictæ et ex collectione Arundeliana," &c. publiſhed at Antwerp in the year 1646. The drawings were preſerved in the Arundel cabinet; the plates are etchings in the uſual ſtyle of its author.

About an hundred and fifty pages of the extenſive work of J. Jonſton, "Hiſtoria Naturalis." is devoted to the ſubject of inſects, which tribes he diſtributes into four books, the firſt of which treats on terreſtrial inſects provided with legs and wings, the ſecond of terreſtrial inſects which have feet and no wings, the third of the terreſtrial apodal order, and the fourth of aquatic inſects. Theſe are illuſtrated by twenty-eight plates engraved on copper by the author, who was doctor in medicine.

Few authors are condemned with more critical ſeverity than Jonſton; his work is certainly a compilation, and as it has been ſtated, his materials are moſtly taken from the works of Aldrovandus, Moufet, and others. Forſkal denominates him a perſevering compiler, and at the ſame time obſerves that he has not added a ſingle remark to what was before diſcovered. Theſe obſervations appear in the "Amœnitates Academicæ," in which there is alſo another paper by Bladh, where we find the ſame ſentiments repeated. The opinion thus expreſſed is known to have the ſanction of Linnæus. This deficiency in the arts, to which he aſpired, is warmly cenſured by Lyonet, who declares his butterflies to be of unſufferable deformity, and in form, or outline, to be conſtantly alike in all the figures. As an artiſt, nevertheleſs, he had his admirers: if we can place any reliance on the truth of his biographers, he was not deſtitute of ability. Moncoyns ſays, he ſaw in the hand of Mr. Platern of Baſil a ſet of drawings executed by him with tolerable accuracy. And Leſſer himſelf owns that many years ago he was ſhewn others very prettily painted by him on blue paper, in the poſſeſſion of a nobleman belonging to the houſehold of one of the kings of Poland.

The work of Jonſton, which is in folio, and dated 1657, was publiſhed at Amſterdam. In the year following, we meet with an Engliſh tranſlation of Moufet's work, printed by Topſal, chaplain of St. Botolph's, in London. Nearly about the ſame time the work of Goedart, a Flemiſh painter, made its appearance in Holland in the language of that country. The laſt mentioned production deſerves more explicit mention, for we think its merits have never been very candidly eſtimated,

eſtimated. The engravings are deſcribed as of miſerable execution, and the figures ſo indifferent in point of reſemblance to the objects intended, that they could only in particular inſtances be underſtood; and again, on the contrary, the details are repreſented as ſo defective, that unleſs accompanied by his valuable plates, they would be uſeleſs. So much is advanced by his various annotators, and yet with all theſe imperfections, thoſe individuals have condeſcended at different times to favour the world with tranſlations of his work, originally written in Dutch, into the Latin, French, German, and Engliſh; and with various editions of the plates alſo. The truth is, that Goedart was a painter; the mere deſcribers, from unworthy motives, were offended that he ſhould preſume to write, while they profeſſed to be enraptured with his talents in the arts; and the artiſts denied him praiſe becauſe they conſidered him as a naturaliſt, not a painter. Were this work of Goedart the production of our days, it would be undeſerving of comment; but let us conſider the period in which it was produced, and abating our expectation of excellence in thoſe times either in the accuracy of obſervation, the hiſtory of inſects, the ſtyle of language, or correctneſs of deſign; and we muſt acknowledge it in every reſpect as a valuable performance. The beſt of his annotators, even the ingenious Liſter, to whom the original work was certainly under moſt obligation, has committed ſeveral errors in endeavouring to correct him.

For the ſpace of about twenty years Goedart devoted great attention to the ſtudy of inſects. He followed them through their progreſſive changes with great preciſion: this renders his book more extenſively acceptable, and his figures, which have never been ſurpaſſed by his predeceſſors, are for the moſt part ſo far correct as to be underſtood. The Dutch edition of Goedart's work being ſoon ſold off, the firſt volume of a Latin tranſlation, by Dr. Mey, miniſter of Middleburgh, was brought forward under the title of “Metamorphoſes et Hiſtoria Naturalis Inſectorum,” in the year 1662; and a ſecond volume alſo, in the ſame language, tranſlated by M. P. Veezaerdt, miniſter in Zealand, who added thereto ſome remarks of his own. Another tranſlation of this latter part was afterwards publiſhed by Dr. Mey, with a farther addition of notes. Liſter allows thoſe annotators no credit for their labours; Goedart, he obſerves, left his writings in Dutch; “His Latin interpreters,” ſays he, “have added comments indeed, but were men wholly ignorant in natural hiſtory, and their comments are mere rhapſodies, and altogether impertinent to the explication of any one hiſtory of Goedartius.” Dr. Liſter re-arranged and corrected this work, and added at the ſame time many curious obſervations.

A hiſtory of animals and minerals, in the courſe of which the ſubject of inſects is noticed at ſome length, appeared in London in 1661, under the title of “Πανζωορυκτολογια.”

The invention of the microſcope opened to the curious a new opportunity of penetrating into the myſteries of nature, and diſcriminating with accuracy the moſt delicate organs of the minor tribes of animals, which from their minuteneſs had evaded obſervation before, and among theſe the inſect race alone conſtituted ſuch a vaſt proportion, that we may attribute to this cauſe that ſpirit and perſeverance with which the ſtudy of theſe minute bodies was purſued about this particular period, and for the ſpace of ſome years after. The era of this invention is aſcribed to the year 1680, and although this does not appear to be ſtrictly accurate, ſince an apparatus correſponding with it was in uſe at the earlier date of 1618, and that glaſſes poſſeſſing the power of enlarging the appearance of objects very conſiderably were known among the ancients; yet, upon the whole, it may be concluded, that what is now underſtood by the microſcopical inſtrument, received ſo much improvement about the time firſt mentioned, that, in qualified terms, we muſt date its invention from that period. The diſcoveries made by the aſſiſtance of the microſcope within a few years after this time renders it a memorable epoch in the ſcience of natural hiſtory, and ſo far as relates to inſects, it is probably owing to the introduction of this valuable inſtrument into general uſe, that the names of Hooke, Power, Pierre Borel, Bonomo, Antoine Van Leuwenhöek, Joblot, and Hartſoeker (the latter of whom detected the circulation of the fluids in inſects); and many other inquiſitive individuals appear in the liſt of entomological phyſiologiſts, or anatomiſts.

The work of Power is in quarto, and was printed in 1664; this relates ſlightly to inſects as objects of microſcopical inveſtigation. Hooke's “Micrographia” appeared the year after, and treats of inſects in the ſame view. In the memoirs of the French Academy of Sciences in Paris, for 1666, there are ſome entomological obſervations by Mignot de la Voye; and in the fifth volume of the Philoſophical Tranſactions a paper relating to “inſects lodging themſelves in willows,” by King and Willughby. But the letters of Liſter, which alſo appeared about the ſame time, or within the courſe of five or ſix years after, are ſtill more valuable; among theſe are “letters concerning a fly that is viviparous, and concerning an inſect feeding on henbain.” “A conſiderable accompt touching vegetable excreſcencies;” “Letters about muſk-ſcented inſects, vegetable excreſcencies, and ichneumon-worms;” “A Letter containing the projection of the threads of Spiders, and Bees breeding in caſes made of leaves, a viviparous fly, &c.”

A ſmall number of the inſects indigenous to Britain is deſcribed by Chriſtopher Merret, in his “Pinax rerum naturalium Britannicarum,” &c. publiſhed at London in the year 1667.

An account of the tarantula engaged the pen of Wolferdas Sanguerdius (a medical profeſſor) about the middle of this century; his work, entitled “Tractatus phyſicus de Tarantula,” appeared in the year 1668; it is a ſmall duodecimo of ſeventy pages, and was printed at Lyons. The general work of an Engliſh entomologiſt, Charleton, was the ſame year publiſhed in London, under the title of “Onomaſticon Zoicon, pluriorumque animalium differentias et nomina propria pluribus linguis exponens,” in which we have a ſyſtematic arrangement of inſects after the manner of Aldrovandus. There is a mantiſſa of this work printed in folio in Oxford, in 1677.

Another work on entomology, a treatiſe profeſſedly elementary, was publiſhed at Leipſic, the year after the firſt part of Charleton's work appeared. It is in quarto, and is entitled “Diſſertatio de Inſectis in Genere,” &c. Jacob Wolff, profeſſor of medicine at Jena, was the author.

Redi's “Experimenta circa Generationem Inſectorum,” for the time in which it appears (1671), is an intereſting little book. Its author combats the doctrine of equivocal generation, maintained among the ancient philoſophers; and deduces its fallacy from a variety of experiments and obſervations of great critical accuracy; in the courſe of which he demonſtrates that every living creature is produced from an egg. The ſame work contains about thirty figures of the lice peculiar to particular birds, ſuch as the pigeon, ſwan, pie, heron, &c. The ſame writer alſo publiſhed his work on the generation of inſects in his native language, “Eſperienze in torno alla Generazione degl' Inſetti,” 1688. There are ſeveral uſeful tracts by Redi on natural hiſtory; but the above-mentioned is that which principally relates to entomology.

Another curious work, "Experienze intorno alla Generazione dellé Zanzare," a ſmall tract of about twenty pages, and embelliſhed with one plate, was publiſhed in 1679. It is entirely confined, as the title implies, to the common gnat (culex pipiens), and is written by F. P. Sangallo.

A writer, whoſe celebrity for his anatomical knowledge of inſects can never be eraſed, while the ſcience itſelf continues to be reſpected, is the next in order for our conſideration: this is the indefatigable Swammerdam. One of the moſt important works of this acute obſerver of nature, his general hiſtory of inſects, bears date 1669. We allude to the firſt edition printed at Utrecht, in the Dutch language, under a Latin title, "Hiſtoria Inſectorum Generalis; ofte algemeenver handeling van de bloedeloose Dierkens." Of this work it has been well obſerved by a German critic, that it has no other fault than that of being written in a language not generally known. The work, in this original ſtate, is in the quarto form, compriſing rather more than two hundred pages, and is illuſtrated by figures contained in thirteen copper-plate engravings.

Some years paſſed away before the excellence of this work, the admiration of the learned in later times, was in any manner acknowledged; and the fate of Swammerdam, a man who, in the generoſity of his mind, had exhauſted the greater portion of his life in the completion of a work, ſo wiſely calculated to enlarge the boundaries of human knowledge, affords another and very ſtriking inſtance of genuine worth neglected:—another example of that culpable ſpirit of ingratitude which living merit ſo rarely fails to experience, in reward for the moſt ſplendid ſervices their talents confer upon an illiberal world!—Chilling thought! that gloomy reflection which oftentimes ſuppreſſes the bright, the enviable, but too fatal exertions of genius, and ſhrouds the mind in apathy and indifference! No ſooner was the death of Swammerdam announced, than his merits were diſcovered; and an anonymous tranſlator rendered his book into French. Almoſt immediately after, another appeared in Latin; and after ſome time, another in Engliſh: all which contributed, but too late, to the author's fame. He died in 1680. The firſt French tranſlation is dated 1682, and, like the original, is in quarto, and embelliſhed with plates. The Latin tranſlation correſponds with the two preceding, except that Hennius, in a ſecond edition of the Latin copies, enlarged one chapter which treats on the analogy between inſects and other animals and plants. The firſt Latin edition, "Hiſtoria Generalis Inſectorum, Latinam fecit H. C. Henninus," was printed at Lyons in 1685; the augmented copy in 1693, at Utrecht. The Engliſh tranſlation is by Thomas Flloyd, and is printed with the edition of the "Biblia Naturæ," in our own language, publiſhed in London, in 1758.

The latter work of Swammerdam was introduced to the public under very extraordinary circumſtances. Such was the ill ſucceſs of his former writings, that the "Biblia Naturæ," after being prepared in manuſcript for preſs, was left unpubliſhed. No bookſeller would venture to print it at his own riſk; and the means of Swammerdam were inadequate to its production. At the death of the writer, M. Thevenot, his friend, became poſſeſſed of his papers, and with the copy of this among the reſt. With him they remained ſome time, and then paſſed into the hands of Du Verney, an able anatomiſt, who enriched his own cabinet with the manuſcript of this work. With him it lay buried, till the zealous and illuſtrious Boerhaave purchaſed them; and he was no ſooner poſſeſſed of it than he haſtened to communicate this treaſure to the world, and it was accordingly put to preſs in 1736. He included in this publication the former works of the author, and publiſhed the whole under the title of "Biblia Naturæ, ſive Hiſtoria Inſectorum Belgice, cum Verſione Latina H. D. Gaubii, et Vita Auctoris per H. Boerhaave." This work is in folio: the firſt volume, conſiſting of five hundred and fifty pages, appeared in 1737; and the ſecond volume, of much greater bulk, and with many plates, in the year following.

The ſyſtem propoſed by the author of this work, for the arrangement of inſects, differs ſo materially from that given by any preceding author, that we cannot avoid conſidering it immediately relevant to our preſent ſubject. The general or principal claſſes into which inſects are divided in his ſyſtem amount to four; and the characters of theſe relate to the metamorphoſes the inſects undergo, rather than to their appearance in the perfect ſtate, the firſt claſs excepted.

The firſt of theſe four claſſes comprehends thoſe ſubject to no change of form, but which quit the egg in the ſame ſtate and appearance they are to retain during life. This claſs includes ſpiders, oniſci, &c.; and muſt be therefore underſtood as admitting of an increaſe in bulk, though not undergoing any change in form.

The ſecond claſs includes thoſe which, after leaving the egg, appear under the form of an inſect without wings, the other members formed; in which ſtate it eats and grows, till, having paſſed into the ſecond or nymph ſtate, it iſſues from thence with wings, and is in a condition capable of propagating its kind. The locuſts and dragon-flies are included by its author in this claſs.

In the third claſs, the animal, after having iſſued from the egg, where it remained in a diſguiſed ſtate, and without food, appears under that of an inſect which eats and grows, while the members of the animal into which it is to be converted are formed under the ſkin, and which it at laſt quits, and becomes a nymph or chryſalis (of the dormant kind). This claſs includes moths and butterflies, &c.

The fourth claſs conſiſts of thoſe which, having arrived at the nymph ſtate, like thoſe before mentioned, do not diveſt themſelves of the ſkin, in order to enter into that ſtate, but aſſume the form of the nymph under its ſkin, where it continues ſhut up, till, quitting two ſkins at once, it comes forth in the perfect ſtate. The inſects of this claſs, according to its writer, are exemplified in the ichneumon.

There are ſome few ſmall tracts publiſhed by this author during his life, neither of which is of material conſequence, except that on the natural hiſtory and anatomy of the ephemera horaria, "Ephemeri Vita, of afbeeldingh van 's menſchen leven, vertoont in de Hiſtorie van het uligent ende een-daghlevent Haft of Oever-aas," a work in octavo, printed at Amſterdam in 1675. Immediately after the author's deceaſe, namely in 1681, there were no leſs than two tranſlations of this work; one in quarto, in Engliſh, and printed at London; the other by M. Thevenot, at Paris.

No work materially important on the ſubject of entomology appeared after the firſt edition of the work of Swammerdam, till the years 1678 and 1679, in which Liſter publiſhed his valuable hiſtory of Engliſh ſpiders, and Madame Merian her extenſive work on the metamorphoſes of lepidopterous inſects. In the interval between there were ſeveral publications, which, though not of the moſt valuable kind, are ſufficiently intereſting to claim remark. Claude Perrault, one of the ableſt writers on exotic inſects of his age, and author of ſeveral papers in the Memoirs of the French Academy, produced a work in folio at Paris, in 1671, which treats on inſects, under the title of "Memoirs pour ſervir à l'Hiſtoire naturelle des Animaux;" and to this ſome additions were made in 1676. The work of Ferrand of Naples alſo relates to inſects, among other animals; and this appeared in 1672. The year after Frenzelio ſubmitted his "Inſecta novifolii cum nive delapſa;" and at Franckfort on the Main, D. W. Mollerus brought forward his "Meditatio de Inſectis quibuſdam Hungaricis prodigioſis anno proxime præterito, ex aëre una cum nive in agros delapſis," an uſeful treatiſe of 120 pages, with two wood cuts. In 1675, George Berelio printed at Upſal his elementary tract, περὶ τῶν ἐντόμων. The ſame year alſo, Samuel Bochart publiſhed his "Hierozoicon, ſive bipartitum Opus de Animalibus ſanctæ Scripturæ." Müller, in 1676, gave an orationary paper on the tarantula ſpider, "Diſſertatio de Tarantula;" and Hermannus Grube, a curious little octavo volume on the ſame ſubject, "De Tarantula, et vi Muſices in ejus curatione, conjecturæ phyſico-medicæ.

Dr. Liſter diſtinguiſhed himſelf in the annals of entomology about this period. Previous to the publication of his "Hiſtoria Animalium Angliæ Tractatus de Araneis," ſeveral papers by this author appeared in the Philoſophical Tranſactions, the principal of which relate to this tribe of creatures; ſuch as his obſervations on the darting of ſpiders, in the fourth and fifth volume; his paper entitled, "Some Inquiries concerning Spiders;" and his "Tabulæ compendiariæ Araneorum Angliæ," in the ſixth volume. Liſter's work on ſpiders, before mentioned, relates chiefly to thoſe indigenous in England, and are arranged and deſignated by conciſe ſpecific characters with much ſcience, correſponding with that adopted afterwards by Linnæus. This is in quarto, and was printed at London in 1678; the appendix, "De Araneis addenda et emendanda," &c. in 1681. There is a tranſlation of this work in the German language, by F. W. H. Martini, printed in 1778.

We are in poſſeſſion of the firſt tranſlation of the works of Goedart by Liſter, a book printed at York in 1682, under the following title, "Johannes Godartius of inſects, done into Engliſh and methodized, with the addition of notes; the figures etched upon copper by Mr. F. Pl." The name of Liſter does not appear; but the initials at the cloſe of the addreſs to the reader are M. L.; and in our copy, the letter L is rendered Liſter, in the hand-writing of an entomological collector well known in the earlier part of the laſt century. The latter circumſtance, though not apparently of much moment, is related becauſe the fact might admit of doubt, the work being anonymous, and perhaps forgotten. The impreſſion conſiſted, as the preface acquaints us, but of 150 copies, which were intended only for the curious; and in the courſe of nearly 130 years, it may be naturally concluded many of theſe muſt have been loſt. The notes in this book are very copious. In 1685, an edition of Goedart by Liſter appeared in Latin. The tranſlator in this, as in the former work, diſtributes the materials of Goedart's performances into a new form of arrangement, the merits of which are too obvious not to be conſidered as an improvement on the original production. He divides them altogether into ten ſections; for they are not ſtrictly, in every inſtance, what we might denominate *orders;* in ſome they certainly are. The firſt, ſecond, and third ſections are of the lepidoptera kind, and very clearly diſcriminate the papiliones from the moth tribe.

The 1ſt includes thoſe with erect wings; theſe are the butterflies which fly by day, and the chryſalids of which are angular.

2d. Moths with the wings placed horizontally, and which proceed from the caterpillars called geometræ by Goedart, becauſe of their gait, which is like that of a meaſurer of land.

3d. Moths with deflected wings, or thoſe with hanging wings ſitting cloſer to the body than in either of the two preceding.

4th. Libellulæ, or dragon flies.

5th. Bees.

6th. Beetles.

7th. Graſshoppers.

8th. Dipterous flies.

9th. Millepedes.

10th. Spiders.

Goedart ſpent forty years of his life, as he expreſſes it, "daily converſing with inſects;" and from the courſe of his obſervations, it is manifeſt he was well acquainted with his ſubject. Liſter is nevertheleſs unwilling to concede this point: he neither allows him credit as a naturaliſt or a writer, at the ſame time that he extols his excellent ſkill in limning. Theſe opinions are delivered in a ſtyle of affected ſuperiority over his author, neither becoming, nor ſtrictly true; and ſeem to be dictated ſo nearly in the ſpirit of ſome more modern critics, that one cannot avoid ſmiling at the compariſon. "Goedart," ſays he, "after forty years attention, ſeems to have made little advancement in his ſkill in the nature of inſects: he ſeems rather to have diverted himſelf with them, than to have given himſelf any trouble to underſtand them; and yet after all, you will find him every where very juſt, and true in his obſervations, but in many places very ſhort, and hardly intelligible." Our Engliſh annotator gained no reputation on the continent for theſe general remarks, although the merit of his notes relating to the metamorphoſes of inſects was acknowledged; the works of Goedart ſtill maintained their credit.

Maria Sybilla Merian, vel Gräffinn, the wife of John Andrew Gräffinn, was a native of Franckfort on the Main, and early in life imbibed a taſte for the ſtudy of inſects, from being occupied at times in painting theſe pleaſing objects as embelliſhments to her flower-pieces. The taſk of painting inſects was performed by this fair artiſt with no very faſtidious ſhare of accuracy. In point of drawing ſhe rarely excels; and her productions, though ſplendid memorials of her talents, and the great encouragement ſhe obtained, are marked by a peculiar exuberance of ſtyle incompatible with any faithful reſemblance of nature. Her firſt work was publiſhed in 1679, and relates to European inſects, chiefly thoſe of the lepidopterous order, with their changes, and is entitled "Der Raupen wunderbare verwandeleng, und ſonderbare blumen-nahrung:" another part appeared in 1683. Theſe were publiſhed at Nuremberg. In 1718, another work by the ſame authoreſs was publiſhed at Amſterdam, called "Erucarum ortus, Alimentum et Paradoxa Metamorphoſis." After this we have an hiſtory of the European inſects, rendered from the Dutch text of Madame Merian into French, with an augmentation of the deſcription of the plants by J. Marret, a work printed in folio at Amſterdam, in 1730. But the beſt of all her publications came out at the Hague in 1726, in a folio of ſuperior ſize, with the title "De Generatione et Metamorphoſibus Inſectorum Surinamenſium," &c.; the materials for which were collected by herſelf, or under her own inſpection in Surinam. This lady had made a voyage from Holland to South America in 1699, for the avowed purpoſe of forming a collection of natural curioſities for this work, and was occupied at Surinam during the ſpace of two years in taking drawings and deſcriptions of various objects for this purpoſe. This work is not entirely devoted to entomology, as, beſides inſects, it contains a miſcellaneous ſineous aſſemblage of toads, lizards, ſerpents, and other reptiles, and likewiſe a pretty extenſive number of plants.

In the Philoſophical Tranſactions are to be found ſome obſervations concerning inſects, made in Virginia in 1680, with remarks by J. Petiver. Hoppio, in 1682, publiſhed at Jena a diſſertation on the gryllus migratorius. Two years after, another ſmall tract appeared alſo at Jena, a paper on ants, "Reſpublica Formicarum," by A. Schmidt.

The fifteenth volume of the Philoſophical Tranſactions affords an account of the "Connough-worm," by Wm. Molyneux, a paper afterwards tranſlated into Latin, and inſerted in one of the continental journals under the title of "Obſervatio de Inſecto Hibernico vocato Connough-worm." Some few entomological obſervations of a miſcellaneous nature, extracted from the manuſcript hiſtory of Pembrokeſhire by George Owen of Henllys, lord of Kemmes, occurs in the eighteenth volume of the ſame Tranſactions. The original MS. of this hiſtory we have ſeen in the Britiſh Muſeum. Beſides the above, the Tranſactions about the ſame time contain ſeveral intereſting papers relative to inſects; as Allen's account of the gall-bee, and the death-watch, in vol. 20. "A Letter concerning an Inſect commonly called the Death-watch," vol. 22. which reſpects both ptinus pulſator, and hemerobius pulſatorius, written by William Durham; and alſo a ſupplement to an account of pediculus pulſatorius or death-watch, in vol. 24.

But, in point of priority, we ought previouſly to have mentioned the earlier works of Leeuwenhoek, a writer whoſe aſtoniſhing aſſiduity, aided by means of powerful microſcopes, has contributed more than any other man, except Swammerdam, to diſcloſe to our view the wonders of the inviſible creation, in the ſphere of which the minima of the inſect race become of the firſt conſideration. One of the firſt papers of this intelligent obſerver appears in the eighth volume of the Philoſophical Tranſactions, and is entitled "A Specimen of ſome Obſervations made by a Microſcope contrived by M. Leeuwenhoek." His communications to the world after this became numerous; and, as the object of his purſuit was of a nature to ſtimulate a ſpirit of inveſtigation, it could ſcarcely at the ſame time fail to excite controverſy. It led, therefore, to the production of many papers by different writers, all which tended, in ſome degree, to the further elucidation of the ſubject. As theſe, however, are only in part connected with entomology, it would be fruitleſs for us to follow, through the varied branches of diſcuſſion, and to ſelect thoſe particular paſſages which relate to our preſent inquiry; for theſe we refer the curious reader to Tranſactions of the Royal Society, from the eighth to the thirty-ſecond volume; and to various publications printed at Leyden and Delft in 1686, 1693, 1697, 1704, &c. Among the principal works of Leeuwenhoek, are "Anatomia, ſeu interiora rerum, cum animatarum tum inanimatarum (ſic) ope et beneficio exquiſitiſſimorum microſcopiorum detecta," 1687; "Arcana naturæ detecta," 1695; and "Opera omnia," 1722; an Engliſh edition of the ſelect works of this author was undertaken in London in 1798.

Geyerus, in 1687, was author of a medical tract in quarto printed at Leipſic and Frankfort, called "Tractatus phyſico-medicus de cantharidibus," and which, as the title implies, relates to the medicinal properties of thoſe well known inſects, the cantharides. Bononius, in the ſame year, publiſhed a letter at Florence, in which he enters on an extenſive detail of his obſervations on many inſects, with the microſcope, and lays claim to ſeveral diſcoveries. And J. F. Griendel, Von Ach, canon of the order of the Holy Ghoſt, produced his "Micrographia nova" at Nuremberg alſo at this time; a quarto volume of ſixty-four pages, ſome of which are dedicated to his microſcopical obſervations on inſects.

The work of Stephen Blankaart of Amſterdam made its appearance in 1688. Its author, a Dutch phyſician, was an aſſiduous collector, and in this inſtance produced a work, the plates of which have been as much admired for the beauty of their execution as the work in other reſpects has been condemned. Friſch, and after him Lyonet, conſider it as an indifferent production. It relates chiefly to the larva of different inſects, as the caterpillars of ſeventeen lepidopterous inſects, twelve maggots of flies, and a few other inſects, amounting altogether to forty-ſeven ſubjects. The title is, "Schou Berg der Rupſen, Wormer, Maden en vliegende Dierkens daar uit voort-kommende." The paper of John de Muralto, and alſo that of C. Mentzelius, relating to different inſects, appeared about this period; and the work of John Cyprien, "Hiſtoriæ Animalium," was alſo printed in 1688; it was publiſhed at Frankfort, and relates to inſects among other animals. A ſmall tract, an orationary paper of eight pages, with a ſingle plate, entitled "Chymica Formicarum," is from the pen of profeſſor Sperling in 1689. Koenig's "Regnum Animale," &c. printed in 1690; Bilberg's "Locuſtæ," a diſſertation, printed at Upſal in 1690; and "Hiſtoria Vermium" by Jungius, printed at Hamburgh in 1691, are all intereſting, and a paper by Sedileau, publiſhed in 1692 in the Memoirs of the French Academy, is rather curious; this latter is denominated "Obſervations ſur l'origine d'un eſpece de Papillon," and the inſect treated upon is bombyx pavonia γ major. The prodigious ravages occaſioned by the ſwarms of locuſts which, in the month of Auguſt 1693, over-ran Germany, and extended their ſcattered legions throughout the reſt of Europe, even to the borders of the moſt northern countries, were an event of ſuch an afflicting nature, that it could not fail to engage the obſervations of many writers, in the number of which we meet with the names of ſome naturaliſts of ability, whoſe diſſertations on this occaſion are acceptable. Treunero, Hebenſtreit, Woollenhaupt, Crellius, Kirkmajor, and Ludolfus, wrote at this time on the ſubject, relating the particulars of their appearance, the devaſtations committed, and the moſt effectual means of deſtroying them. The ſpecies was the common migratory kind, gryllus migratorius. Theſe tracts were generally trifling in point of ſize, that of Hebenſtreit, however, "De Locuſtis immenſo agmine aërum noſtrum implentibus, et quid portendere putentur," conſiſts of 65 pages and one plate, and that of Ludolphus, entitled "Diſſertatio de Locuſtis, anno præterito immenſa copia in Germania viſis, cum diatriba, qua ſententia autoris de שלוים defenditur," is a folio of eighty-eight pages, and embelliſhed with figures.

Albino publiſhed a ſmall tract on the cantharides in 1694, and the following year "Jacobi Petiveri Muſæum," a ſmall octavo, was publiſhed in London. Theſe, with the elementary work of Jacobæus, "Diſſertatio de vermibus et inſectis," and that of Baglivus, printed at Rome in 1696, on the effects of the bite of the tarantula, and a paper of Homberg on the libellula virgo in the Memoirs of the French Academy for 1699, appear to be the only publications deſerving of mention till the commencement of the eighteenth century.

The earlier part of the eighteenth century forms an era in which the ſcience of entomology was cultivated with the happieſt ſucceſs. It is with ſome pride alſo, we obſerve, that even in the comparatively improved ſtate to which the ſcience had then attained, it derived no inconſiderable

ſiderable advancement through the labours of our own countrymen. The works of Ray and Liſter, with thoſe of Petiver in England, and thoſe of the indefatigable Reaumur in France, contributed eſſentially to this purpoſe, and to the preſent day ſerve in ſome meaſure to maintain the reputation of ſcience. The works of thoſe authors were ſucceeded within the firſt fifty or ſixty years by other works of high conſideration, as will be found hereafter. In the interval of time that elapſed between the publications of thoſe more extenſive and valuable works, others of leſs importance, but which yet deſerve mention, made their appearance; as, for inſtance, in 1701 the ſmall, but curious diſſertation of Heucherus, called "Araneum homini pernicioſum et ſalutarem;" the little treatiſe by Vallerio of Upſal on the tarantula, publiſhed the year after; the entomological part of the work of G. B. Rumphius, in 1705, and that of Ruiſch, "Theatrum univerſale omnium animalium," publiſhed in 1710—1718. Henninger produced a ſmall medical tract relating to millepedes, in 1711. Wedelio on an old ſubject, the utility of the cantharides, in the Materia Medica, at Jena, in 1717; and Whitaker, the year following, on the ſame inſect: the remarks of J. Pontedera, "De Cicada," &c. annexed to his botanical work; and two tracts by Laurentius Roberg, medical profeſſor at Upſal, "Formicarum Natura," and "Libella inſecta."

It was in the year 1702 that Petiver produced the firſt decade of his "Gazophylacium naturæ et artis," the publication of which was carried on progreſſively till for about ten years after, during which period the work was extended to ten decades, each containing plates excluſive of the "claſſical and topical catalogues." This work relates to inſects among other animals, plants, and foſſils. About twelve months before the author's death, which happened in 1718, there was, however, another work printed by him under the title of "Papilionum Britanniæ Icones," &c. and which, as the title expreſſes, relates to the Engliſh butterflies, and is entirely confined to entomology.

A work by Ray, appropriated to this branch of ſcience, was publiſhed in 1705, under the title of "Methodus Inſectorum, ſeu in methodum aliqualem digeſta," and which can be conſidered only as the introduction or prelude to the great work, "Hiſtoria Inſectorum," which the world received in 1710, through the care of Dr. Derham; for Ray did not live to ſee it publiſhed.

This celebrated naturaliſt divides all inſects into two principal claſſes, thoſe which undergo transformation in their form, and ſuch as do not paſs through any tranformation after being produced in the firſt inſtance. Each of the two principal claſſes are ſub-divided into ſeveral orders, which are variouſly characterized, as by the number of the feet, or by being deſtitute of thoſe limbs. Some are determined by the habitation of the inſects; by the ſize or conformation of various parts of the body; by the odour they emit; the form of the caterpillars, and various other peculiarities. This arrangement is in part conformable with the writer preceding; the intranſmutablia, or order of thoſe which do not paſs through any metamorphoſes, is due to Willughby; and the three orders of changeable inſects correſpond with the 12th, 13th, and 14th orders of Swammerdam's claſſification. His claſs of changeable inſects is divided into ſeveral families, as vaginipennes, from having the wings covered with a ſheath, papiliones, quadripennes, bipennes, &c. There is an appendix to this work by Liſter, "Appendix de Scarabæis Britannicis," &c. Ray, like many other writers, includes certain tribes of the vermes with inſects, from which they are ſeparated by Linnæus; it is poſſible that Ray might conceive what has been ſince proved by indubitable authority, that ſome few, at leaſt, of the ſuppoſed vermes are no other than the larvæ of inſects.

The work of Albin, for the time in which it was executed, was conſidered as an elegant publication; it is in one volume quarto, containing one hundred copper plates, with a brief deſcription of the objects repreſented in each, and was originally ſold at four guineas a copy, a great price in thoſe times, being publiſhed in the year 1720. If we miſtake not, another edition is dated a few years later; there is certainly one printed with notes and obſervations by Dr. Derham, in 1749. Albin was author of a work on Engliſh ſpiders, in which the lice of ſeveral animals and birds are repreſented from the plates of Redi.

At the ſame time that Albin was engaged in the preparation of the above-mentioned work in England, J. L. Friſch, rector of the Royal Academy at Berlin, was occupied on his hiſtory of the inſects of Germany, "Beſchreibung von Inſecten in Deuſchland," the firſt part of which appeared in 1720; the whole work conſiſts of thirteen parts, and each part is embelliſhed with three plates. Copies of this work have been printed ſince that time; the lateſt we have ſeen bears date 1766.

Valiſinieri, in his work, entitled "Eſperienze et Oſſervazioni intorno agli inſetti," publiſhed in 1730, diſtributes all inſects into four claſſes, according to the different places in which they are found. The firſt comprehends thoſe inſects which live on plants; the ſecond, ſuch as live in water and other fluids; the third, thoſe that live in the earth, or among ſtony ſubſtances; and the fourth, thoſe which ſubſiſt on the other animals, or in their bodies.

Reaumur produced the firſt volume of his "Memoirs pour ſervir à l'Hiſtoire des Inſectes," at Paris, in the year 1734. The five ſucceeding volumes appeared between that time and 1742. This voluminous work contains ſome thouſand pages, and nearly two hundred plates; and is one of the beſt productions on the ſubject that has been ſubmitted to the world. There are two editions of this work, one publiſhed in Paris by its author, in quarto ſize; the other is in octavo, a pirated concern by the Dutch bookſellers.

After the works of Ray, Liſter, and Petiver, the intelligent entomologiſts of our own country, in the commencement of this century, the name of Bradley ought perhaps to have been introduced. His publication, "A Philoſophical Account of the Works of Nature," which was printed in London ſo early as the year 1721, contains a brief account of inſects. This author, though a profeſſor of botany in one of the univerſities, ſeems not to have been poſſeſſed of any very extenſive or accurate information on this ſubject of entomology; his work at leaſt abounds in the marvellous, but was, perhaps, for this very reaſon, more likely in his time to have been peruſed with pleaſure by the common reader. As a popular work, it was not in other reſpects without its advantages. The works of Reaumur in France contributed materially to facilitate the ſtudy of entomology on the continent. And about the ſame time that he was engaged in this field of enquiry, ſeveral tracts and papers made their appearance from other individuals. In the memoirs of the French Academy for 1731, there is one entitled "Eſperiences ſur les Scorpions," by Maupertuis; and in 1734, ſome others by Trew, as "Inſectorum quodam genere," "De duabus Erucis," and "Peculiare quoddam Quercus excreſcentiarum genus," all which are inſerted in the "Commerc. Literar." of Nuremberg. Theſe papers immediately preceded the publication of the firſt entomological work which the celebrated Linnæus produced to the world.

The principal writings of Linnæus on this branch of natural ſcience are to be found in his deſervedly eſteemed production the "Syſtema Naturæ, ſive regna tria naturæ ſyſtematice propoſita per claſſes, ordines, genera, et ſpecies;" the firſt edition of which is in folio, and was publiſhed in 1735. Linnæus in this work diſtributes inſects into four orders, according to the number and form or nature of their wings, under the ſeveral names of coleoptera, angioptera, hemiptera, and aptera. The firſt order contains thoſe inſects which have covered wings; the ſecond thoſe with naked wings, as butter-flies, dragon-flies, ephemeræ, &c. In the third, he enumerates crickets, locuſts, bugs, &c.; and in the fourth, thoſe which have limbs, but no wings, as the ſpider, lobſter, &c. Beſides theſe four orders, this primary arrangement of inſects comprehends three other orders of animals, referred ſince to the vermes claſs, but which, at the period of the firſt publication of the "Syſtema," Linnæus conſidered to be genuine inſects. The firſt of theſe includes all creeping "inſects" whoſe body is naked and deſtitute of limbs, as the earth-worm and the leech: the ſecond, both land and ſea-ſhell animals; and the third, thoſe furniſhed with limbs, as the echinus, aſterias, &c.

Linnæus by no means deviated from the received opinion of his time, in placing the firſt and third of theſe laſt mentioned tribes of animals with inſects. Theſe bodies were conſidered as appertaining to the inſect race by moſt of his immediate predeceſſors, and by ſome naturaliſts in earlier times. In a ſubſequent edition of the Linnæan work, theſe orders are ſeparated, and the latter conſtituted into a diſtinct claſs after the manner of Ariſtotle, who points out the natural obvious difference which prevails between theſe two orders of animals with ſo much clearneſs, that we are not without ſome ſurprize his example was overlooked by Linnæus in the firſt inſtance. Linnæus, according to this plan, in his later works, ſeparates the echini, &c. under the denomination of vermes. The inſects alone were then extended by him from four to ſeven orders. This is the arrangement which his claſs "Inſecta" finally aſſumed in the edition of 1767, and which is ſtill adopted by the admirers of Linnæus. The following are the definitions of the ſeveral orders eſtabliſhed by this eminent naturaliſt.

Coleoptera, ſuch as have cruſtaceous elytra, or ſhells, which ſhut together, and form a longitudinal ſuture down the back of the inſect, as in the chafer-beetle. In moſt inſects of this claſs, the elytra cover the abdomen entirely, in others but partially, as in the ear-wig, &c. The word is derived from κολεὸς, *a ſheath*, and πτερὸν, *a wing*.

Hemiptera, which have their upper wings moſt commonly half cruſtaceous, and half membranaceous, not divided by a longitudinal ſuture, but incumbent on each other; as in the water ſcorpion and graſshopper. From ἥμισυ, *half*, and πτερὸν, *a wing*.

Lepidoptera, having four wings covered with fine ſcales in the form of powder or meal; as in the butterfly and moth, from λεπὶς, *a ſcale*, and πτερὸν, *a wing*.

Neuroptera. In this order the wings are membranaceous, tranſparent, and naked, and are generally reticulated with veins or nerves; the tail is without a ſting, as in the libellula or dragon-fly. The term is derived from νεῦρον, *a nerve*, and πτερὸν, *a wing*.

Hynenoptera, have four membranaceous wings, and the tail furniſhed with a ſting for various purpoſes, as in the waſp, ichneumon, &c. From ὑμὴν, *a membrane*, or *pellicle*, and πτερὸν, *a wing*.

Diptera, with two wings only, and poiſers as in the houſe-fly; from δύω, *two*, and πτερὸν, *a wing*.

Aptera, have no wings; as the ſpider, &c. from ἀ, *without*, and πτερὸν, *a wing*.

The great perſpicuity of the Linnæan ſyſtem of entomology aroſe from its author having made choice of the moſt obvious characters which inſects afford for the leading diſtinctions of his orders, ſuch for inſtance as the number, texture, and poſition or folds of the wings, or the abſence of theſe parts; and in the conſtruction of the genera, the like attention being devoted to the form of the head, thorax, and wings; and in particular to the ſtructure of the antennæ: theſe latter being conſpicuous in moſt inſects, and ſo infinitely varied in their appearance as to conſtitute in general a permanent definition. That there are other characters which, in the opinion of later entomologiſts, are better adapted to the purpoſe of claſſification the reader muſt be aware, but theſe, although really preferable in ſome reſpects, are perhaps too minute to become always uſeful. The ſtructure of the various parts of the mouth, the character on which the Fabrician ſyſtem is founded, however definitive, and therefore excellent, requires that degree of attentive ſcrutiny in their examination, which is rarely beſtowed by the ordinary obſerver of nature; and which cannot for this reaſon be ſo well calculated for the general purpoſe of diſcriminating the families of inſects, as thoſe which are at once too obvious to be miſtaken.

The ſimplicity of the arrangement adopted by Linnæus, the celebrity of his name, and the princely patronage under which he wrote, conſpired with other favourable circumſtances to render this ſcience more univerſally cultivated, admired, and reſpected about his time, than it had probably been at any former period. The credit due to this naturaliſt for his labours in entomology is great. This we allow, but, let us alſo remember, that he is not alone entitled to our commendation for the arrangement propoſed in his work. We muſt in candour acknowledge the merits of many among his predeceſſors, who wrote under circumſtances of leſs encouragement, and have neverthelеſs excelled in this ſcience: men to whom the writings of Linnæus ſtand in a very high degree indebted, and without the aid of which it is impoſſible to imagine the ſyſtem, which now commands our admiration, could have been produced, at leaſt in its preſent ſtate of purity.

From the various entomological works extant before the time of Linnæus, it may be collected that the hiſtory of theſe creatures was deeply inveſtigated prior to the appearance of his writings; and even that ſyſtem itſelf, the prominent feature of his labours, from progreſſive advancement, had gradually attained to a ſtate of conſiderable perfection. In the works of Ariſtotle and Pliny, in thoſe of Agricola, Aldrovandus, Frenzius, Moufet, Swammerdam, Ray, Wilughby, Liſter, Valliſnieri, and various others whoſe names have been already repeated, we diſtinctly perceive, with ſome occaſional variation, the outline of the ſuperſtructure raiſed in the "Syſtema Naturæ."

Theſe valuable ſources of information furniſhed him with abundant materials, from which he ſelected with profound judgment, and interwove with ability, induſtry, and ſucceſs. Linnæus was in this reſpect commendable; he did not ſuffer his mind to be ſwerved on this occaſion from any ambitious or innovating motives; and ſo far as he deemed it conſiſtent with his plan, he appears to have adhered to the examples of his predeceſſors. The characters of his ordines are to be found in ſeveral earlier publications than his own, and ſo likewiſe are moſt of his genera, and the far greater number of his ſpecies. But theſe he remoulded throughout with ſo much ſkill, that this "Syſtema" conſtitutes the central point in which the ſcattered rays of natural ſcience are concentrated with more preciſion than they really appear in the original authors, to whoſe induſtry he ſtands indebted. It was in the conciſe and very expreſſive ſtyle which Linnæus adopts in all his works, and which was almoſt peculiar to himſelf, that he excelled.

Our limits are inadequate to the fair diſcuſſion of this important ſubject; and of this we feel ſo deeply ſenſible, that for the preſent we ſhall wave all further comment, reſerving to ourſelves a future opportunity for entering upon a more extenſive view of the merits of the Linnæan ſyſtem, as contraſted with thoſe of other authors who have appeared ſince his time, and which have obtained the ſanction of public approval.

After the firſt edition of the “Syſtema Naturæ,” Linnæus wrote ſeveral papers on the ſubject of entomology; ſome of which are printed in the Tranſactions of the Royal Society of Upſal. One of the earlieſt of theſe appeared in 1739, under the title of “Om Renarus Brömſkulor i Lapland;” and another dated Stockholm, in the ſame year, “Tal om Märkwardighter uti Inſecterne.” In 1746, we find a paper, jointly the production of Linnæus and Degeer, relative to the lantern-fly of China (fulgora candeleria); and about the ſame time, his “Fauna Suecica,” an enlarged and improved edition of which was publiſhed in 1761. That elegant inſect, panorpa coa, a ſcarce ſpecies at that period, forms the ſubject of a ſmall Linnæan paper in 1747. His diſſertations “Miracula Inſectorum,” and “Noxa Inſectorum,” bear the ſame date, 1752: they were both printed at Upſal, and poſſeſs merit: the latter is in particular valuable, from the object in the contemplation of the writer. Six years after this he produced a diſſertation, called “Pandora Inſectorum;” the year after, a paper on the coccus; and in 1761, his “Fundamenta Entomologiæ,” a book in thoſe days of conſiderable value as an elementary work, or introduction to this ſtudy. There is a tranſlation of the tract by W. Curtis, printed at London in 1772. His laſt entomological paper is upon the genus pauſus, a curious coleopterous tribe, diſtinguiſhed by the comparatively enormous magnitude of the antennæ.

The work of L'Admiral, entitled “Naawkeurige Waarneemingen van Geſtaltverwiſſelende gekorwene Diertjes,” appeared in 1740 at Amſterdam. It is in folio, and contains a ſeries of elaborately finiſhed etchings, which, though engraven in a diſſimilar ſtyle, have ſomewhat the air of Merian's work on the inſects of Surinam, or as is diſtinctly copied in the Aurelian of Moſes Harris. The work of L'Admiral is confined to the European inſects, of which it comprehends about fifty ſpecies of the larger kinds, and thoſe principally of the lepidopterous tribe. Theſe are repreſented in a heavy, though not unpleaſing, and often very beautiful manner, in various attitudes, with large branches of the different kinds of plants on which they feed; and in moſt inſtances, the perfect inſect is accompanied on the ſame plate with the larva and pupa. L'Admiral's work began in numbers, and was intended to contain, according to its author, one hundred plates and four hundred pages of letter-preſs. This deſign was never completed. There are few copies with more than twenty-five plates, and about five pages of letter-preſs. Our copy contains thirty-two plates and twenty pages, and is the moſt complete in this reſpect we have ſeen.

A ſmall treatiſe relative to the larvæ of phalænæ, by Detharding, “Diſquiſitio Phyſica Vermium in Norvegia, qui novi viſi,” was publiſhed in quarto in 1742. The ſame year, the tarantula ſpider engaged the attention of Franceſco Serao of Naples, who on this ſubject only has given a quarto of two hundred and ſixty pages, entitled, “Della Tarantola o vero Falargio di Puglia.” The hiſtory of the tarantula about this time engaged the pen of ſeveral curious perſons; and, among others, N. Caputus had the year preceding publiſhed a book nearly the ſame ſize, “De Tarantulæ Anatome et Morſu.”

The work of Leſſer, “Inſecto-theologia,” &c. written in the German language, and better known from the French tranſlation by Lyonet in 1742, entitled “Theologie des Inſectes,” is rather a curious than valuable publication. The ſucceſs of this book in Germany renders it worthy of particular mention. The views of its author, (a clergyman at Nördhauſen,) as he himſelf explains, was to “promote the glory of God.” He does not aſpire to the eſtabliſhment of any new facts relative to entomology: his attention is directed ſolely to the ſelection of ſuch anecdotes and particulars of the hiſtory of inſects, gleaned from other works, as could be rendered a convenient medium for the theological remarks with which his pages abound. The piety of his mind we ſhall not diſtruſt: to an entomologiſt his work is of no material worth; he was not very well acquainted with this ſubject, and his remarks are often erroneous. As a theological production, and in this view the author wiſhed it to be conſidered, certain paſſages in the work of Leſſer may have an uſeful tendency: it is calculated to expoſe ſome glaring errors in the writings of other theologians, who in a ſpirit of fanaticiſm had entered upon the ſame ſubject. One of his beſt chapters on this head is that relating to the “abuſe of inſects in theology;” in which he points out the groſs outrage on reaſon committed by the pagans, in making certain inſects the idols of their worſhip; and remarks how much more abſurd it muſt appear, that the Jews and even Chriſtians ſhould have followed their example: a fact inferred by him from various authorities. The Jews are accuſed of ſtating many wonderful things relative to inſects, which can only be conſidered as fables. Among others, after repeating the ſacred text, 1 Kings, vi. 7. concerning the erection of the temple, which was “built of ſtone made ready before it was brought thither; ſo that neither hammer, nor ax, nor any tool of iron was heard in the houſe, while it was building,” he ſtates, that the Jews explain this paſſage in the following manner. The workmen, they affirm, employed a worm to ſhape the ſtones; which inſect, named ſchamir, cut and broke them to pieces in places where applied. They add, that it was the figure of a grain of barley, and was kept in a leaden box, becauſe, had it reached any rocks, it would have cleft and deſtroyed them. This fable, with ſome others invented by the rabbis, is particularly mentioned. Among the legends of Catholic ſuperſtition he ſelects other anecdotes equally remarkable. Baldus, he ſays, in order to prove the real preſence in the euchariſt, relates that a number of bees being found on holy ground, paid it homage, and carried a portion of it reſpectfully to their hive. Baptiſte tells us, that a ſpider having accidentally fallen into the chalice, while St. Francis was ſaying maſs, the holy man determined to ſwallow it; and adds, that the ſpider came afterwards out of the bone of his leg. But to conclude with one of theſe tales of fanaticiſm not unworthy of record with the reſt: it is gravely ſtated that St. Francis, once walking in a garden, ſaw a graſshopper, which immediately quitted the plant it ſat upon, and perched on his hand; he ordered it to ſing to the praiſes of God, and with a pretty loud voice it immediately began a very fine pſalm! If ſuch holy impoſtures were actually liſtened to with any faith, the time of Leſſer could not be miſapplied, as a divine, in endeavouring to expoſe their abſurdity.

Degeer publiſhed at Stockholm, in the year 1744, an intereſting little octavo on the utility of the ſtudy of inſects, called “Tal om nyttan, ſom Inſecterne och deras ſkärſkâdande, tilſkynda oſs;" in which he points out the advantages likely to reſult from our acquaintance with this tribe of animals, and which appears to be the firſt tract expreſsly written under this view of entomology. About this ſame period, Röſel of Nuremburg, by profeſſion a miniature painter, was engaged in the preparation of a valuable entomological work, the firſt part of which was ſhortly after produced to the world. This work bears the title "Der Monatlich-herausgegebenen Inſecten-Beluſtigung," and conſiſts of ſeveral volumes in quarto. The firſt part was produced in 1746, and two ſucceeding volumes in 1749 and 1755; to theſe a fourth volume was added by his relation Kleemannin, 1761, two years after the death of Röſel; and ſince that period Kleemanahus publiſhed three other parts in continuation.

Röſel does not adopt any ſcientific order of arrangement: his work was produced as a miſcellany, and, according to the title, as an amuſement in the ſtudy of inſects. Many of the inſects included are European; others are natives of Aſia, America, &c. Beſides inſects, ſome few of the cruſtacea are contained; and a portion of the third volume is devoted to the vermes tribe. The text is in the German language, and exceedingly copious; the ſlighteſt peculiarity in every individual inſect being deſcanted upon with as much minuteneſs as the more important details of its hiſtory. The plates are numerous and intereſting. The ſupplemental faſciculi, given by Kleemann, "Beyträge zur Natur-und Inſecten-Geſchichte," &c. relate to European inſects, and a ſmall number of the extra European kinds.

A tract, dedicated to the purpoſe of explaining the advantages ariſing from the ſtudy of inſects, was printed in 1747, by C. F. Mennander, "Diſſertatio de Uſu Cognitionis Inſectorum." Bazin, the ſame year, publiſhed his "Abregé de l'Hiſtoire des Inſectes, pour ſervir de ſuite à l'Hiſtoire naturelle des Abeilles," in Paris; and in London, William Gould, "An Account of Engliſh Ants." T. C. Hoppe publiſhed, the year after, two ſmall entomological tracts, as "Antwort-Schreiben auf Hrn Schreibers zweifel," at Gera; and "Eichen-Weiden-und Dornroſen," at Leipſic; and J. Dutfield of London, ſix numbers of a natural hiſtory of Engliſh moths and butterflies, after which the work diſcontinued.

About this ſame period, or rather earlier, but certainly before the year 1749, a work was undertaken in London by Benjamin Wilks, under the title of "The Engliſh Moths and Butterflies, together with the Plants, Flowers, and Fruits whereon they feed, and are uſually found." This publication, conſiſting originally of plates only, appeared in the firſt inſtance without a date. From collateral circumſtances we are, however, enabled to ſtate that it muſt have preceded the year laſt mentioned; becauſe at that time the whole work, conſiſting of 120 plates, was nearly completed, as we learn from comments upon that work in the third volume of Röſel's Inſecten Beluſtigung. The nature of this work is rather incorrectly ſtated in its title page; for the plants on which the groups of inſects are reſpectively diſplayed are not thoſe which conſtitute their natural food: they conſiſt of gaudy flowers, auriculas, roſes, monſtrous varieties of cultured plants, fruits, &c. the introduction of which, in preference to their natural food, has incurred blame. But another charge, and one in our opinion of more importance, is brought againſt our author by Röſel; an imputation tending to depreciate the reſpectability of the Engliſh entomologiſts of that particular criſis, when the ſcience ought, from the labours of former writers, to have ſtood in this country on very high ground, and the public judgment to have been ſo far matured as to diſcover impoſition. He plainly accuſes our author of piracy; and when we reflect on the celebrity this work has heretofore enjoyed as an original production, it does attach ſome little reproach at leaſt that facts ſtated with the utmoſt publicity on the continent ſhould have remained unknown to us. The remarks are curious; and as in all probability they have not before met the eye of the Engliſh reader, we ſhall tranſlate the paſſage in this place: "In dem nachtragoder 3," &c. "In the ſupplement, or third part of my Amuſements of Inſects, I have mentioned a certain work which Mr. Wilks in London publiſhes monthly, and promiſed that I would be more circumſtantial at another time. Since then the plates amount to ninety, all which I have examined with great attention: they are as yet deſtitute of any deſcription, which, however, is to appear at ſome future period. If the notice which accompanies theſe plates deſerves credit, all thoſe inſects are drawn after life; but to thoſe who know other works, and examine theſe plates with caution, it ſoon appears that the author has copied ſeveral from Albin's inſects, from Merian's book, and a great many from my own. Whether he has been ſucceſsful in his attempt, I leave to the judgment of others. An ape mimicks every thing, but does not always ſucceed. This may appear to many to be too ſevere; but let them conſider that the author counterfeits the works of others, and gives them out as his own. I venture to aſſert that in the future deſcription of his work, he will take care not to tell us from what books he has compiled his own; for he already ſtrives to hide on his plates whatever he has copied from others, by reverſing the figures, or by giving them a different poſition." Vol. iii. p. 192, A.D. 1749. This we muſt conſider as in ſome meaſure the language of reſentment for the liberties taken with his work: it is nevertheleſs in ſubſtance true; for the eye of the artiſt will perceive, on comparing the two publications, that Wilks has taken an unlimited range through the firſt volume of Röſel. The remarks are repeated at length, becauſe we wiſh to impreſs on the public mind the value and importance of any genuine work, in preference to productions of this nature. Wilks was the publiſher of "Twelve new Deſigns of Butterflies," in which the inſects are diſpoſed in ſtars, feſtoons, circles, or other whimſical groups, forming what are uſually denominated "Butterfly pictures."

The firſt volume of the invaluable work of baron Charles de Geer, the "Memoirs pour ſervir à l'Hiſtoire des Inſectes," was printed at Stockholm in 1752, and was received with every demonſtration of praiſe, to which its merits are entitled. From the teſtimony of the author's talents which this volume afforded, the continuation was expected with impatience; but nine years elapſed before the ſecond volume appeared, and it was altogether twenty-ſix years from its commencement to its termination. It was completed in 1778, in which year the labours of its author cloſed with his life. De Geer was the author of many other publications, which are to be found diſperſed through the Tranſactions of various learned ſocieties; but that above noticed is the moſt conſiderable of his works.

Dr. Hill, in his hiſtory of animals, publiſhed in London in the year 1752, divides inſects into three claſſes: the firſt of which, apteria, comprehends all inſects without wings; the ſecond, pteraria, is devoted to the winged kinds; and the third, called gymnarthridia, conſiſts of thoſe which have ſoft and naked bodies, and are furniſhed with limbs. The apteria is divided into two families; and pteraria, or the winged inſects, into diptera and tetraptera, or thoſe with two wings and four wings.

The "Entomologia Carniolica" of Scopoli appeared in 1753.

1753. This author diſtributes all the inſects of which he treats into orders, genera, ſpecies, and varieties, nearly after the manner of Linnæus; changing, nevertheleſs, the names they bear in the works of the latter for others he deemed more appropriate. Thus, for example, proboſcidea is ſubſtituted for hemiptera, in reference to the beak by which theſe inſects are diſtinguiſhed; aculeata for hymenoptera, from the abdominal ſting; halterata for diptera; and pedeſtria for aptera.

As a ſyſtematic work, this publication of Scopoli is of ſmall importance; in other reſpects it is valuable. The arrangement of inſects, better known on the continent as the ſyſtem of Scopoli, appeared in a work, entitled "Introductio ad Hiſtoriam naturalem," printed ſo lately as the year 1777, and which, as the title expreſſes, does not relate excluſively to the ſcience of entomology. He divides inſects into five tribes, under the ſingular appellations of Swammerdamii-lucifuga, Geoffroy-gymnoptera, Roeſelii-lepidoptera, Reaumurii-proboſcidea, and Friſchii-coleoptera: by this means, identifying each particular tribe with the name of an author, who in his opinion had been moſt ſucceſsful in the explanation of that to which his name is attached.

The order lucifuga includes two genera, cruſtacea and pedicularia; gymnoptera comprehends halterata, aculeata, and caudata; lepidoptera, the genera ſphinx, phalæna, and papilio; proboſcidea are divided into two parts, the terreſtrial and aquatic; and the coleoptera, in the ſame manner, conſiſt of two families, the inhabitants of the water and thoſe of the land.

The ardour with which the ſcience of entomology was cultivated about this period in various parts of Europe, is to be aſcribed to the occaſional labours of Linnæus and his immediate coadjutors, whoſe example excited the moſt laudable aſſiduity; and though no work of any material conſequence appeared exactly at this time, we may ſafely conclude that this ſpirit of emulation laid the foundation of ſeveral which were ſubmitted to the world a few years after. Among the entomological tracts and papers of this time, ſome only are worthy of notice. Kalm, a name familiar to the botaniſt, beſtowed attention on this ſubject, as we perceive from a paper on a ſpecies of cicada, (ſeptemdecim,) written in the Swediſh language; and alſo from another by the ſame author on acarus americanus: theſe appeared in 1754. The year after G. W. Sigwart treats ſlightly on coleopterous inſects; and Sauvages produced ſome papers of little moment in the Memoirs of the French Academy. And now we proceed gradually to the conſideration of other works of greater conſequence; the uſeful work of Clerk on the ſpiders of Sweden, printed in 4to. at Stockholm, in 1757, is one of the beſt works extant on this curious tribe. Another production by the ſame author is alſo valuable, his "Icones inſectorum rariorum," a thin and ſmall quarto, publiſhed two years after. Indeed, this laſt mentioned work may be conſidered as having the immediate ſanction of Linnæus, from being produced under his own direction, and, we believe, inſpection. The work contains a moderate number of coloured plates, ſome of which are appropriated to the diſplay of ſelect exotic inſects of the moth and butterfly tribe, and others to the mere choice and rare lepidopterous inſects of Europe, all which are highly finiſhed in colours. There were only a few copies of this work printed off, and it is now become ſcarce, and bears a conſiderable piece. Dr. Smith poſſeſſes one copy, that originally in the library of Linnæus, and there is another in that of ſir Joſeph Banks.

An intereſting little work, called "Inſecta Muſei Græcenſis," from the pen of Nicolaus Poda, publiſhed in 1761, affords an account of the inſects of Greece, arranged in the Linnæan manner. The ſame year an introductory work to the ſtudy of inſects by J. H. Sulzer, was printed at Zurich: it is in quarto, with a number of plates, and bears the title of "Die Kennzeichen der Inſekten durch 24 kupfertafeln erläutert, und mit derſelben natürlichen geſchichte begleitet." The ſame writer, in 1776, produced another publication alſo introductory to the ſcience of inſects, called "Abgekürtze geſchichte der Inſecten," illuſtrated with thirty-two coloured plates; which latter, with five or ſix additional plates, form the hiſtorical part of the quarto work publiſhed in Switzerland, in 1789, by J. J. Roemer, as an elucidation of the Linnæan and Fabrician ſyſtems. The title of the latter is "Genera Inſectorum Linnæi et Fabricii iconibus illuſtrata." The outline of the Fabrician ſyſtem, which this work contains, is conformable with that propoſed in the earlieſt work of the laſt mentioned entomologiſt.

As a ſyſtematic production, the work of Geoffroy, printed at Paris in 1762, demands the particular attention of the modern entomologiſt. The work is entitled "Hiſtoire abrégée des Inſectes," and compriſes all the inſect tribes in the ſix following claſſes: 1ſt, coleopteres; 2d, hemipteres; 3d, tetraptères à ailes farineuſes; 4th, tetrapteres à ailes nues; 5th, dipteres; 6th, apteres. The firſt claſs correſponds with the Linnæan coleoptera; the ſecond is more accurately regulated by the form of the proboſcis; the third agrees with the lepidoptera, having the wings covered with fine powder; the naked-wing tribe unite the neuroptera and hymenoptera; the dipteres and apteres are the ſame with the Linnæan orders. It is a material diſtinction of this ſyſtem, that the characters of the orders are determined chiefly by the number of joints in the feet; the generical characters are taken from various parts of the body, wings, &c. The genera differ exceedingly in their conſtruction from thoſe of Linnæus, and many of them are in uſe to this day among the continental writers.

Brünniche is the author of two entomological tracts, printed about the ſame period, as, "Prodromus Inſectologiæ Siællandicæ," and an elementary work in Latin and Daniſh, called "Entomologia ſiſtens Inſectorum tabulas ſyſtematicas, cum introductione et iconibus." Sepp began his work, "Beſchouwing der wondern gods in de minſtgeachte ſchepzelen of Nederlandſche Inſecten," in the year 1762; it is dedicated entirely to the more uncommon moths and butterflies of Holland; the text is in the Dutch language, and the plates, which are not numerous, are admired for their peculiar neatneſs, being engraven in the dot or ſtipple ſtyle, with conſiderable delicacy.

This elaborate kind of engraving was in great eſteem about the period adverted to, as appears from the encomiums beſtowed on the plates executed by the hand of Lyonet, for his laborious work, "Traité Anatomique de la Chenille," printed in Holland the ſame year. This work of Lyonet is a treatiſe dedicated ſolely to the anatomy of the caterpillar, which lives in the wood of the willow, (phalæna coſſus,) upon the diſſection of which this author enters with ſuch minuteneſs of inveſtigation, that his deſcriptions of this object alone occupy rather more than ſix hundred quarto pages. The plates, eighteen in number, with the exception of the firſt, which repreſents the microſcope employed in his examinations, are entirely appropriated to the repreſentations of the muſcles, tendons, fibres, medullary veſſels, ſpiracles, &c. every part of which throughout the whole animal are exhibited in their natural and magnified appearance. Theſe plates, as before intimated, are finiſhed ſpecimens of the ſtipple ſtyle of engraving then prevalent, and which, from the cloſeneſs of its texture, nearly reſembles mezzotinto.

Lyonet is ſaid to have left at his death two manuſcripts on the ſubject of entomology, neither of which have, to our knowledge, appeared before the world. One of theſe is inſcribed "Œuvres Melées ſur les Inſectes," and contains his obſervations on the inſects found in the environs of the Hague, where he reſided. The other, an "Eſſai Anatomique ſur la Chryſalide et la Phalene qui range le bois de ſaule," a work on the ſame plan, and forming a continuation of the hiſtory of the ſame inſect, as his former eſſay on the caterpillar. This unpubliſhed work on the chryſalis and fly was to be accompanied by no leſs than fifty-four plates, all the drawings of which were executed, and ſome of the plates engraved, previouſly to the death of the author, which happened, at an advanced age, in 1789.

The ſcience derived ſome improvement from the various publications of Schæffer between the years 1764 and 1777. He produced, among others, an elementary work in German, "Zweifel und Schwürigkeiten, welche in der Inſectenlehre annoch vorwalten," and another, entitled "Elementa Entomologica," containing no leſs than 132 plates, appropriated to the illuſtration of the principles of his ſyſtem; and an additional ſection with two more plates, deſcribing the various apparatus for catching, and the manner of feeding inſects, microſcopes for examining them, &c. "Vierter abſchnitt von den Werkzeugen der Bedhandlung und Sammlung der Inſecten." The moſt important of Schæffer's works, is that entitled "Icones Inſectorum circa Ratiſbonam indigenorum," compriſed in three volumes 4to. with a vaſt number of coloured plates, the latter of which poſſeſs a character of great peculiarity in having two impreſſions on every print, one on the front of the leaf as uſual, and the other on the back; by which means the plates are compriſed in half the number of leaves they would otherwiſe occupy. The claſſification of Schæffer differs extremely from that of Linnæus; it approaches that propoſed by Geoffroy, from which, however, it is ſtill ſo far diſtinct, that being a ſyſtem in ſome repute, it may not be amiſs to preſent an outline of it in this place.

Schæffer divides all inſects into ſeven claſſes, in the following manner;

1. Inſecta coleoptero-macroptera, inſects whoſe elytra are cruſtaceous throughout their whole length, and extend beyond the abdomen when cloſed.

2. Inſecta coleoptero-microptera, differ from the former only in having the wing-caſes ſhorter than the abdomen.

3. Inſecta coleoptero-hymenoptera, or hemiptera, ſuch as have the elytra half cruſtaceous, or becoming membranaceous towards their extremity.

4. Inſecta hymeno-lepidoptera, or having wings imbricated with ſcales.

5. Inſecta hymeno-gymnoptera, or with naked and membranaceous wings, comprehending the two Linnæan orders neuroptera and hymenoptera.

6. Inſecta diptera, or inſects having two wings.

7. Inſecta aptera, or without wings.

The ſecond part of "Zoophylacium Gronovianum," by Laur. Theod. Gronovius, contains the deſcription of about ſix hundred inſects with ſynonyms after the Linnæan manner, accompanied by four illuſtrative plates. The work is in folio, and was printed at Leyden in 1764.

Seba, in his ſplendid folio work, "Theſaurus Naturæ," publiſhed at Amſterdam in 1765, deſcribes a number of the larger kinds of extra European inſects, with figures executed with great force, and in a ſtyle correſponding with the other plates of his work.

In 1769, Berkenhout publiſhed the firſt edition of his "Outlines of Natural Hiſtory of Britain;" ſince which time two other editions of the ſame work have appeared. That portion of the work which is devoted to entomology includes a ſmall ſelection of the ſpecies moſt conſpicuous for their ſize, under each of the Linnæan genera, the inſects being arranged throughout in the order of that ſyſtem. The number of inſects deſcribed amount to about ſix hundred. The work is deſtitute of figures.

Among the number of exotic inſects figured in the plates of "The Hiſtory of Birds," and the "Gleanings," by George Edwards, ſome are intereſting from their beauty. There are a few alſo remarkable for their rarity, particularly ſcarabæus atlas, one of the three larger "Indian beetles;" libellula chinenſis, called "the green-winged libellula;" and the larva or pupa of an extraordinary gibbous kind of locuſt, repreſented only, we believe, in this work. Inſects were not ſparingly introduced, notwithſtanding that they were conſidered only as ornamental objects, the work being devoted principally to ornithology. In the courſe of the whole of this voluminous production, more than fifty ſpecies of the inſect tribes are noticed, the greater part of which are butterflies. Edwards began this publication in 1743, from which period it was continued progreſſively till 1764. The catalogue was publiſhed in 1770, and forms part of the tracts entitled "Edwards on Natural Hiſtory."

John Reinhold Forſter, one of the eminent naturaliſts who accompanied the celebrated Capt. Cook in his voyage round the world, has left us a catalogue of Britiſh inſects printed in 1770. It is only a liſt of Latin names of a certain number of ſpecies, and was intended as a prelude to the copious work on the inſects of this country, which its author intended to write. This catalogue, however, and his "Novæ Inſectorum Centuriæ," which appeared in London the year after, are the only entolomogical works that author publiſhed. Of the latter we ought to ſpeak more at large. The avowed purpoſe of this little book, as the reader is informed in the preface, was to give a deſcription of one hundred inſects not mentioned in the lateſt work of the illuſtrious Linnæus. The inſects included are partly indigenous, ſome are from China, and others from South America. The greater number of theſe are coleopterous inſects, and are arranged after the manner of Linnæus, though the genera anthribus and ciſtela are taken from Geoffroy. It may be laſtly obſerved, that although theſe inſects do really appear to be undeſcribed by Linnæus, ſome few of them were previouſly made known to the world by the works of Schæffer and Drury. This its author was aware of, but as they had eſcaped the obſervation of the author, whoſe work he was ſolicitous to improve, it was ſtill conſidered right to introduce them.

The firſt volume of the "Illuſtrations of Natural Hiſtory, wherein are exhibited figures of exotic inſects," &c. by D. Drury, was publiſhed in 1770. The plates, fifty in number, form a miſcellaneous aſſemblage of the more beautiful extra European inſects, which the extenſive collection of its author afforded. The ſecond volume was produced three years after the firſt; and the third, which concludes the work, ſo far as the author proceeded with the publication, appeared in 1782. Beſides the inſects repreſented in theſe volumes, the extenſive cabinet of the author contained many very choice ſpecimens, reſerved as materials for the fourth volume which was in contemplation; and among the reſt, a number of curious ſpecies collected in the interior of Africa, and other countries rarely viſited by Europeans, the introduction of which would have rendered the fourth volume of much greater intereſt to the entomologiſt than either of the preceding; this may be collected from the manuſcripts of Mr. Drury, in the poſſeſſion of the writer of this article, and which are now before us. From an inſpection of theſe papers, it likewiſe appears, that the author intended, in a reviſal of his former volumes, to have aſſigned the Fabrician names to all the inſects contained, ſo far as theſe could be obtained, and that for this purpoſe Fabricius had himſelf furniſhed Mr. Drury with a number of names and references, independently of thoſe which had been publiſhed in his "Species Inſectorum," a paper by Sebaſtiani, "Inſecta ad aquas Mattiacas ſuper nive deprehenſa," bears the ſame date with Drury's firſt volume of exotic inſects, and as nearly as we can aſcertain Kahn was about this very period engaged at Berlin in his publication "Anecdoten zur Inſekten-geſchichte," a work written in German, and publiſhed in numbers. The tract of Kahn, relative to the mode of catching and preſerving inſects, called "Kurze anleitung Inſecten zu ſammlen," is dated 1773.

The "Inſtitutions of Entomology," by Thomas Pattinſon Yeats, is the only production of its unfortunate author relative to this ſubject: it is a tranſlation of the Linnæan orders and genera, collated with three other ſyſtems, namely, thoſe of Geoffroy, Schæffer, and Scopoli, together with obſervations by the tranſlator. This was a valuable book at the time of its production. In the preſent day it is become rather obſolete; and it is in particular defective in the compariſon drawn between the Linnæan ſyſtem and that of Scopoli; not from any error of the tranſlator, but an event that could not be anticipated. Scopoli coincided nearly with Linnæus in his arrangement of inſects, when he wrote his "Entomologia Carniolica;" after which, however, he abandoned that method, and adopted another; that which has ſince obtained currency on the continent under the name of "Scopoli's Syſtem." This laſt mentioned work was not printed till four years after the tranſlation by Yeats.

"The Aurelian's Pocket Companion," by Moſes Harris, is a kind of alphabetical catalogue of the larger butterflies, ſphinges, and moths collected in England by its author: a tract of no utility to the naturaliſt, unleſs he firſt condeſcends to become an adept in the jargon of the aurelian, or, as now termed, the entomological ſociety; the inſects being throughout deſignated by the ſilly names impoſed by the few illiterate perſons aſſociated under this denomination. In this Engliſh lexicon of entomology, we have "The Wall," "The Bank," "The Turnpike-gate Keeper," "Ghoſt," "Old Woman," "Diſh-clout," and a vaſt number of others equally capricious and replete with abſurdity.

J. C. Fabricius, the indiſputable founder of a new ſyſtem of entomology, publiſhed in the year 1775, his "Syſtema Entomologica," in which the principles of his novel mode of claſſification is for the firſt time developed. The eſſential characters of the claſſes are determined from the organs of manducation, or mouth (inſtrumenta cibaria). In this work inſects of every deſcription are comprehended in eight claſſes to which the ſeveral names of eleutherata, ulonata, ſyneſtata, agonata, ungonata, gloſſata, rhingota, and antliata, are aſſigned.

This work obtained for its author very high reputation, and ſuch further inducements to the proſecution of his entomological ſtudies, that in the courſe of a few years after ſeveral other works appeared from his pen on the ſame ſubject, among which were his "Species Inſectorum," "Entomologia Syſtematica," &c. in all which his original manner of claſſification was adopted with progreſſive improvement. His "Supplementum Entomologiæ Syſtematicæ," preſents an outline of his ſyſtem in its lateſt ſtate, and is the baſis on which the laſt work in which he was engaged, his "Syſtema Eleutheratorum" was undertaken. Part only of this valuable work has hitherto appeared, its completion being impeded, if not finally interrupted, through the death of the author; but ſo far as he did proceed, the arrangement propoſed in his ſupplement is adopted, and we cannot entertain any other concluſion than that it would have been acceded to throughout. This may hence be admitted as the beſt he had formed in the opinion of its author, and a concluſion, the reſult of ſo much extenſive knowledge in the ſcience as Fabricius poſſeſſed, deſerves our ſerious conſideration.

In this ſyſtem Fabricius diſtributes all inſects into thirteen claſſes, the characters of which are as follow:

Claſs 1. *Eleutherata.* Jaws bare, free, and bearing feelers.

2. *Ulonata.* Jaws covered by an obtuſe mouth-piece

3. *Syniſtata.* Jaws elbowed near the baſe, and connected to the lower lip.

4. *Piezata.* Jaws horny, compreſſed, and uſually elongated.

5. *Odonata.* Jaws horny, dentated; palpi two.

6. *Mitoſata.* Jaws horny, vaulted; no palpi.

7. *Unogatæ.* Jaws horny, unguiculated.

8. *Polygnata.* Jaws ſeveral (uſually two) within the lip.

9. *Kleiſtagnatha.* Jaws ſeveral, outſide the lip.

10. *Exochnata.* Jaws ſeveral, outſide the lip, and covered by the palpi.

11. *Gloſſata.* Mouth compoſed of a ſpiral tongue, ſituated between two palpi.

12. *Rhyngota.* Mouth compoſed of a beak or articulated ſheath.

13. *Antliata.* Mouth compoſed of a ſucker, not articulated.

This able entomologiſt is the author of various tracts on entomology, written in the Latin and German languages; and alſo of two principal introductory works, "Genera Inſectorum," and "Philoſophia Entomologia."

The inſects of Switzerland are deſcribed by J. C. Fueſſlin, in an intereſting little work, to which its author gives the title "Verzeichnis der ihm bekannten Schweitzerſchen Inſeckten," printed at Zurich, and bearing the ſame date (1775) with the Fabrician "Syſtema Entomologica."

The number of inſects figured in the "New Illuſtrations of Zoology," by Peter Brown, in 1776, is by no means conſiderable; ſome few of which it does contain are nevertheleſs ſufficiemtly important in point of rarity to deſerve explicit mention. The purple-winged locuſt is, in particular, a magnificent inſect: at the time this artiſt made his drawing, the ſpecimen, which is preſumed to be unique, was in the poſſeſſion of Mr. Tunſtal; at preſent it enriches the ſplendid collection of Mr. Macleay. The work of Stoll, it ſhould be obſerved, affords likewiſe a figure of this ſpecies, and which, it is believed, was taken from the ſame ſpecimen previouſly to its being purchaſed in Holland for Mr. Tunſtal.

The extenſive ſyſtematic work of J. A. E. Goeze, called "Entomologiſche beyträge zu des Ritter Linné zwölften aufgabe des Natur ſyſtems," began to be publiſhed at Leipſic in 1777, and was continued progreſſively in parts till 1783. In the ſame year, with the commencement of this publicaton, Eſper produced in Germany the firſt part of his uſeful book on the lepidopterous tribe of inſects, "Die Schmetterling in Abbildung nach der natur mit beſchreibungen," a work with many plates, and of which a ſecond part was publiſhed in 1779. Between that time and 1786 two other parts appeared likewiſe, and which altogether form a very extenſive publication. Two other very coſtly works, devoted excluſively to this beautiful order of inſects, were alſo begun in 1779, one at Paris in the French language; the other in Holland, and in the language of that country: the firſt of theſe is entirely appropriated to the inſects of Europe, and is named "Papillons d'Europe, peints d'après nature;" the latter is by Pieter Cramer, and conſiſts of the extra European ſpecies. The title of this work is, "De uit landſche kapellen, voorkomende in de drie waereld deelen Aſia, Africa, en America," and including the continuation publiſhed about the year 1782, conſiſts of four volumes quarto, with many plates. The production of theſe expenſive works ſufficiently demonſtrates the encouragement beſtowed on the ſubject of entomology upon the continent of Europe.

An elementary work by James Barbut, bearing the title of "The Genera Inſectorum of Linnæus, exemplified by various ſpecimens of Engliſh Inſects," was publiſhed in London in 1781; and which, beſides the text, contains altogether about twenty-two plates, two of which are explanatory, and the reſt comprehend indifferent figures of a ſmall number of ſpecies in each genera. As an illuſtration of the Linnæan ſyſtem, this work may be in ſome reſpects uſeful to the Engliſh reader: its views are too limited to admit of more general utility. The author does not ſeem to be aware of the improvements the ſcience had undergone upon the continent, in the interval between the publication of the "Genera Inſectorum" of Linnæus, and the time in which he wrote, and has not therefore drawn thoſe compariſons between them, which, without innovation on either, could not fail to have placed the ſcience in a more lucid point of view. It is, indeed, to the ſilence of Engliſh writers in this reſpect, generally ariſing either from the want of information, from ſentiments of illiberality, or from negligence, that we muſt aſcribe the very low ſtate of entomological knowledge in Britain, even to the preſent period. Franciſcus de Paula Schrank diſtinguiſhed himſelf by his enumeration of the inſects of Auſtria in 1781, written in Latin, "Enumeratio Inſectorum Auſtriæ indigenorum," afterwards rendered into German by Fueſsly. The ſame year John Nepomuk von Laicharting publiſhed at Zurich his catalogue of the inſects of the Tyrol, "Verzeichniſs und beſchreibung der Tyroler Inſecten," a ſecond part of which appeared in 1784. Laicharting adopts a ſyſtem ſomewhat different from that of Linnæus; he divides inſects into ten claſſes, characterized from various parts of the body. His claſſes are ſcarabæides, grylloïdes, cimicoïdes, papilionoïdes, libelluloïdes, veſpoïdes, muſcoïdes, cancroïdes, aranoïdes, and oniſcoïdes. In 1782, a paper by Morand was publiſhed in the Tranſactions of the Paris Academy, entitled "Memoire ſur les vers de Truffes, et ſur les mouches qui en proviennent." A ſmall octavo by J. S. Semler, in the German language, bears the ſame date, and is worthy of attention, "Verſuch eines Diarium über die Œconomie mancher Inſecten im Winter," and there is beſides this another more extenſive book printed in 1783, relative to the aphides, called "Nachleſe zur Bonnetiſchen Inſektologie." A catalogue of lepidopteræ, written by Lang in the German language, came out in the ſame year. And, laſtly, a "Short hiſtory of the brown tail Moth," by W. Curtis. The caterpillars of this moth, it may be recollected by many readers, appeared in ſuch immenſe ſwarms in the fields ſurrounding London during the ſummer of 1782, and from their ravages deſpoiled ſo many trees of their foliage, as to create very ſerious apprehenſions of approaching deſtruction to the whole vegetable tribe. The object of this pamphlet was to prove that graminiferous plants, not being the natural food of theſe voracious vermin, would eſcape their attack. This circumſtance alone will ſerve to teſtify, that ſome benefit at leaſt may reſult from an acquaintance with the ſcience of inſects. Its author was by this means enabled to diſpel the uneaſineſs occaſioned through the appearance of theſe ſuppoſed miniſters of famine; and which prevailed to ſuch an alarming extent throughout the whole population of this vaſt metropolis, that prayers were ordered to be read in all the churches to avert the impending calamity.

An elementary work by J. A. B. Bergſtræſſer, a ſmall octavo, entitled "Entomologia, ſcholarum in uſus concinnata," was publiſhed in 1784; this author had previouſly diſtinguiſhed himſelf by his German work, entitled "Nomenclatur und beſchreibung der Inſecten in der Grafschaft Hanau-Müntzenberg," &c.

The entomological tracts publiſhed about this period, and rather earlier by Thunberg, contributed to promote this ſcience; his diſſertations, named "Novæ Inſectorum," of which ſeveral appeared between 1781, and ten years after; and alſo his "Diſſertatio ſiſtens Inſecta Suecica," the firſt of which occurs in 1784, are intereſting. The relation of his travels to the Eaſt abounds with information reſpecting natural hiſtory, and relates in ſome degree to entomology; and he alſo produced a curious memoir on the pauſus genus, called "Beſkrinfning poa tuänne nya Inſecter," beſides other tracts in the Swediſh and Latin languages.

Retzius, in 1783, produced his "Genera et Species Inſectorum," in which the method of Degeer is ſimplified, and the Linnæan terminology adapted to that performance. Inſects, according to this ſyſtem, are divided into fourteen claſſes; namely, lepidoptera, alinguia, neuroptera, hymenoptera, ſiphonata, dermaptera, hemiptera, coleoptera, halterata, proboſcidea, ſuctoria, ancenata, atrachelia, and cruſtacea.

Harrer wrote on the inſects of Germany, in a ſmall book printed in 1784. The year after Jablonſky began the important ſyſtematical work, called "Natur ſyſtem aller bekannter in-und auſländiſchen Inſecken," printed at Berlin; about the ſame time Fourcroy publiſhed his catalogue of the inſects found in the neighbourhood of Paris in Latin, under the title of "Entomologia Pariſienſis;" and another illuſtration of the elements of entomology, written in German, appeared at Leipſic from the pen of Schmiedlein. Some African inſects, that inhabit the Cape of Good Hope, were deſcribed in 1786 by Xavier Walfen; and two publications on the lepidopteræ of Germany, and both written in the language of that country, came out in the ſame year, one by W. Geſenius, the other bearing the title of "Beitrage zur geſchichte der Schmetterlinge," and printed at Augſburg, is by Hübner.

The inſects of Naples are deſcribed by Dominicus Cyrillus in a folio work publiſhed in 1787, called "Entomologiæ Neapolitanæ." A curious and uſeful little tract on the oeſtrus, or gad-fly genus, was the ſame year printed at Leipſic by J. S. Fiſcher under the title of "Obſervationes de Œſtroovino atque bovino factæ," to which a copious appendix was annexed in 1788. The cochineal inſects diſcovered at Madras ſome few years before, gave riſe to a ſeries of letters on this important ſubject, by James Anderſon, addreſſed from Madras to ſir Joſeph Banks, fourteen of which were printed together in that country in the year 1788; there are, beſides theſe, two other letters which have been publiſhed ſince, alſo a ſeparate publication by the ſame author, containing an account of the importation of American cochineal inſects into Hindooſtan. Swederus, in 1788, publiſhed a monograph on that curious coleopterous genus terapterus, in a memoir entitled "Beſkrifuing poa elt nytt genus ibland inſecterna, hörande til Coleoptera."

The ſcience of entomology obtained ſome further advantages about this period, from the publication of the enlarged edition of the Linnæan "Syſtema Naturæ," by J. F. Gmelin; not from poſſeſſing in itſelf any peculiar merit, but becauſe as a general, and therefore uſeful work, it combines much valuable information, compiled from the labours of various naturaliſts of the firſt conſequence ſince the time of Linnæus. In the entomological part, conſiſting of three volumes, publiſhed at Leipſic in 1788, the editor is conſiderably indebted to the writings of Fabricius; for although he rejects his mode of claſſification, his orders, and moſt of his genera, he has copied no inconſiderable portion of his new ſpecies, and by that means very materially augmented and improved the original work of Linnæus. Beſides this, the pleaſing works of Stoll contributed about this time to facilitate the ſtudy of the hemipterous order of inſects, from affording ſigures of many extraordinary ſpecies of the locuſt, fulgora, cicada, cimex, and other tribes, extant in the various continental cabinets at that time, and, among others, that of the prince of Orange. His firſt work is called "Natuurlykye af beeldingen en beſchryvingen der Cicaden in alle vier waerelds deelen." The two publiſhed ſince are only a continuation, including other genera beſides the cicadæ, as the locuſtæ, phaſmæ, &c. Theſe works were printed at Amſterdam. The work of M. B. Borkhauſen, written in the German language, relates entirely to European inſects of the lepidoptera kind, and bears the title of "Naturgeſchichte der Europaiſchen Schmetterlinge nach Syſtematiſcher ordnung." The firſt part appeared at Franckfort in 1788; and ſince that time the work has been conſiderably extended. The article entomology, inſerted in Hall's Encyclopædia, as it appeared originally in 1788, was written by Marſham, and is exemplified by three plates; and about the ſame time, Roemer publiſhed in Switzerland his "Genera Inſectorum Linnæi et Fabricii iconibus illuſtrata," including thirty-ſeven explanatory plates, nearly all of which, however, had previouſly conſtituted the work of Sulzer.

Immediately after this, the publication of one of the moſt voluminous works on entomology that has been attempted was undertaken at Paris, by G. A. Olivier. Its title is conciſely "Entomologie, ou Hiſtoire naturelle des Inſectes;" from which we may infer, that its author propoſed to have treated on every claſs and order, and, in conformity with the firſt part, to have accompanied the whole with figures. Several faſciculi or numbers were publiſhed, amounting altogether to about three volumes; the whole of which are confined to the order coleoptera, and that even remains very incomplete. So far as it does proceed, the work is valuable. Olivier is the author of ſeveral other entomological writings. In the "Journal d'Hiſtoire Naturelle," he has a memoir, "Sur l'Utilité de l'etude des Inſectes, relativement à l'Agriculture et aux Arts." He is alſo the propoſer of a methodical diviſion of inſects, in the "Dictionnaire Entomologique." According to this plan, inſects are to be divided into four parts, namely, 1. Inſects with four wings; 2. Inſects with two wings and two wing-caſes; 3. Inſects with two wings; 4. Inſects without wings in either ſex. Theſe are ſubdivided into eight orders, the characters of which are taken from the mouth.

The inſects of Europe were further deſcribed by C. de Villers, in a ſmall work publiſhed at Lyons, in 1789, under the title of "Linnæi Entomologia," &c.; in which he profeſſes to avail himſelf of the works of Scopoli, Geoffroy, Degeer, Fabricius, and others. Paykull was at this time engaged alſo upon the inſects of Sweden, at leaſt on the coleopteræ; and this year he publiſhed his "Monagraphia Staphylinorum Sueciæ;" and which, a while after, was ſucceeded by two other tracts on the curculiones and the carabi, "Monagraphia Curculionum Sueciæ," and "Monagraphia Caraborum Sueciæ." But the moſt extenſive of the works of Paykull is his "Fauna Suecica," in three octavo volumes, printed at Upſal in 1799.

In the "Journal für die Entomologie," the name of Meyer occurs as the author of ſome remarks on the melolontha. Preyler, in the year 1790, publiſhed at Prague a "Verzeichniſs," or catalogue of the inſects of Bohemia. Quenſel is the author of a tract on the papilio, entitled, "Beſkrifningar öfer 8 nya Suenſka Dagfjärillar;" and alſo of another on noctua pruni, "Beſkrifning öfver en y Nattfjäril."

The firſt part of a conſiderable work, "The Natural Hiſtory of Britiſh Inſects by E. Donovan," appeared in the early part of the year 1792; and having obtained a favourable reception, has been continued in a courſe of monthly numbers from that period to the preſent time (1809). The deſign of this undertaking is to afford ſcientific and general deſcriptions, accompanied by appropriate coloured figures of every inſect diſcovered in this country; and ſo far as that deſirable object could be accompliſhed, in all their various ſtates of transformation. In its preſent form, the work conſiſts of fifteen volumes; the number of plates exceed 500, and theſe include an extenſive variety of ſpecies. Without incurring the charge of preſumption, the writer of this article believes he may be allowed to obſerve that the preſent conſtitutes the moſt copious work of its kind that has hitherto, or probably ever may be undertaken, as an elucidation of the entomology of Britain.

The inſects of Germany afforded materials for another entomological work of a local nature, commenced by Dr. G. W. F. Panzer, in 1793, under the title of "Faunæ Inſectorum Initia, oder Deutſchlands Inſecten;" and this was ſhortly after ſucceeded by his "Entomologia Germanica," &c.; both which are written in German and Latin, and are illuſtrated by plates. Dr. Smith's "Tour on the Continent in 1786-7," was publiſhed alſo in 1793; and this claims our particular mention, as it will be found to contain ſome curious obſervations reſpecting the inſects of the countries he viſited. About the ſame time, a French edition of Fueſsly's "Archiv der Inſektengeſchichte" made its appearance in quarto, with the original plates.

A valuable ſyſtematic paper, propoſing "a new arrangement of the papilios" by Mr. William Jones, occurs in the ſecond volume of the Tranſactions of the Linnæan Society, printed at London in 1794. The object of this communication is to point out, that the ſhape of the wings, which form a principal character with Linnæus in his diſtribution of this genus into families, though various at the firſt view, approach each other ſo gradually, that it is impoſſible to draw from them the diſtinguiſhing line between each family. The number of ſpecies known to Linnæus are eſtimated at rather more than 274, whereas the writer obſerves he had ſeen above 1000 in various cabinets, and about 400 more repreſented in various publications; and from an attentive examination of theſe is induced to offer the following amendments to the characters of each family, as defined by Linnæus. The latter author deſcribes the *Equites* as having "the upper wings longer from the poſterior angle to the point than to the baſe; and the antennæ often filiform:" this is corrected by ſaying, "the upper wings are longer from the poſterior angle to the point than to the baſe, occaſioned by having four nerves inſtead of three, viſible in every other family. The palpi frequently only a bruſh; under wings, with a connecting nerve in the centre, and without an abdominal groove."—*Heliconii.* "Wings narrow, entire, often naked, or deprived of ſcales; the upper wings long, the inferior ſhort." Linn. To this character is added, that the upper wings have "a connecting nerve in the centre, very ſlightly grooved to admit the abdomen, which is in general long, as are alſo the antennæ."—*Danai.* "Wings entire." Linn. Addition: "the under with a connecting nerve in the centre, and a deep abdominal groove; palpi projecting."—*Nymphales.* "Wings denticulated." Linn. Addition: "the under without a connecting nerve in the centre, and with a deep abdominal groove; palpi projected."—*Plebeii.* "Small, rurales; ſpots on the wings obſcure." Linn. Addition: "thorax and abdomen ſlender; under wings without a connecting nerve; antennæ clubbed:" and theſe are divided into two ſections, thoſe with long, weak, flexible tails; and thoſe without tails, and having the wings entire.—*Plebeii urbicolæ.* "Spots on the wings for the moſt part tranſparent." Linn. Theſe Mr. Jones divides into three families, according to the following character. * Thorax and abdomen ſhort, thick, or broad; under wings without a connecting nerve; antennæ uncinated, or crooked at the extremity. ** With upper wings pointed at the extremity, and long in proportion to their width. *** Upper wings leſs extended, and together with their under wings more rotund; their margins entire. There ſtill remain ſome papiliones, which do not rank with any diviſion above mentioned: theſe are generally of a large ſize, without an abdominal groove; have no connecting nerve; their antennæ generally acuminated; and the veins of both upper and under wings extending from their root to the extremity nearly in ſtraight lines. The author of this paper conſtitutes theſe as a new family, under the name of romani.

We ought not to diſmiſs our abſtract of the above paper, without obſerving that, from the great attention beſtowed on the papiliones by Mr. Jones, his opinion is of unqueſtionable authority. The ſpecies, which it is intimated the writer has ſeen in various cabinets to the amount of 1000, or perhaps more, have not to our own knowledge been obſerved merely: Mr. Jones has taken the trouble, for the gratification of himſelf and his ſcientific friends, to paint every ſpecies, and that in a very correct and elegant manner. The collection of drawings thus formed affords an unparalleled diſplay of this beautiful tribe of inſects.

In 1795, "The Papilios of Great Britain," a quarto work with plates, by William Lewin, was publiſhed in London. Whether it was the intention of the author to have proceeded further with this publication is uncertain: it finally terminated with the completion of the butterflies. About the ſame period the coleopterous inſects of Sweden were publiſhed in the language of that country, by D. E. Naezén, ſome part of whoſe works had, however, been produced to the public before that period. His books (for there are two) are entitled "Beſkrifning poa noagra, vid Umeoa fundene okände arter ibland Skalbaggarne," and "Beſkrifning poa noagra vid Umeoa fundne Inſecter, dels okande, dels foorut otydeligen bemarkte ochi Fauna Suecica ej uptagne." A Latin tract, printed in 1795, by D. H. Hoppe, contains an enumeration of the coleopterous inſects found in the invirons of Erlang, in Franconia; and in the ſame year, Latreille publiſhed his work, entitled, "Precis du Charactére des Genres." In this laſt-mentioned work, inſects are divided into two principal claſſes, namely, thoſe with wings, and thoſe without wings. The orders are coleopterès, orthoptères, hémiptères, neuropteres, lépidoptères, ſuceurs, thyſanoures, paraſites, acéphalés, entomoſtracés, cruſtacés, and myriapodes. An arrangement of the inſect tribes, in a manner ſomewhat different, occurs in "Tableau Methodique des Inſectes," by the ſame author. An important paper on the oeſtrus genus, by B. Clark, inſerted in the third volume of the Linnæan Society Tranſactions, is duly noticed under the article Bot. The laſt production we have to mention in the preſent year is a ſmall tract, accompanied by a coloured figure of an extremely beautiful and ſingularly formed beetle, in the cabinet of Mr. Francillon; a ſpecies of ſcarabæus, having the poſterior legs remarkable both for their length and thickneſs, and hence denominated the kangaroo beetle (ſcarabæus macropus). The inſect is preſumed to be a native of Potoſi, in South America.

The ſecond volume of "Catalogus Bibliothecæ Hiſtorico Naturalis, Joſephi Banks baroneti," &c. by J. Dryander, comprehending the entomological works of that invaluable library, iſſued from the preſs in 1796. From the claſſic manner in which each production is arranged in an appropriate department, according to its leading character, this work muſt be conſidered as forming in itſelf a valuable bibliothecal ſyſtem of entomological writers. As an aſſemblage of references, we cannot ſpeak too highly of its contents.

"The Natural Hiſtory of the rarer Lepidopterous Inſects of Georgia," in North America, forms a pleaſing acceſſion to our knowledge of thoſe particular ſpecies which it is the object of this work to elucidate. The number of inſects contained in the two coſtly volumes, of which the work conſiſts, amounts to about one hundred. Theſe conſtitute an ample ſelection of the larger kinds of the butterfly, ſphinx, and moth tribes, peculiar to that region. Each inſect is repreſented with its larva, pupa, and an example of one of the plants on which it is known to ſubſiſt. This work is written by Dr. J. E. Smith, from a ſeries of notes and drawings made by Mr. Abbot, an aſſiduous collector in North America; and beſides combining the practical information derived from the latter ſource, is rendered valuable by the numerous additional obſervations of the author. This work appeared in 1797.

Clairville, the author of a work on the inſects of Switzerland, publiſhed in 1798, propoſes to divide inſects into eight orders, ſomewhat after the manner of Linnæus, but to diſtinguiſh them under other names, and to denominate them claſſes inſtead of orders. The names he propoſes are elytropteres, dictyopterès, thleboptères, halterеptères, lepidopteres, hémiménoptères, rophoptères, and pododunères.

In the ſame year with the preceding, "Donovan's Natural Hiſtory of the Inſects of China" appeared in London. This is the only work dedicated to the diſplay of the entomological productions of that vaſt empire that has been publiſhed. The materials which conſtitute the baſis of this volume, and from which it was in a great meaſure compoſed, were obtained from the firſt and moſt authentic ſources; including examples of the inſects collected at the time of the embaſſy of lord Macartney, in addition to many others obtained from various cabinets of the higheſt celebrity, and the communications of friends. The work is embelliſhed with fifty coloured plates. A tranſlation of this publication has appeared on the continent in the French, and another in the German language.

The year 1800 was productive of ſeveral valuable works on the ſubject of entomology; in Sweden, Paykull this year publiſhed his "Fauna Suecica," a much admired publication, in three volumes octavo. Cuvier, with the aſſiſtance of

Duméril, brought forward in Paris his celebrated "Anatomie Comparée," a work which, however ill ſuited to the philoſophic taſte of our own country, is a production of very extraordinary merit. The organization of the various tribes of inſects is treated at great length in the lectures relating to invertebral animals. This work affords us alſo a new ſyſtematical arrangement, in which all inſects are divided into two principal ſections; thoſe with jaws, and thoſe without jaws. In the firſt of theſe orders are comprehended the gnathaptères, neuroptères, hymenopteres, coleopteres, and orthopteres; the ſecond, conſiſting of ſuch as are deſtitute of jaws, are, hemipteres, lepidopteres, dipteres, and apteres. The fifth volume of "Bibl. Hiſt. Nat. Bankſiana," the addenda of which contains ſome further mention of entomological writers, was alſo publiſhed in 1800. The laſt work that appeared in the preſent year was "Donovan's Inſects of India," a publication correſponding in ſize, and ſtyle of embelliſhment, with the "Inſects of China," and, like that work, embracing in a general, though ſcientific view, a comprehenſive diſplay of the more curious, rare, and ſplendid ſpecies peculiar to thoſe fertile regions, the entomology of which it is deſigned to explain. This work, as in the former inſtance, is conſtituted from the firſt ſources of original information. The more immediate intention is the elucidation of the entomological production of the Britiſh poſſeſſions in India; but it contains alſo a variety of inſects of the more beautiful kinds diſcovered in the interior of that vaſt continent, and in the iſlands ſituated in the Indian ſeas.

Lamarck's "Syſtême des Animaux ſans Vertèbres," printed at Paris in the 9th year of the revolution (1801), preſents a new mode of arrangement for inſects. Theſe its author propoſes to divide into three primary claſſes; namely, 1ſt, thoſe with mandibles and jaws; 2d, thoſe with mandibles and a kind of trunk; 3d, thoſe without mandibles, but having a trunk or ſucker. The firſt of theſe claſſes contains the coleopteres, orthopteres, and neuropteres; the ſecond is confined to the ſingle order hymenopteres; and the third includes the lepidopteres, hemipteres, dipteres, and apteres. The coleopteræ are ſub-divided into three families, according to the number of joints in the feet, as thoſe with five joints in all the feet; thoſe with five joints in each the four anterior feet, and four in thoſe of the poſterior pair; and thoſe with only three joints in all the feet. Moſt of the Linnæan aptera are removed to another claſs preceding the inſect tribe; the only Linnæan genus of aptera, admitted by Lamarck into his order apteres, is the pulex.

The publication of "Marſham's Entomologia Britannica" commenced in the year 1802, with the production of the volume in which the coleopteræ are deſcribed. As the outline of the arrangement adopted by this author is ſtrictly Linnæan, thoſe after the manner of that naturaliſt conſtitute the firſt ſeries, and are to be ſucceeded progreſſively by the hemiptera, lepidoptera, and other remaining tribes. For the purpoſe of this continuation very ample materials are provided. Mr. Marſham, whoſe abilities as an entomologiſt are well known, has devoted many years of his life to this laudable object: his collection of Britiſh inſects is of the firſt claſs, and his manuſcripts of the moſt valuable kind. The completion of this work muſt be therefore anticipated as a deſirable event. The merit of the firſt volume is acknowledged, and ſhould the future part appear with correſponding excellence, we could not heſitate in pronouncing it one of the moſt important works of its kind that has appeared.

Kirby's "Apum Angliæ" was alſo printed in 1802. This work contains much curious information relative to the bees of this country; a path of entomology in which its ingenious author has trod with great ſucceſs. The Linnæan genus apis Mr. Kirby conceives it neceſſary to divide into two genera, to one of which he retained the original name, the other he terms melitta, and under both genera he deſcribes many ſpecies, ſome of which are noticed for the firſt time in this intereſting work. Latreille, who has written on the Linnæan genus apis, and is eſteemed an entomologiſt of ability, pronounces this "un bon travail." The ninth volume of the Tranſactions of the Linnæan Society contains an ingenious paper on the apian genus of Herbſt by Kirby; and there are alſo two or three other papers diſperſed in thoſe volumes, by the ſame writer, well deſerving of attention.

The contents of the ſecond and third volumes of Turton's tranſlation of the Linnæan "Syſtema Naturæ a Gmelin," relate entirely to entomology. This work deſerves further obſervation. The editor does not, in treating of inſects, confine himſelf to the direct tranſlation of his author; he introduces ſome commendable improvements in the arrangement after the Fabrician manner; and he beſides incorporates from other entomological works of credit, publiſhed ſince the time of Gmelin, whatever prominent traits of information he conceived calculated to amend the original work. We may eaſily perceive that Dr. Turton has availed himſelf of the Fabrician "Entomologia Syſtematica" to a greater extent than Gmelin, and has by this means rendered more eſſential ſervice to the Engliſh reader.

The pages of "Donovan's Tour through South Wales and Monmouthſhire," lately publiſhed, are interſperſed with obſervations on the various natural productions of the intereſting tract of country immediately under conſideration. Thoſe digreſſions, from objects of more general moment, if ſuch the reader be inclined to deem them, we at leaſt may preſume to think important; and ſo far as theſe relate to the ſcience of entomology in particular, conceive they may, without impropriety, be adverted to in this place.

"Donovan's Inſects of New Holland," including alſo thoſe of New Zealand, New Guinea, and the ſeveral iſlands in the Great Southern and Pacific ocean: this accords with the "Inſects of India," already mentioned, being in quarto, with ſcientific and general deſcriptions, and in having the ſimilar accompaniments of accurately coloured plates. Of this work it will be alone ſufficient to obſerve, that through the diſtinguiſhed favour beſtowed on the deſign, the author was allowed to enrich his volume with delineations of thoſe uncommon inſects collected during the voyage of captain Cook, by thoſe celebrated naturaliſts who accompanied that circumnavigator round the world, and which appear for the firſt time in this work.

The ſixth volume of "Shaw's General Zoology" is offered as an illuſtration of the ſcience of entomology. The work profeſſes only to elucidate the Linnæan genera of inſects, with the hiſtory of the principal ſpecies. This being the intention of its ingenious author, the work is comprized in a very moderate compaſs. The plates are rather numerous, and in general remarkable for the neatneſs of engraving. Theſe, however, are not original, being compiled from the plates of Seba, Roſel, Swammerdam, Barbut, and others. The "Naturaliſt's Miſcellany" contains a variety of coloured figures of the more ſplendid kinds of exotic inſects, with deſcriptions extremely ſuitable to the general claſs of readers, for whoſe purpoſe they are deſigned.

Laſtly, we ought to mention the work of Coquebert, entitled "Illuſtratio iconographia," recently publiſhed in France: the late entomological tracts of Olivier and Latreille, the "Faune Pariſienne" of Walcknaer, and the papers on different tribes of inſects inſerted in the Tranſactions of the Linnæan Society of London; the Societé d'Hiſtoire Naturelle of Paris, and thoſe of various other learned inſtitutions, through the medium of which they are diſtributed to public obſervation.

Our review of entomological writings is at length drawn to concluſion. In its progreſs we have endeavoured to include every work of importance in this department of ſcience, that has appeared. To what has been advanced reſpecting theſe, nothing material can be added in this place; it was our aim, throughout the preſent inquiry, to point out the leading character of each work, while paſſing under immediate conſideration, and for this reaſon we ſhall abſtain from offering any general comments. By connecting the whole in the order of time in which they were produced, our object has been to ſhow at one glance, ſo far at leaſt as our ſlight compariſons would permit, thoſe eſſential reſpects in which each has materially improved upon his predeceſſor; and by that means mark the progreſſive advancement made in the ſcience with ſome preciſion. We ſhall finally diſmiſs this part of our ſubject with obſerving, that it is poſſible ſome few works of real worth may have eſcaped our mention; the number of theſe, however, we are perſuaded, muſt be very inconſiderable, and confined to ſuch as have recently appeared in countries remote from Britain.

Claſſification.

It will be obſerved, from the preceding obſervations, that naturaliſts entertain very diſtinct opinions as to the principles on which the claſſification of inſects ought to be founded. This diverſity of idea ariſes from the different views under which they have been conſidered. Valiſneri divides inſects into four claſſes, according to the places in which they live, as plants, in water, in the earth, or upon the bodies of other animals. Agricola into three, namely, thoſe which walk, fly, and ſwim; Frenzius, into flying inſects, aquatic inſects, and terreſtrial or creeping inſects. Swammerdam diſtributes them into claſſes from their appearance in the ſtates preceding their final transformation, without particular regard to the laſt or complete ſtate. In this reſpect Swammerdam is followed by Ray, whoſe two primary claſſes are, of thoſe which undergo transformation, and thoſe which do not; and his orders are determined from their metamorphoſes, and the number of their feet. Liſter has given a ſyſtem founded on the figure of the egg in which the inſect is incloſed, and the number of the feet. The difference obſervable in the texture, and alſo in the number of the wings, form the diſtinctions of the primary diviſions of Linnæus. And laſtly, the principal characters upon which inſects are diſtributed, in the arrangement of Fabricius, is taken from the ſtructure of the mouth. Each of the ſyſtems founded on thoſe diſſimilar characters have gained admirers. The characters of the Linnæan and Fabrician ſyſtems appear the beſt, and are moſt univerſally approved.

General obſervations on Inſects.

Inſects are a race of animals deſtitute of internal bones, in which reſpect they accord with a very extenſive number of natural families in the lower orders of animated beings. Their bodies are kept in a ſtate of moiſture by the circulation of lymphatic tranſparent juices inſtead of red blood, and in this particular agree with the worm tribe. They have no diſtinct heart, external ears, openings at the noſe, or noſtrils, nor teeth in the mouth; and ſome aſſert that they are deſtitute of voice. An inſect is divided into ſegments, or joints, and covered externally with a tough or bony ſkin, which is either naked or clothed with down. The head is furniſhed with moveable antennæ, and the body with feet.

Theſe animals are deſtitute of viſible external organs of breathing at the mouth, their reſpiration is performed through the lateral apertures, or ſpiracles of the body and thorax.

They have two eyes, in which reſpect they agree with the larger tribe of animals: they have no eyelids, and their eyes are rarely placed on a pedicle; the diopſis is an exception.

The antennæ are ſituated on the head before the eyes; and are compoſed of an indefinite number of articulations; in genuine inſects, the antennæ never exceed two. The cancri have a greater number, and many of the Linnæan apteræ have none.

The feelers are articulated, moveable, variable in number from two to ſix, and are affixed contiguous to the mouth.

The mouth is uſually ſituated beneath the head.

The jaws are diſpoſed tranſverſely in the head, and move laterally, by which means they are diſtinguiſhed from moſt other animals.

The trunk is placed between the head and the abdomen.

The abdomen is uſually annulated with five ſegments, and is ſometimes armed at the end with a ſting.

The legs are uſually ſix in number, and are attached to the trunk. Each leg conſiſts of three diſtinct diviſions, the thigh, ſhank, and feet.

The wings are either two or four; ſome of thoſe with two wings only are protected by a ſhelly covering, as in the coleopteræ.

Inſects are oviparous; depoſit their eggs in an impregnated ſtate in general, and do not brood over them, or their young. Moſt inſects undergo a triple transformation, the egg producing a grub or larva, which becomes, when full grown, a pupa, and the later producing the perfect fly. The ſexes are male and female; there are alſo neuters in ſome ſpecies devoted to labour for the former. Inſects caſt their ſkins, and therein agree with reptiles. They are ſaid to inhabit thoſe plants on which they uſually feed.

Deſcription of the component parts of Inſects.

The external parts of which inſects conſiſt are divided into four principal ſections, the head, trunk, abdomen, and members, each of which require to be ſeparately conſidered.

Caput, or *Head.*—Under this term is included the firſt, or principal organ, the head, properly ſo denominated in its collective form. This part is ſuppoſed to be the principal ſeat of the ſenſes, as in all others of the larger and apparently more perfect animals. Internally it contains the medullary ſubſtance or brain; its exterior characters are, the mouth, eyes, ſtemmata, antennæ, front, vertex, and throat.

In ſome inſects the head is very large in compariſon with their body. The proportion between the head and body is not the ſame in all inſects, even in the different ſtages of growth or transformation. In the caterpillars, which have this part horny, it is generally ſmall before they moult, or change their ſkin, and becomes larger after each moulting.

This part is almoſt conſtantly diſtinct from the thorax: in the coleoptera it is connected cloſe to the latter: the hemiptera offer many examples in which the head is ſlightly attached, as in the genera blatta, acheta, phaſma, mantis, &c.: in the lepidoptera order the head is not always very intimately ſituated to the thorax; there is a ſmall interval ſometimes between which the articulation of the neck may be ſeen, when the head is inclined downward. The ſucceeding order, neuroptera, afford numberleſs inſtances of the head being placed upon a ſlender ligamentous pedicle at a diſtance from the thorax: in hymenoptera and diptera the head is rather remote, ſometimes being placed on a ſmall tubercle in the anterior part of the thorax; and in the laſt, or apterous order of Linnæan inſects, ſeveral of the genera are diſtinguiſhed by having the head and thorax confounded with each other, as in ſcorpio, aranea, monoculus, &c.

The connection between the head and thorax in inſects ſubſiſts by one of two modes of articulation; the firſt, in which the point of contact is ſolid, and the motion depends upon the ſhape of this part, or another in which the articulation is formed by a ligament. In the articulation of the head by the contact of the ſolid parts, the head has commonly, at the part anſwering to the neck, one or two ſmooth tubercles, which are received into correſpondent cavities on the anterior part of the thorax. This is exemplified in the genera ſcarabæus, lucanus, cerambyx, and moſt other coleoptera, and which hence have the power of moving the head backward or forward, and thus of directing the mouth downward. Another mode of ſolid articulation takes place when the poſterior part of the head is rounded, and turns on its axis in a correſpondent ſocket on the anterior part of the thorax, as in the brentus, &c. The axis of motion is then in the centre of the joint, and the mouth of the inſect can be directed either upward or downward, or to the right and left. A third ſort of articulation occurs when the head is truncated behind, and joins by a flat ſurface either to a tubercle of the thorax or to another flat and correſponding ſurface, as is ſeen in many of the hymenoptera and diptera. In ſome kinds of the Fabrician attelabi, this ſolid articulation is accompliſhed by another means: the head of theſe inſects terminate behind in a round tubercle, which is received into a correſpondent cavity of the thorax: the inferior edge of this cavity is notched, and thus confines the motion of the head to one direction.

The ligamentous connection of the head and thorax is ſhewn in the blatta, forficula, mantis, and ſeveral of the neuroptera. In this mode of articulation, the motion of the head is very extenſive, and confined only towards the back, in which direction it is oppoſed by the projection of the back. The muſcles which move the head are ſituated within the thorax: the membranes or ligaments extend from the anterior part of the collar to the ſurface of the occipital foramen.

Brain, or Medullary Subſtance.—According to the "Fundamenta Entomologiæ," it was the idea of Linnæus, that inſects have no brain in the head; an opinion often repeated ſince his time, but which, from the obſervations of the ableſt phyſiologiſts of the preſent period, proves to be unfounded. Linnæus does not deny the exiſtence of a medullary thread in this part of inſects, but ſtates that he never could diſcover it to be organiſed; and hence, he ſays, the hippoboſca equina, or horſe-fly, will run, live, nay even form an union with the oppoſite ſex, after being deprived of its head, to ſay nothing of many others, which are capable of living for a conſiderable while in a decapitated condition. From the anatomical inveſtigations of Cuvier it is, nevertheleſs, ſufficiently obvious, that independently of a nervous medullary thread, inſects have a brain diſtinctly organiſed, from which this thread and other nerves ariſe, and that its ſeat is in the head, as in the more noble tribe of animals. The exiſtence of a true brain in inſects was believed by many writers before the time of Linnæus, and by ſome after; but, generally ſpeaking, the opinion of this celebrated naturaliſt was aſſented to, and enquiry ceaſed, till its conſideration was revived by Fabricius, and the phyſiologiſts of France, the moſt diſtinguiſhed of whom is Cuvier, and from the reſult of their obſervations it may be affirmed, that inſects, as well as moſt other animals, have a genuine brain.

Fabricius is reputed to be the firſt who diſcovered the true brain in inſects. That Fabricius affirms the fact, and that as an entomologiſt his aſſertion was ſucceſsfully oppoſed to the opinion of Linnæus in this reſpect, is not to be denied, yet the merit of diſcovery is by no means due to this writer. His obſervations on the brain, the organs of hearing, and other ſenſations of inſects, were made chiefly on the lobſter or cray-fiſh, animals of the cruſtaceous kind, and which, though in ſome reſpects analogous, we do not admit to be of the inſect race. But if they were, can we have ſo entirely forgotten the anatomical inveſtigations of cancer aſtacus by Roeſel, as to allow Fabricius the credit of diſcovering thoſe very organs which he deſcribes many years before; and if he really obſerved thoſe organs in genuine inſects, can we overlook the laborious anatomical enquiries of Swammerdam, or the minute reſearches of Lyonet, in which the exiſtence of ſuch an organ is rendered manifeſt, with no other view than to award the merit of its diſcovery to Fabricius?

No phyſiologiſt whatever has purſued this intereſting ſubject of enquiry ſo far as Cuvier. This attentive and ſkilful obſerver examined a conſiderable number of the different tribes of inſects, in order to aſcertain their internal organization, and has eſtabliſhed, beyond diſpute, if any doubt could ſtill remain, that inſects have a brain in the head. From Cuvier we alſo learn that the brain is not conſtantly of the ſame ſtructure in all inſects; in ſome tribes this organ conſiſts of one lobe, in others of two, and in others again of four; and the nerves ariſing from them differ alſo very materially in different families, and ſometimes even in ſpecies. But beſides this diſſimilarity, there is another circumſtance infinitely more remarkable, the form of the brain and medullary nerves in certain inſects, are aſcertained to undergo a conſiderable change, as well as the external organs, in paſſing from the larvæ to the perfect ſtate. The moſt extraordinary of theſe deſerve notice, and the circumſtance being ſtated may ſtimulate others, perhaps, to a farther enquiry, in the reſult of which, it is apprehended, a ſimilar change, will be obſerved, in a far greater number of the inſect race than may be at preſent conceived.

Brain in Coleopterous Inſects.—The larva of a large beetle, common in Europe, and known by naturaliſts under the name of ſcarabæus naſicornis, affords a favourable opportunity for the aſcertainment of this fact; it is of a large ſize, and the change it undergoes in paſſing to the winged ſtate is very conſiderable. The brain in this larva is ſituated under the great ſcale which covers the head, immediately above the origin of the œſophagus. It conſiſts of two approximate lobes, which are very diſtinct at the front and back part. Four nerves ariſe from the anterior part, two on each ſide, which are loſt in the cirri and parietes of the mouth, one pair of nerves ariſes alſo from the lateral and ſomewhat poſterior part of the brain, which, embracing the œſophagus, proceeds below to form a nervous cord; and another pair is produced from the lower ſurface of the brain. In the perfect inſect, the nervous cord preſents a very conſpicuous difference; in the larva there is only a ſingle ganglion, but the perfect inſect has ſeveral, and which are very diſtinct. The firſt is ſituated above the condyle: it proceeds from the two poſterior filaments of the brain, and is diſtributed to the muſcles which move the head on the corſelet. Its poſterior part produces two filaments, which paſs into the breaſt, where they unite towards the middle, and form a triangular ganglion, from the ſides of which three pairs of nerves ariſe, and are diſtributed to the muſcles. Its poſterior angle detaches two parallel nerves which proceed into the breaſt, where they form a third and fourth ganglion, ſituated very near each other, and apparently divided into two lobes by a longitudinal furrow. All the other nerves of the body proceed from theſe two ganglia, by an irradiation preciſely in the ſame manner as in the larva.

The nerves in the larva of the ſtag beetle (lucanus cervus) differ greatly from that of the foregoing inſect. The brain conſiſts of two contiguous and almoſt ſpherical lobes, which produce four nerves anteriorly; two beneath and two behind, which latter form a collar round the œſophagus, and uniting underneath compoſe the nervous cord of the body. The cord is formed of eight ganglia, and extends to the ninth ring of the body. In the perfect ſtate the brain conſiſts likewiſe of two approximate lobes of a ſpherical form. There are alſo two ganglia on the lateral parts of the brain, which are almoſt as large as each of the lobes: in form they reſemble a pear, and reſt on the brain by their baſe: the two anterior pairs of nerves ariſing from the brain terminate in the palpi and other parts of the mouth. The brain produces alſo two very long and ſlender nerves behind, and the diſpoſition of the nerves ariſing from the various parts differ very much from thoſe obſervable in the larva.

The nervous ſyſtem of the larva of hydrophilus piceus, or great water beetle (dytiſcus, Linn.), will ſerve to illuſtrate thoſe of an extenſive number of other coleopterous inſects, ſuch as the larva of cerambyces, dytiſci, carabi, ſtaphylini, &c. Some little variation will be found, but the analogy is very conſpicuous. The brain in the larva of this inſect is ſituated in the head above the origin of the œſophagus; it is formed of two lobes, which lie very cloſe together. From its anterior part it detaches ſome filaments to the palpi, the antennæ, and the parietes of the mouth. Its lateral parts produce two cords, which ſurround the œſophagus, and which are the origin of the nervous cord ſituated inferiorly. The chief nervous cord is compoſed of ten ganglia, each of which produces three pairs of nerves, which are loſt in the muſcles of the abdomen. In the perfect inſect the brain conſiſts of two ſpherical bulbs, which are cloſely united. The lateral parts give origin to the optic nerves. The anterior part of the brain detaches ſome filaments intended for the parietes of the mouth. In the ſame place is alſo a ſmall ſpherical ganglion, which ſeems to belong to the recurrent nerve that accompanies the œſophagus. The brain in the larva of dytiſcus marginalis is different from that in the larva of hydrophilus piceus, although thoſe two inſects are ſo cloſely allied in genera; in the latter it is ſpherical, and conſiſts of a ſingle lobe, it is ſituated in the head above the origin of the œſophagus: its anterior part produces ſome filaments for the mouth, and its lateral parts the two optic nerves: the latter are compoſed of two parts, which are very diſtinct in form. That portion next to the brain is of an oval figure, pointed at the extremity which joins the brain, the other extremity is rounded, and produces a ſlender nerve, which paſſes directly to the eye.

Hemiptera.—The ſtructure of the nervous ſyſtem in the larvæ of hemipterous inſects does not often differ very ſenſibly, it is ſaid, from that which is exhibited in the perfect inſect to which they reſpectively belong. But the ſmall number of this tribe already examined do not authoriſe us to ſpeak on this ſubject with much confidence. A conſiderable difference prevails in this reſpect between the perfect inſects of ſome oppoſite genera, as appears from thoſe which Cuvier deſcribes. In the cock-roach, blatta americana, the brain is compoſed of two lobes, ſeparated by a very diſtinct notch anteriorly. The optic nerves ariſe on the ſides, and its anterior part detaches ſome filaments to the parietes of the mouth, and to the inſtruments of manducation. The nervous cords, which form the medulla, ariſe from its inferior ſurface. In the great green locuſt (gryllus viridiſſimus) the brain is ſituated in the head above the œſophagus; it conſiſts of two lobes, which are pyriform, united at their baſe, and prolonged at their other extremity into an optic nerve for the eye of each ſide. The anterior part alſo produces two nerves of a pyramidal form, the baſe of which reſts upon the brain. The brain of the mole-cricket (acheta gryllo-talpa) is compoſed of two rounded lobes, which are particularly diſtinct at the poſterior part. The nervous ſyſtem of the water ſcorpion (nepa cinerea) is different. This conſiſts of three ganglia, the firſt of which (properly the brain) is ſituated in the head. It is formed of two approximate pyriform lobes, which touch each other at the baſe, while their ſummits are directed obliquely forward towards the eyes in which they terminate: the middle and anterior part of theſe lobes alſo produce filaments for the parts of the mouth; the third, which is more voluminous than the brain, lies near the baſe of the ſecond pair of legs.

Lepidoptera.—The nervous ſyſtem of caterpillars, or lepidopterous inſects in the ſtate of larvæ, conſiſts of a ſeries of thirteen principal ganglia, which furniſh filaments to all the other parts of the body. The firſt of theſe ganglia is what may properly be conſidered as the brain: it is ſituated in the cavity of the head above the œſophagus, and conſiſts of two round tubercles, which are concave beneath, and correſpond to the convexity of the œſophagus. This ganglion communicates with the reſt of the nervous cord by two thick filaments, which embrace the œſophagus, and which are united below it to the anterior and lateral parts of the next ganglion; and it beſides produces eight pairs of nerves. The firſt partly unites with other filaments; produces ſome for the œſophagus, and forms ſeveral remarkable ganglia below the lower lip. The largeſt and moſt poſterior, which Lyonet has named the firſt frontal ganglion, is prolonged behind into a thick recurrent nerve, which is continued the whole length of the body contiguous to the back. The ſecond pair of the brain appears chiefly intended for the antennæ, though it furniſhes ſeveral filaments to the neighbouring parts, and the others for the more remote portions of the body. Theſe obſervations are from Lyonet, and relate principally to the larva of the goat moth (phalæna coſſus of Linnæus.) Few of the lepidopterous inſects in the winged ſtate have yet been examined for the purpoſe of aſcertaining the ſtructure of the brain. In phalæna diſpar this organ is almoſt ſpherical; there is, however, a longitunal furrow on the middle line. Its anterior part produces ſome exceeding ſlender nerves. There are alſo two large optic nerves on the ſides which proceed into the concavity of the eye, where they terminate by a bulb, from whence ariſe a great number of filaments.

Neuroptera.—In the larva of the lion-ant, (myrmellon formicarius) the nervous medulla, proceeding from the brain in the head, conſiſts firſt of two ganglia, which are compoſed of two lobes ſituated cloſe together, and are placed in the thorax; the remainder of the nervous medulla, conſiſting of eight ganglia placed in very cloſe ſeries, and each formed of two lobes, is contained in the abdomen. The larva of the ephemeræ has eleven ganglia, excluſive of the brain, which furniſhes two large optic nerves. The larvæ of the libellulæ, or dragon flies, have a ſmall two-lobed brain, which produces optic nerves, larger or ſmaller in different ſpecies.

The Fabrician genus æſhna has the largeſt. The reſt of the nervous ſyſtem forms a ſeries of ganglia of different ſizes. In the æſhna the thorax contains ſix, the two laſt of which are the largeſt, and there are ſeven ſmall and equal ganglia in the abdomen. In the winged ſtate the brain is formed of two very ſmall lobes, and the optic nerves are dilated into the form of two very large plates, which have the figure of a kidney, and which is ſpread upon all the inner ſurface of the eye next the head. The remainder of their medullary cord is exceedingly ſlender, and furniſhed with twelve or thirteen ſmall ganglia, the laſt of which is, as uſual, connected with the organs of generation.

Hymenoptera.—The brain in the larvæ of ſome kinds of tenthredines, which have the head large, is broad and ſhort, and ſeems to conſiſt of four bulbs of equal magnitude, and the form of which is nearly ſpherical; the two external ones ſerve as the baſe of the optic nerves, which are ſlender, and enlarge a little at their other extremity. The firſt ganglion is produced by two very ſmall nerves, which ariſe from the inferior ſurface of the brain, and which, after having embraced the œſophagus, unite under the firſt ring of the body; it furniſhes filaments to the muſcles of the feet, and terminates poſteriorly in two other nerves, which, at the diſtance of one line, produce a ſecond ganglion, and ſo on in ſucceſſion: the nervous cord is in this manner formed of eleven ganglia, excluſive of the brain: all the ganglia are of a roundiſh form, and diminiſh in thickneſs as they recede from the head. The brain of one of the hymenopterous tribe in the winged ſtate (the common bee) is rather ſmall, and is divided into four lobes. It produces the nerves which are diſtributed to the different parts of the mouth, and the two large optic nerves which are dilated, and applied behind each eye, as in the libellulæ. There are afterwards ſeven ganglia, three of which are in the thorax and four in the abdomen. The nerves of the laſt chiefly ſupply the ſexual organs.

Diptera.—The nerves of the larvæ, in ſome of the Linnæan muſcæ, as m. chamæleon, &c. (ſtratiomys, Fabr.) have ſome reſemblance to thoſe of the larva of ſcarabæus naſicornis. The brain is formed of two lobes placed cloſe together and almoſt ſpherical; it is ſituated above the œſophagus, on a level with the ſecond ring of the body. A number of ſmall nervous filaments ariſes from its anterior part, and they are diſtributed to various parts of the mouth. The poſterior part of theſe two lobes ſends forth two thick branches, which embrace the œſophagus, and form the origin of the nervous medulla. This nervous cord is very ſhort, and in diameter one half leſs than that of the brain. It conſiſts of eleven ganglia placed very near each other, each of which produces one pair of nerves.

A more ſingular appearance is exhibited in the ſtructure of the nervous ſyſtem of muſca putris than that juſt deſcribed. The brain is ſituated immediately above the origin of the œſophagus behind the head; it is very large in proportion to the reſt of the body. The anterior part is notched, poſterior rounded, and appears altogether as if formed of two lobes. A pair of nerves ariſes from the anterior part of the brain, proceeds forward, and is diſtributed to the mouth. Theſe nerves become conſpicuouſly large previouſly to diſtribution. Poſteriorly the brain preſents an aperture which affords a paſſage for the œſophagus: the nervous part, ſituated at the ſides, may be regarded as cords which produce the medulla, and all below the œſophagus as the medulla itſelf.

Muſca tenax (Linn.) in the perfect ſtate has a ſmall brain, formed of two lobes, which are ſituated very near together, but diſtinguiſhed by a longitudinal furrow; the anterior part produces a large nerve, which is afterwards diſtributed to the antennæ and the proboſcis. In aſilus crabroniformis is a ſingle cord uniting the abdominal ganglia, which are ſix in number. The brain itſelf is ſimilar to that of the ſyrphus (as in muſca inanis, &c.) but the bulbs formed by the optic nerves are ſtill broader in proportion to the extent of the eyes they have to inveſt.

Aptera.—In the great centipede, ſcolopendra morſitans, the brain has a very ſingular form: the two lobes of which it is compoſed are almoſt ſpherical; the optic nerve is produced laterally and is very ſhort. The filaments are four in number, but two nerves ariſe anteriorly which are ſo very thick, that they appear part of the brain, to which they are equal in diameter. Theſe nerves are particularly intended for the antennæ, into which we obſerve them enter. The two cords which embrace the œſophagus proceed directly downward, and form a large ganglion at the union of the firſt ring with the head. The firſt ganglion produces two nerves poſteriorly, and ſeveral towards the ſides. A ganglion, preciſely of the ſame ſhape, is placed above each of the articulations: thus there are in all twenty-four very diſtinct ganglia in this inſect, from each of which are detached three pairs of nerves.

Mouth.—In order to afford ſome idea of the amazing difference that prevails in the ſtructure of the ſeveral parts or organs which conſtitute the mouth, it will be only requiſite to obſerve that the claſſification of all inſects, in the Fabrician ſyſtem, is founded on this character. There are ten principal parts of which the mouth conſiſts; and it is from the relative proportion of each, from the diſſimilarity in the form, poſition, variation in number, or occaſional peculiarities, that the moſt permanent characters are deduced. Theſe parts have one diſadvantage: they are generally ſmall, and from this circumſtance have not been ſo univerſally adopted in the arrangement of inſects as they would otherwiſe. Without, however, beſtowing ſome little attention to theſe organs, it is impoſſible to diſtribute inſects into their natural order with any great degree of certainty.

The organs of the mouth were ſlightly regarded by Linnæus; and to this cauſe alone we may attribute ſome few ſerious errors in the works of that naturaliſt. The parts he deſcribes are the roſtrum (or proboſcis), maxillæ, lingua, and labium ſuperius. Some of theſe are not ſufficiently diſcriminated; his roſtrum and proboſcis are not different; the maxillæ are confounded with the mandibulæ; and the labium ſuperius is not, as the expreſſion implies, the upper lip of the inſect, this latter part being ſituated under it. Fabricius defines theſe parts with more preciſion, as he derives his eſſential characters from them. In the arrangement of Olivier, in the works of Latreille, and moſt other modern writers on entomology, the eſſential characters are eſtabliſhed chiefly on the peculiarities of theſe organs.

The ten principal parts of which the mouth conſiſts are the following.

Labium ſuperius, or upper lip: a tranſverſe, ſoft, moveable piece of a coriaceous or membranaceous nature, known from its ſituation at the anterior or upper part of the mouth. This part is very diſtinct in many of the coleoptera, and in the gryllus, apis, and ſome other genera. Linnæus ſometimes confounds the upper lip with the clypeus or ſhield of the head; and ſimilar inſtances occur in the works of Fabricius. Theſe two parts may be diſtinguiſhed by one invariable character; the clypeus is fixed, and forms a portion of the head; the upper lip is moveable.

Labium inferius: the piece which terminates the mouth beneath, and which is ſometimes lengthened, ſo as to form the inſtrument called ligula. It is ſoft, flexible, uſually bifid, and has the poſterior pair of feelers placed at the baſe.

Mandibulæ, mandibles: two hard pieces, in ſubſtance reſembling horn, which are placed one at each ſide of the mouth, below the upper lip. Theſe have a lateral motion, while the upper and lower lip move up and down, as in other animals. Theſe differ from the maxillæ, with which they are ſometimes confounded, by not having any of the palpi or feelers attached to them. In rapacious inſects, theſe are larger and more powerful than in thoſe which perforate wood; and the latter again have ſtronger mandibles than inſects which feed only on herbage or leaves.

Maxillæ: two ſmall pieces of a ſomewhat membranaceous conſiſtency, and in figure different from the mandibles. Theſe are commonly indented at the extremity, and nearly all ciliated at the inner edge. They are placed under the mandibles, and above the lower lip; their motion is lateral. In thoſe inſects which have more than one pair of feelers, the poſterior ones take their origin from the ſides of the maxillæ.

Galeæ.—Shields of the mouth, two membranaceous appendages, uſually of a large ſize and cylindrical form, placed one on each ſide, at the exterior part of the jaw, and which cover and protect the organs of the mouth, conjointly with the lips. The galeæ are inſerted at the back of the jaws, as is well exemplified in the gryllus tribe.

Organs of Taſte.

Theſe appertaining of courſe, like the foregoing, to the mouth, and of which they conſtitute the moſt material part, admit of conſiderable variety in their formation, and in ſome particular tribes differ ſo greatly as to have obtained diſtinct names in the works of entomologiſts, according to their preciſe form; ſuch, for example, as ligula, lingua, roſtrum, proboſcis, and hauſtellum.

Ligula.—This is the part conſidered by many authors as the lower lip; its ſituation is immediately under the jaws; and it conſiſts of a ſingle piece, which is of a ſoft texture, often bifid, and, if attentively examined at the baſe, will be found of a horny ſubſtance.

In the coleoptera, and ſome of the hemiptera, as the blatta, phaſma, gryllus, &c. this tongue terminates at the point in a membranaceous ſubſtance: its form is extremely various in the different genera. The hymenoptera and ſome neuroptera have the tongue or ligula ſituated in the ſame manner; but it is in theſe concave, and is frequently prolonged into a ſort of proboſcis, which ſometimes exceeds the length of the whole body. It is membranaceous, but of a ſoft and ſpongy texture, and well ſuited for receiving the impreſſions of taſte. This kind of tongue is extremely well exemplified in the bee.

Lingua: tongue, the involuted tubular organ which conſtitutes the whole mouth in lepidopterous inſects. This is of a ſetaceous form, and either very long, as in the papilio and ſphinx genera, or ſhort, as in moſt of the bombyces and other moths. It conſiſts of two filamentous pieces, which are externally convex, concave within, and connected longitudinally by a ſuture along the middle above and beneath. Theſe in uniting form a cylinder, through which the nectareous juices of the flowers on which theſe inſects ſubſiſt are drawn up with facility. Theſe two pieces are not very cloſely united, and may be ſeparated by means of a needle point. When the inſect takes its food, this tube is exſerted; at other times it is rolled up ſpirally between the palpi.

A curious circumſtance is mentioned by Degeer, relative to the tongue of the butterfly. Having cut off the tongue of a papilio antiopa, almoſt as ſoon as it was emancipated from the chryſalis, it moved and rolled itſelf up at intervals for a conſiderable time: an hour after it had been cut off it repeated the ſame motions, recommencing them every time it was touched. It was obſerved that the ſame effect did not follow, if the butterfly had been liberated from the chryſalis for a few days.

Roſtrum, or beak: the part which forms the mouth in many of the hemipterous order of inſects. This inſtrument is moveable, articulated, and bent under the breaſt. Within this beak is hollow, and contains, as in a ſheath, three or more very fine and delicate briſtles, the points of which theſe inſects introduce into the body of the animal, or ſubſtance of the plants, from which they draw nouriſhment. The roſtrum is conſpicuous in the genera cicada, nepa, and cimex.

Proboſcis.—The trunk is inſerted in place of the mouth, in moſt dipterous inſects. It is rather fleſhy, retractile, of a ſingle piece, and often cylindrical; the end forming two lips, which are of a ſoft ſubſtance, and from the delicacy of their teguments muſt poſſeſs the faculty of taſte in a very high degree.

Hauſtellum.—Formed of two or more very ſmall and delicate filaments, incloſed in a ſheath of two valves.

Lingua, roſtrum, and proboſcis, are Linnæan terms: the firſt is adopted according to the definition of that ſyſtem; the two latter are ſynonymous with Linnæus. Ligula is a Fabrician expreſſion, indicating the lower lip.

Palpi.—Feelers. Theſe are the ſmall, moveable, filiform organs, or appendages, placed at each ſide the mouth in the generality of inſects. In ſome reſpects they reſemble the antennæ, but are more diſtinctly articulated. They vary in number in different inſects, being either two, four, or ſix, and are commonly inſerted at each ſide the exterior part of the jaw. In thoſe which have only one pair, they are uſually ſituated on the upper lip; when two or more, the poſterior ones are generally on the lower lip; and in ſome inſects furniſhed with a ſucking trunk, they are oftentimes found inſerted at each ſide of that organ. Theſe feelers are compoſed of ſeveral joints, the number of which vary. Like the antennæ, to which they bear analogy, they are endowed with powers of motion, but ſtill more extenſively. They alſo ſerve, like the antennæ, as an eſſential character in the conſtruction of genera; and from their ſituation, the number of joints, termination, and relative proportion and ſize, are exceedingly uſeful for that purpoſe.

Theſe feelers, as their name implies, are conſidered as the organs of touch; and this is conceived probable, becauſe the inſect agitates theſe parts, and preſſes its food with them before it begins to eat. Some have ſuppoſed them to be the organs of hearing; and others of a ſenſe peculiar to inſects, which we are ignorant of. It has been aſcertained from experiment, that they are not abſolutely neceſſary to the life of the inſect, and that it even ſuſtains their loſs without much apparent inconvenience. Feelers are not common to all inſects. There are many whole genera deſtitute of them; as, for example, the fulgora, cicada, the ſeveral genera of the Linnæan cimices, nepa, notonecta, and various others.

Certain kinds of inſects are provided with feelers, both in the larva and perfect ſtate, as is particularly exemplified in the dytiſcus and hydrophilus genera, and again in the libellulæ; and it is worthy of remark, that theſe organs appear to be more immediately uſeful to the carnivorous tribes of inſects than to thoſe which feed on plants.

Olfactory organs.—Nature has denied the inſect race that particular part which is properly called the noſe; and it is further evident, that there is no organ within the head appropriated to the ſenſe of ſmell. From analogy, and compariſon with other animals, naturaliſts have been led to ſeek this organ in the head: and as inſects afford the moſt convincing evidence of being poſſeſſed of this faculty, ſome have placed it in the antennæ, and others in the feelers; neither of which, from attentive examination, appears calculated for this purpoſe.

It is ſufficiently clear that inſects poſſeſs the faculty of ſmell, if not in a very eminent degree, and that in many reſpects they are rather guided by this ſenſe than by the force of inſtinct. Inſects diſcover their food at a great diſtance, and, as it is ſuppoſed, by this means; and it is concluded likewiſe, that butterflies and moths are directed by the ſame ſenſe to the diſcovery of their mates. A female of phalæna quercus (eggar moth), incloſed in a box, and thus expoſed in an avenue of a wood, will attract the males in numbers to the ſame ſpot; and though ſhe cannot poſſibly be ſeen, they will appear fully ſenſible of her preſence. Admitting that theſe circumſtances may be otherwiſe accounted for, one argument at leaſt bears ſtrongly in its favour, namely, that of the fleſh fly (muſca vomitoria) being ſo far deceived by the ſimilarity of odour, as to lay its eggs on plants of the ſtapelia genus inſtead of animal ſubſtances. Theſe inſects, as the name implies, ſubſiſt in the larva ſtate on fleſh, preferring that which is putrid, or haſtening to the ſtage of putrefaction, and from whence, in conſequence, a powerful odour ariſes. The plants of the ſtapelia genus have the ſame ſmell; and the parent inſect, miſled by this means, actually depoſits her eggs on theſe plants.

As inſtinct never errs, though judgment may, it is a natural inference that the inſect is not in this inſtance under the controul of inſtinct, but of her own will, becauſe otherwiſe ſhe would not fail to lay thoſe eggs in fleſh, where the larva, when hatched, would be provided with food; while, on the contrary, the plants reſemble this food only in its offenſive odour, and thus, when hatched, the infant brood inevitably periſh. Does not this afford preſumptive evidence at leaſt, that the inſect is directed to theſe plants by the organs of ſmell?

If inſects then evince ſuch apparent proofs that they do poſſeſs this faculty, and that it appears likewiſe the ſeat of this faculty does not reſide in the head, it muſt be ſought after in ſome other part. The organs of ſmell, in all animals which reſpire air, is ſituated at the entrance of the organs of reſpiration: from this circumſtance it is conceived moſt likely that the reſpiratory ſpiracles on each ſide the body muſt be the true organs of that ſenſe. This idea was advanced by Baſter; yet it ſeemed to imply ſuch an inverſion in the ordinary courſe of nature, that it gained little credit. Of late years the ſame opinion has obtained the concurrence of the beſt anatomiſts. Cuvier is decidedly in favour of this concluſion, and, in addition to the reaſons hitherto ſtated in its ſupport, obſerves, that the internal membrane of the tracheæ appears well calculated to perform this office, being ſoft and moiſtened; and that the inſects in which the tracheæ enlarge, and form numerous or conſiderable veſicles, are thoſe which ſeem to poſſeſs the moſt perfect ſenſe of ſmell. Olivier endeavours to maintain that the palpi or feelers, and alſo the antennæ, are the olfactory organs in inſects.

Eyes.—Moſt inſects have two eyes. Theſe are placed in the anterior part of the head, and vary very much in their external figure in different tribes. Some of the Linnæan inſects of the apterous order have a greater number, the ſcorpions have eight, and the ſpiders from ſix to eight, and there are beſides other genera in which the eyes amount to more than two.

This pair of eyes in the inſect race is of a compound kind, while thoſe of the ſcorpion and ſpider are ſimple, and in this reſpect the difference is very remarkable. The compound eye is one of the moſt extraordinary deviations from the ordinary courſe of nature in the conformation of the organ of ſight; the ſimple eyes approach much nearer thoſe of other animals. By compound eyes we mean thoſe kinds which are reticulated, and when magnified are found divided into a great number of compartments, and of theſe every genuine inſect appears to poſſeſs two. Beſides theſe eyes, many of the neuropterous and hymenopterous families have three ſmall ſhining convex points placed in the middle of the head, and called by entomologiſts ſtemmata, the utility of which has never been aſcertained. The extreme minuteneſs of theſe organs does not allow the comparative anatomiſt the means of diſſecting them, but we ſtill think they can be no other than organs of ſight. Should this appear doubtful, becauſe we obſerve them in thoſe inſects, which are beſides furniſhed with a pair of eyes of the compound kind, it ſhould be recollected that ſcorpions and ſpiders, as before-mentioned, have ſeveral more eyes than a pair; and if, on the other hand, the ſimplicity of their ſtructure be conſidered as an argument againſt this concluſion, let it be obſerved that they poſſeſs every character in their form, appearance, ſituation, and immoveability, which the only kind of eyes theſe creatures are furniſhed with are known to poſſeſs. We, indeed, conceive it very probable, that thoſe three ſhining points, called ſtemmata, are truly organs of ſight; and that, conſequently, many inſects which appear to have only two eyes, have in reality no leſs than five.

The compound eye in inſects is ſo very different from that of other animals, that it would be difficult to perſuade ourſelves of its being an organ of ſight, had not experiments, purpoſely made, demonſtrated its uſe. If we cut out, or cover with an opake matter the eyes of a libellula, or dragon fly, it will ſtrike againſt walls in flight. The waſp is ſaid to aſcend perpendicularly in the air till it completely diſappears, when the compound eyes are treated in the ſame manner, and to remain perfectly immoveable when both the compound eyes and the ſtemmata are covered; in the firſt caſe it ſeems to follow the direction of its ſight upwards, in the other to be deprived entirely of the viſual organ, and uncertain whither to direct its flight.

The compound eyes are generally convex, and when viewed by the microſcope exhibit an innumerable multitude of hexagonal facets, ſlightly convex, and ſeparated from one another by ſmall furrows, which frequently contain fine hairs, more or leſs long. Theſe facets give, to the naked eye, the appearance of net-work, and amount to a greater or leſs number in different inſects. Leeuwenhoek counted 3181 in the eye of a beetle, and in that of the common houſe fly about 8000.

Theſe facets form altogether a hard elaſtic membrane, which, when freed from the ſubſtances that adhere behind, is very tranſparent. Each of theſe ſmall ſurfaces may be conſidered either as a cornea, or a cryſtalline, for it is externally convex, and concave internally, but thicker in the middle than at the edges, and it is alſo the only tranſparent part in this ſingular eye. Behind this tranſparent membrane is a ſubſtance, which varies greatly as to colour in different ſpecies, and which ſometimes forms, even in the ſame eye, ſpots or bands of different colours. Its conſiſtence is the ſame as that of the pigment of the choroides; it entirely covers the poſterior part of the tranſparent facets, without leaving any aperture for the paſſage of the light. Behind this pigment we find ſome very ſhort white filaments, in the form of hexagonal priſms, ſituated cloſe to each other, like the ſtones of a pavement, and preciſely equal in number to the facets of the cornea; each penetrates into the hollow part of one of theſe facets, and is only ſeparated from it by the pigment mentioned above. If theſe filaments are nervous, we may conſider each as the retina of the ſurface behind which it is placed; but it will always, in the opinion of Cuvier, remain to be explained how the light can act on this retina through a coat of opake pigment. This multitude of filaments, perpendicular to the cornea, have behind them a membrane, which ſerves them all as the baſe, and which is conſequently nearly parallel to the cornea: this membrane is very fine, and of a blackiſh colour, which is not cauſed by a pigment, but extends to its moſt intimate texture; we obſerve in it very fine whitiſh lines, which are tracheæ, and which produce ſtill finer branches that penetrate between the hexagonal filaments as far as the cornea: this membrane by analogy Cuvier calls the choroides. A thin expanſion of the optic nerve is applied to the poſterior part of the choroides. This is the real nervous membrane, perfectly ſimilar to the retina in red-blooded animals; it appears that the white filaments, which form the particular retinæ of the different ocular ſurfaces, are productions of this general retina, which perforates the membrane named choroides by a multitude of ſmall and almoſt imperceptible holes. To obtain a diſtinct view of all theſe parts, it is neceſſary to cut off the head of an inſect which has the eyes of large ſize, and diſſect it behind, each part will then be removed in an order, the reverſe of that above deſcribed.

The conſtruction of theſe compound eyes is admirably adapted to the convenience of the inſect, for as the eyes of inſects are immoveable, they would have loſt ſight of many objects, if their eyes had been framed like thoſe of other animals, but by theſe means they can eaſily view ſurrounding objects. It ſeems a falſe concluſion that as each of the facets which compoſe the compound eye is a diſtinct organ of ſight, any ſingle object muſt appear multiplied as often as there are facets; it is, on the contrary, far from improbable, that as objects do not appear double to our eyes, but that the viſual organ is ſtrengthened, and many illuſive appearances are corrected by the uſe of both, ſo the numerous inlets to ſight in an inſect may increaſe their field of view, and be productive of other advantages, of which we are ignorant.

Stemmata: the three ſmooth, gloſſy, hemiſpherical dots, ſituated at the vertex of the head, and which, as juſt obſerved in ſpeaking of the eyes, are ſuppoſed to be organs of ſight. Theſe are moſt conſpicuous in the hymenopterous order of inſects.

An experiment made by abbé Catalan tends to confirm the truth of this conjecture. With the view of obſerving whether an inſect could ſee equally well with both the eyes and ſtemmata, he covered the reticular eye of a fly with fluid pitch, leaving the ſtemmata open; he then put it under a glaſs, where it ran up and down without ſtriking againſt any object, and when he lifted the glaſs, it flew away towards the window. He took another fly, and covered with pitch the ſtemmata, leaving the reticular eyes open, and found that with theſe it ſaw equally well as before. Laſtly, he took a third fly, and covered both the reticular eyes and the ſtemmata, and this he found completely blind; it walked ſlowly under the glaſs, and when removed would not venture to fly. Act. Erudit. A.D. 1682.

Antennæ are thoſe delicate moveable horns which appear on the fore part of the head in all perfect and genuine inſects; and which, in many inſtances, are very remarkable for their beauty and elegance of ſtructure. The antennæ are extremely diverſified in form, and vary conſiderably in their proportional dimenſions in different tribes; and for this reaſon are conſidered by entomologiſts of material conſequence in diſtinguiſhing the various orders, genera, and ſpecies. Theſe parts are always articulated, or conſiſt at leaſt of more than one joint, including the baſe, and moſt commonly are compoſed of a far greater number; few leſs than eight, ten, or twelve, and ſome amounting to twenty, or even more. This articulated ſtructure of the antennæ is of infinite utility to the inſect, as it is thereby enabled to move theſe organs in every direction their wants or wiſhes may require.

Antennæ are not entirely peculiar to inſects; the cruſtaceous animals poſſeſs the ſame organs, though in other reſpects they differ ſo eſſentially, (ſee article CANCER,) as do likewiſe ſome of the apterous order of Linnæan inſects, which modern naturaliſts exclude from this claſs. Nor will it be amiſs to obſerve that, even according to Linnæus, many of his apterous inſects are deſtitute of antennæ, and are conſequently inadmiſſible on this account, upon his own definition, into the ſyſtem of entomology. Spiders and ſcorpions are of the latter deſcription. The organs termed antennæ are eaſily diſtinguiſhed from the tentaculæ of vermes, by having a ſhelly covering, and from the palpi or feelers of inſects, the latter being more numerous, and ſituated at the mouth. The Linnæan and Fabrician entomologiſts admitting the cancer, and other cruſtacea among the inſect tribes, allow four, or in ſome caſes even ſix antennæ to this race, but as we refer theſe to another claſs, we apprehend that the number of antennæ in all genuine inſects invariably amounts only to two. Thoſe inſects which have attained their laſt ſtate, and are therefore denominated perfect, and which poſſeſs ſix legs, are always provided with two antennæ. It is true that the larvæ of many inſects are not furniſhed with theſe organs, yet they are ſtill genuine inſects, becauſe in their complete ſtate they poſſeſs them; ſpiders and ſcorpions on the contrary, with all their organs complete, have no antennæ. A very conſiderable number of inſects, even in the larva ſtate, are not deficient in theſe organs, and in many, though not in all, there is no difference whatever between the antennæ of the larva and perfect inſect. The genera blatta, gryllus, mantis, phaſma, cimex, and various others of the hemiptera order, are furniſhed with antennæ, which exactly reſemble thoſe of the ſame ſpecies in their perfect ſtate.

No writer, who has attentively regarded the ſtructure of the antennæ in inſects, has hitherto pretended to determine preciſely the purpoſe for which nature has deſigned them, and thoſe who have not very maturely conſidered them cannot poſſibly be competent to decide ſuch a doubtful circumſtance. We know of nothing analogous to theſe organs in larger animals whoſe manners we might be ſuppoſed to have a better acquaintance with, and it is not therefore by analogy that this point can be determined. Some naturaliſts conceive that they are appropriated to a feeling more delicate than our own, and that they are ſenſible to the leaſt motion or diſturbance in the ambient fluid, or that they are the organs of ſome ſenſe unknown to us, and of which we cannot conſequently form the leaſt conception. Some ſuppoſe they ſerve to ſound, and occaſionally to probe the earth on which they move, or that they are the organs of hearing, of feeling, or ſmelling, and by the means of which they diſtinguiſh their proper food. Each of theſe conjectures is liable to objection, and can be conſidered as an opinion merely, while the real purpoſes of theſe organs may perhaps for ever remain unknown.

Though it is difficult even to conceive the immediate object for which the Creator has aſſigned theſe organs to the inſect race, we muſt reſt perſuaded that they are intended to anſwer ſome very important deſtination in the economy of the animal, as the medullary nerves, ariſing directly from the brain, may be traced into theſe parts, and followed throughout their whole extent. In ſome inſects alſo, which have the antennæ ſmall, the palpi are obſerved to be very large, as if they were intended to anſwer the ſame purpoſe, or partake of the ſame ſenſe, as the antennæ; and thus, by their mutual aid, ſupply the deficiency of antennæ. This will in ſome degree account, perhaps, for the manner in which nature ſeems occaſionally to counterbalance the want of antennæ in the larvæ of certain kinds of inſects which have palpi, but no antennæ; others in the ſame ſtate have antennæ and no palpi. Many that are deſtitute of both the two firſt-mentioned kinds are thoſe chiefly which prey on inſects, and the latter ſuch as feed on plants.

The antennæ, nevertheleſs, appear to us to be rather connected with the organ of hearing, than either that of feeling or ſmelling. The palpi, we have little doubt, are the organs of feeling, both from their texture, and the manner in which inſects are oftentimes obſerved to make uſe of them in touching their aliments; and the organs of ſmelling in inſects, however ſingular it may be imagined, we conceive to be no other than the apertures diſpoſed on each ſide the thorax and body. By the organs of hearing, we do not mean to conſider them as external ears, but as being in ſome manner auxiliary to the organ of hearing, the ſeat of which we ſuſpect to be contiguous to the baſe of the antennæ, the ſpot in which the ſame organ has been diſcovered in the cray-fiſh. They may anſwer this and ſome other purpoſe likewiſe.

We have previouſly obſerved, that nothing can be diſtinctly inferred of the actual utility of the antennæ from analogy; nor do the purpoſes to which inſects appear ſometimes to appropriate them aſſiſt our concluſions in a ſatisfactory manner. Many inſects, when they walk, fly, or take their food, have the antennæ directed forward; others, on the contrary, carry them inclining backward, like the cerambyces; ſome kinds lay them along their back; and others, as the elater tribe, diſpoſe them on each ſide the thorax. The ſpheges and the ichneumons bear their antennæ directly before them, and continually agitate them, whether in flight, when ſtanding, or ſeizing on their prey. In others, the antennæ have little perceptible motion. Some inſects are ſaid to cover their eyes with their antennæ when they ſleep; the diminutive ſize, compared with the magnitude of the eyes in moſt inſects, will not permit us to believe that this is the principal object of their deſtination.

Notwithſtanding the direct connection of the antennæ with the brain, inſects, it has been affirmed, can undergo their partial privation, or total loſs, without experiencing any ſenſible injury; and hence it has been concluded they cannot be neceſſary to the life of the inſect. If the fact be true, the latter inference muſt ſurely be admitted, but this will not diſprove their utility: nor will it diſcountenance the idea that the antennæ are requiſite for ſome important end. We well know, that in the animal economy of larger beings, not only the medullary nerves may be in part deſtroyed, but even the animal be deprived of a portion of the brain itſelf, without ſuſtaining mortal injury. The antennæ of inſects may not be abſolutely neceſſary to the life of the inſect, but are certainly ſo to its well being, and to the perfect exerciſe of all its functions.

The antennæ of the male inſects generally differ from thoſe of the females. It is principally the antennæ of the former that are plumoſe, or furniſhed with teeth, or tufts of feathers, while thoſe of the female appear like a delicate thread, entirely ſmooth, or only ſlightly pectinated. This is obſervable throughout the moth tribe. In coleopterous inſects the males are often diſtinguiſhed by the ſuperior ſize and beauty of the antennæ from the other ſex. The antennæ are characterized by entomologiſts according to their ſtructure under different names. Linnæus deſcribes the following: 1, Setaceæ, thoſe which gradually become taper towards the extremity; 2, Filiformes, ſuch as are of an equal thickneſs throughout; 3, Moniliformes, are filiform like the preceding, but conſiſt of a ſeries of round knobs, like a neck-lace of beads; 4, Clavatæ, ſuch as gradually increaſe in thickneſs from the baſe, and form a club at the end; 5, Capitatæ, like clavatæ, increaſe in thickneſs towards their extremity, but are diſtinguiſhed from thoſe by the form of their laſt articulation, which is larger and more rounded than the others; 6, Fiſſiles are like the laſt, but are divided longitudinally into three or four plates or laminæ; 7, Perfoliatæ are alſo capitatæ, but have the head divided horizontally, the plates being connected by a kind of thread paſſing through their centre; 8, Pectinatæ are thoſe which have lateral appendages, like the teeth of a comb, or plume of a feather, as in the moth tribe. 9. Ariſtatæ, ſuch as have a lateral hair, which is either naked, or furniſhed with leſſer hairs, as in the muſca genus. Each of theſe is alſo diſtinguiſhed according to their length, as breviores, thoſe which are ſhorter than the body; longiores, thoſe which are longer than the body; and mediocres, ſuch as are of the ſame length with the body, all which varieties are conſpicuous in the Linnæan tribe of cerambyces.

The ſtructure of the antennæ in inſects is of ſuch vaſt importance in the definition of genera, ſpecies, and ſexual diſtinctions, that it is to be regretted we have not a more comprehenſive number of terms by which their particular forms might be minutely diſcriminated. Linnæus affords us ſome, the utility of which is univerſally allowed; others which he propoſes require ſome reviſal and modification; and among the immenſe number of inſects diſcovered ſince the time of Linnæus, the antennæ of many exhibit characters which cannot be expreſſed by any of thoſe his work preſents. Fabricius has others, but theſe, even in addition to thoſe of Linnæus, are not adequate to the purpoſe.

Organs of hearing at the baſe of the Antennæ.

The organs deſtined by nature for the conveyance of ſounds to the ſeat of the ſenſes in the inſect race have never been clearly aſcertained. This can be attributed only, perhaps, to their minuteneſs, which defies inveſtigation, except in ſome few of the larger kinds, and theſe even phyſiologiſts ſeem never to have examined. In the cray-fiſh the organs of hearing are exemplified by Fabricius and Scarpa. Theſe were diſcovered within the head, at the baſe of the antennæ, through the hollow tube of which it is ſuppoſed the ſound muſt be conveyed. Perhaps, from the analogy in certain reſpects, which this tribe of cruſtaceous animals bears to inſects, it may be imagined that the organs of hearing in both are ſimilar: this is very probable; but theſe two orders of creatures differ ſo eſſentially in ſeveral particulars, that we wiſh to expreſs ſuch an opinion with caution.

In the cray-fiſh the labyrinth of theſe organs is very ſimple, reſembling a ſmall purſe, encloſed in a ſcaly cylinder open at both ends. The extremity by which this ſmall cylinder joins the baſe of the antennæ affords a paſſage for the nerves into the purſe. The oppoſite extremity is cloſed by an elaſtic membrane, which may be named tympanum, or, with more propriety, Cuvier thinks, feneſtra ovalis. The air, or water in which the animal lives, acts immediately on this membrane, the external part of which is obſervable at the lower ſurface of the baſe of the antennæ. That inſects are ſenſible of ſounds, and, conſequently, are furniſhed with organs of hearing, is demonſtrated by numberleſs obſervations.

Front: the anterior or fore part of the head, the ſpace between the eyes and the mouth.

Clypeus: ſhield of the head in coleopterous inſects, the part correſponding with the front of the head in the other orders. In the beetle kind it is advanced more or leſs upon, or over the mouth, and in ſome forms a ſort of cap, the rim of which extends ſo far over the head as to conceal the mouth beneath. The anterior edge of the clypeus is ſometimes miſtaken for the upper lip.

Vertex: the crown, or ſummit of the head.

Gula: that part which is oppoſed to the front of the head, uſually called the throat.

Trunk: the ſecond principal diviſion of which an inſect conſiſts, comprehending that portion which is ſituated between the head and the abdomen. The trunk includes the thorax, collar, ſternum, and ſcutel.

Thorax: a term indefinitely applied ſometimes to the whole trunk, the ſcutel excepted: in a ſtricter ſenſe it implies only the dorſal part of the trunk, and may be conſidered as expreſſive of that portion of the ſuperior ſurface which lies between the head and the baſe of the wings. Linnæus is not ſo explicit as could be wiſhed in his definition of the word thorax; according to this author, it is "the back part of the breaſt," and "upper part of the trunk between the head and ſcutel," yet it is evident, from the diſſimilar ſtructure in this part of the trunk in different inſects, that the definition requires rather more preciſion. It is not unuſual in the ſpecifical deſcriptions of inſects, both by Linnæus and Fabricius, to read of "thorax beneath," and "lower ſurface of the thorax," for the under ſurface of the trunk; though both endeavour to eſtabliſh it as a principle, that the word thorax applies to the back or upper ſurface of the trunk only. The appropriation of ſuitable terms, by which a thorax conſiſting of one, or of ſeveral pieces, may be diſcriminated from each other, is deſirable. In ſome the thorax is of a ſingle piece, as in the orders coleoptera and hemiptera; in that of lepidoptera it comprehends ſeveral ſegments, and a ſimilar ſtructure is ſtill more conſpicuous to view in the order hymenoptera. The firſt or anterior ſegment of the thorax in thoſe conſiſting of ſeveral pieces has been ſometimes called the collar; but in admitting this, we muſt by analogy define the coleopterous and hemipterous orders of inſects as having no thorax. This will be rendered plain, when we conſider that in the latter kinds of inſects the firſt pair of legs ariſes from what is uſually underſtood by the lower ſurface of the thorax; the interior ſegment in hymenopterous correſpond with the whole thorax in the former, for the firſt pair of legs ariſes from it exactly in the ſame manner. In the former the thorax of a ſingle piece is immediately ſucceeded behind by the ſcutel, while in the hymenoptera and lepidoptera a larger plane of one or more joints intervene between this true thorax and the ſcutel; and it is to this laſt mentioned dorſal ſpace that the term thorax is aſſigned. Hence it is evident that the language of entomology in this point is not altogether conſiſtent; becauſe what we denominate the collar in hymenoptera, is the thorax in coleoptera, and in coleoptera we find nothing analogous to the thorax of the other order, except the collar.

The thorax in thoſe inſects, which have that part conſiſting of a ſingle piece, or the firſt ſegment in ſuch as are of a compound nature, have the firſt pair of legs ariſing from the lower ſurface, and it is in this part that the muſcles that move the head, as well as this pair of legs, are ſaid to be contained. The thorax in different kinds of inſects varies conſiderably in form, and affords very excellent generical and ſpecifical diſtinctions. Some are armed with ſpines, others denticulated, marginated, &c.

Pectus.—The breaſt is the third ſegment of the body, or that to which the four poſterior feet are attached, and which is longitudinally divided at the anterior part by the ſternum. The wings in lepidopterous, and moſt other inſects, have their origin or baſe in the ſuperior part of the breaſt. The wings and elytra in the coleoptera and hemiptera deviate a little from this, as they are placed more immediately on the back, than in a lateral poſition; the breaſt contains the muſcles that move the wings, and give action to the four poſterior legs. This part is capable of being compreſſed and dilated, the alternate motion of which is very evident in ſome inſects of the butterfly or moth kind, when held between the fingers. The power of compreſſion and dilatation is ſuppoſed to ariſe from the action of ſome very ſtrong muſcles, which ſeem to approximate the dorſal and ventral ſurfaces. They are four in number on each ſide, and differ very much in colour and texture from the other muſcles, being reddiſh yellow, and extremely looſe. It has been conjectured theſe muſcles may aſſiſt the motions of the organs of flight.

Sternum, or breaſt bone.—By this term entomologiſts define that portion of the middle part of the breaſt which is ſituated between the baſe of the four poſterior legs. This piece terminates inſects anteriorly in a ſomewhat acute point, in others it appears rather bilobate, and in the far greater ends obtuſely or in an obtuſe lobe. There are few inſects in which the ſternum is remarkable, either from its magnitude or figure. In ſome of the coleopterous tribes, as hydrophilus and dytiſcus, this part is moſt conſpicuous.

Scutel, or eſcutcheon (ſcutellum, Linn.) the lobe-like proceſs, ſituated immediately at the poſterior part of the thorax, in ſcutellate inſects. The ſcutel is not of the ſame form in all inſects, yet its general tendency is towards a ſub-triangular figure. In the coleopterous tribes it approaches neareſt to this form; its deviations incline more or leſs to heart-ſhaped, with the tip pointing backwards. The ſame figure prevails in ſome of the hemiptera order. In the neuroptera, hymenoptera, and diptera, the triangular contour is ſtill obſervable under various modifications, and moſt commonly with the poſterior tip rounded off. Sometimes, as in ſeveral of the hymenopterous inſects, the poſterior end is armed with ſpines, or denticulations; this is, however, not uſual, the ſcutel in the far greater number of inſects, whether terminating in a point, or rounded, is commonly unarmed. In point of ſize the ſcutel is more variable than in figure; in ſome it is ſo ſmall as almoſt to eſcape notice, merely forming a point at the extremity of the thorax, as we obſerve in certain kinds of the beetle tribe; in others it is very conſpicuous; ſometimes it is ſo large as to cover the middle of the back, and in others, as the ſcutellate kinds of cimices, and a few of the genus acrydium, it expands over the back, entirely concealing the wings and wing-caſes, and covering the margin of the abdomen.

Abdomen is the laſt principal diviſion, or poſterior part of the body, and is connected with the breaſt, either cloſely, or at a diſtance, by means of a fillet. The abdomen is compoſed of annular joints or ſegments, the number of which vary in different inſects. Each of theſe rings is pierced at the ſide with a ſingle pore, which in ſome kinds are of conſpicuous ſize, in others ſcarcely perceptible, and theſe are the orifices of the ſpiracles through which the inſects breathe. The upper part of the abdomen is called by entomologiſts tergum; the inferior, or belly, venter. The opening at the poſterior part of the abdomen is the vent, and the extremity in moſt inſects contains the organs of generation: there are exceptions to the latter.

The total movement of the abdomen is not very obvious, except in inſects which have that portion of the body pediculated, as in many of the hymenopterous genera. It has then a real joint, in which the firſt annulation is indented above, and receives a projecting proceſs from the breaſt on which it moves. This joint is rendered ſecure by elaſtic ligaments, which have a conſiderable degree of force. Some muſcles which ariſe within the breaſt are inſerted into the firſt ring, and determine the extent of its motions. The partial motion of the rings is produced by very ſimple muſcles, conſiſting of fibres which extend from the anterior edge of one ring to the poſterior edge of that which immediately precedes it. When the dorſal fibres contract, the ſuperior part of the abdomen being ſhortened, it turns up towards the back, but when the contraction takes place in the ventral or lateral fibres, the abdomen is inflected towards the belly, or directed towards one of the ſides. The extent of the motion, however, depends upon the number of the rings, and their mode of junction. In the coleoptera, for example, the rings only touch each other by their edges, and the motion is very limited, but in the hymenoptera they are ſo many ſmall hoops, which are incaſed one into another like the tubes of a teleſcope, ſo that ſcarcely half, and ſometimes not above one-third, of their extent appears viſible externally.

The form, connection, proportions, and appearance of the ſurface of the annulations of the abdomen, afford numberleſs ſpecifical diſtinctions; and ſo likewiſe do the appendices at the extremity of the abdomen.

The abdomen contains the inteſtines, the ovary, and part of the organs of reſpiration: it is affixed to the thorax, and in moſt inſects diſtinct from it, forming the poſterior part of the body. The abdomen is compoſed of rings or joints, by which means the inſect can lengthen or ſhorten it, or even move it in different directions. The upper part of the abdomen is called tergum, the under part venter, the vent is in the poſterior part.

Tail.—An appendage of any kind terminating the abdomen is uſually denominated the tail. Theſe appendages vary in figure conſiderably in different inſects, and many tribes are totally deſtitute of them. They are ſuppoſed to be deſtined to direct the motion of the inſect in flight, to ſerve for its defence, and for the depoſition of its eggs. In ſome inſects this tail is ſimple, (ſimplex,) and yet capable of being extended and withdrawn at pleaſure. In others elongated (elongata). Some are ſetaceous (ſetacea) or briſtle-ſhaped, as in the raphidia. Thoſe termed triſeta have three briſtle-ſhaped appendices, as in the ephemera. In ſome it is forked (furcata), as in podura. When it terminates in a pair of forceps it is called forcipata. In the blatta and others it is folioſa, or reſembling a leaf. In the panorpa it is furniſhed with a ſting, and is called teliſera; this laſt may be more properly referred to the next.

Aculeus, ſting, an inſtrument with which inſects wound and inſtil a poiſon. The ſting generally proceeds from the under part of the laſt ring of the belly: in ſome it is ſharp and pointed, in others ſerrated or barbed. It is uſed by many inſects both as an offenſive and defenſive weapon: by others it is uſed only to pierce wood, or the bodies of animals, in order to depoſit their eggs. In waſps and bees the ſting is known to be retractile: in the ſcorpion fixed or immoveably connected to the laſt ſegment of the body. In ſome inſects it is the male only, and in others the female only, which nature has provided with this inſtrument: it is not frequently met with in both ſexes of the ſame ſpecies; and the far greater number of inſects have no ſuch organ.

Spiracles.—Theſe are the apparent orifices to the organs of reſpiration in inſects, and which are known to many entomologiſts by the name of ſtigmates. The ſpiracles are a ſeries of ſmall apertures diſpoſed along both ſides of the abdomen: ſome few appear on each ſide the thorax, the remainder on the abdominal rings, every one of which is pierced on each ſide with a ſingle aperture. Among the ancients it was generally believed that inſects had not the power of breathing, and this they concluded becauſe they have no reſpiratory organs, as in larger animals. The moderns are better informed; from the effects produced on inſects by the pneumatic machine it is demonſtrated, beyond diſpute, that they do reſpire, though not in the manner of other animals. An inſect placed in the receiver of this machine, upon the air being exhauſted, becomes ſuffocated, and dies in a very ſhort time; and the ſame reſult will be produced by cloſing the apertures of the ſpiracles with wax, oil, or other glutinous ſubjects, in a ſufficient degree to preclude the paſſages of air through theſe openings, a fact which in itſelf may be regarded as concluſive, that theſe are the true organs of reſpiration in inſects. They are alſo conſidered, and with much probability, as the organs of ſmell, as will be ſhewn hereafter.

Reſpiration being one of the moſt important actions in the life of every animal, it can be no matter of aſtoniſhment that great pains have been taken by naturaliſts to inveſtigate the organs of breathing in inſects; numberleſs facts contributed to prove its exiſtence, but this being accompliſhed by means unknown in the other tribes of animals, it became an object of the greater ſolicitude to explain the manner in which it was effected. Malpighi, Swammerdam, Reaumur, and Lyonet, are among the number of the earlieſt writers on this ſubject, and from their obſervations it appears, that in the caterpillar there are two air-veſſels, called tracheæ, which extend throughout the whole length of the inſect; from theſe proceed an infinite number of ramifications, which are diſperſed in various directions through the body; but the principal are thoſe which form a direct communication between the tracheal veſſels and the openings in the ſides of the body. Of theſe there are nine on each ſide placed nearly at equal diſtances, one extremity terminates in the orifice of the ſpiracle, and the other enters the principal tracheal veſſel diſpoſed neareſt, or on that ſide of the body. Theſe lateral or ſpiracular veſſels ſeem calculated for the reception of air; they are of a cartilaginous nature, and when cut preſerve their figure; they are conſtantly obſerved in a temperate ſtate of moiſture, and communicate in many inſects in the form of conſiderable veſicles, at their junction with the principal tracheæ.

Some writers have imagined, that though the air entered by the ſpiracles into the trachea, it did not come out by the ſame orifice, but was expired through a number of ſmall holes in the ſkin of the caterpillar, after being conveyed to them through the extremities of the finer ramifications of the tracheal veſſels. Others ſuppoſed, that the inſpiration and expiration of air through the ſpiracula, and that there was no expiration of air through the pores of the ſkin. Experiments were made to aſcertain the truth of theſe opinions, by plunging the caterpillars into water, or anointing them with fat and greaſy ſubſtances, either partially or entirely. The number of ſmall bubbles which are obſerved to cover the ſurface of their bodies when they are immerſed in water, is ſaid not to ariſe from the air included in them, and then proceeding from them, but to be formed by the air which is lodged near the ſurface of their bodies, in the ſame manner that it is about all other ſubſtances. To render the experiment more accurate, and prevent the air from adhering to the ſkin, before the caterpillars were plunged into water, they were bruſhed all over with a hair pencil, and after this, it is affirmed, that few air bubbles were found on their bodies when immerſed in water. The latter experiments were made chiefly by Bonnet, in order to aſcertain the truth of ſome opinions previouſly advanced by Reaumur.

A caterpillar, according to Bonnet, may be retained a conſiderable time under water, without deſtroying the principle of life, and will recover ſoon after being taken out of the water, when it has lain till all apparent ſigns of life have ceaſed. A caterpillar partially immerſed in water, or with two or three of the ſpiracles remaining in the open air, does not become torpid for a conſiderable time. One caterpillar lived eight days ſuſpended in water, with only two of its anterior ſpiracles in the air. During this time it was obſerved, that when the inſect moved itſelf, little ſtreams of bubbles iſſued from the ſpiracles on the left ſide; from this and other experiments, however, it appeared, that the anterior pair of ſpiracles, together with the poſterior pair, are of the greateſt uſe in reſpiration.

It has been remarked, that "when we conſider the great ſolidity of the caſes or cones of certain kinds of inſects, it is not eaſy to conceive how they can live ſeveral months under the earth in ſpaces ſo confined, and almoſt impervious to the air. If reſpiration was abſolutely neceſſary to their exiſtence, and indeed if they did reſpire, the ſame ſituation ſeems to preclude a continuance of the operation, as the air would ſoon be corrupted, and unfit for the offices of life."

But though it is difficult to aſcertain the reſpiration of ſome inſects at certain periods of exiſtence, except from its effects in preſerving life, which from analogy and collateral circumſtances we are aſſured muſt depend on this cauſe, there are others to whom reſpiration ſeems neceſſary in a very extraordinary degree. Many inſtances of this might be adduced; but in no tribe is this more clearly ſhewn than in thoſe of the aquatic kinds. There are a number of the latter which are obliged to keep their tails ſuſpended on the ſurface of the water for this reaſon, and in proof of which, if they be plunged entirely under water, they become agitated and uneaſy, firſt endeavouring to eſcape and riſe again to the air, or, if prevented, ſhortly fall to the bottom and die. Some aquatic beetles reſiſt the trial for a conſiderable time, while their larvæ can ſupport the privation of air only for a few minutes. A remarkable evidence of the ſame kind occurs in the larvæ of muſca pendula, which, though they live in the mud at the bottom of the water, have the power of extending the tube of the tail to a great length, in order to elevate it to the ſurface of the water; and the extremity of it is furniſhed with a tuft of fine hairs, which preſerves that part buoyant on the ſurface, while the creature remains in a ſtate of quieſcence. A ſimilar verticillated organ is placed at the tip of the tail in the larva of muſca chameleon, which alſo lives in the water; this is expanſile or retractile at the pleaſure of the inſect; when at reſt the expanded tail reſts upon the ſurface of the water, the remainder of the body being ſuſpended in that element with the head downwards, and when it is inclined to deſcend, it has only to retract or cloſe up the rays of the tail to effect its purpoſe; an expanſion of the tail will again raiſe the larva to the ſurface.

Upon anatomical examination, it has been found that the body of this laſt mentioned larva contains two large tracheal veſſels: theſe air-veſſels extend from the head to the tail, terminate in the reſpiring tubes, and receive the air from them. The larva quits the water when the time of its transformation approaches, and enters into the earth, where the ſkin hardens and forms a caſe, in which the pupa is formed: ſoon after the change, four tubes or horns are ſeen projecting from the caſe, which ſome ſuppoſe to be the organ for communicating air to the interior parts of the inſect: they are connected with little veſicles which are filled with air, and by which it is conveyed to the ſpiracles of the pupa. The larvæ of gnats, and various other little aquatic inſects of the ſame kind, are furniſhed with ſmall tubes that play on the ſurface of the water, and convey the air from thence into the body of the inſect.

Nothing can be more evident than that inſects do not reſpire by the mouth, like other animals. To determine the reſpiratory organs in inſects, and alſo to aſcertain in what manner this function of life is performed, has been an object of ſolicitude with many. The experiments made with this view are numerous and concluſive, the reſult demonſtrating, beyond diſpute, that the ſpiracles are the apertures through which the air is drawn into the body. This may be inferred from the writings of Swammerdam, Malpighi, Reaumur, Muſchenbröek, Degeer, and many others, who treat at large on this particular ſubject.

Theſe ſpiracles exiſt in every ſtage of life, in the larva and pupa as well as perfect ſtate. They are viſible externally as a ſmall knob of a roundiſh or oval form, ſlightly elevated and perforated in the middle: the aperture is uſually oblong or ſubovate, and is the orifice of the channel which communicates with the trachea, one of which is diſpoſed lengthwiſe on each ſide of the body.

The extreme tenacity with which many inſects retain life, while deprived of air, ſeems to indicate that they exiſt much longer without the benefit of this renovating fluid than moſt other animals; and that in certain caſes they may endure a temporary ſuſpenſion of the functions of reſpiration. But nevertheleſs every experiment tends to confirm the fact, that ſo far as reſpiration is neceſſary, it is performed only by means of theſe ſpiracles, the cloſing of which, to the total ſecluſion of the air, will at length deſtroy the vital principle.

Lyonet has obſerved, that although it is a general rule that every thing which lives reſpires, it is not perhaps without exceptions in inſects. Many give reaſon to doubt of their reſpiration, at leaſt in certain ſtages of their exiſtence. "I took, for inſtance," ſays he, "ſome of thoſe large cantharides of the willow, whoſe ſtrong ſmell, though not very diſagreeable, is felt at a conſiderable diſtance. I put them under a glaſs, where for a long time ſulphur had been burning on a piece of copper made red-hot, that the ſulphur might continue to burn in the midſt of its own vapours; and although there aroſe ſo thick a ſmoke that it almoſt hid the inſects from ſight, they ſupported theſe vapours for more than half an hour, without ſuffering, that I could perceive, the ſmalleſt injury." Inſects, we are aware, may live ſome time confined in this manner amidſt the vapours of burning ſulphur, but the inſtance adduced by Lyonet is ſtill remarkable, for we have known the ſame experiment tried with theſe cantharides, in the reſult of which the inſects died within the ſpace of time mentioned by Lyonet; and if, inſtead of ſulphur, we employ camphor, the reſpiratory powers ceaſe, and life becomes extinguiſhed in a ſhorter period.

This author argues, that from the ſolidity of the greater number of the cones made by the pſeudo-caterpillars, and moſt of the ichneumon flies, it cannot be conceived poſſible how theſe inſects ſhould live ſeveral months under ground, in a place ſo cloſe and impenetrable to the air, if they were to breathe in it. "Neither," ſays he, "would I maintain the reſpiration of chryſalids; at leaſt one experiment convinces me there are ſome which do not breathe. I took the chryſalis of the ſphinx liguſtri, which being one of the largeſt is the moſt proper for experiments. It had, beſides, the two anterior ſpiracles ſo open, that with a common magnifier I could ſee into the ſubſtance of its body, and obſerve a ſmall vacuum between it and the cover. This made me hope, that if reſpiration took place in the chryſalis this would give me certain proofs of it. Two or three months before the perfect inſect iſſued from its cover I dug it up, and covered ſeveral times, firſt one and then two, and afterwards ſucceſſively, the whole of its ſpiracles with ſoap water. At each time I obſerved, for a conſiderable ſpace, with the glaſs, the ſpiracles thus covered, to ſee if any bubbles of air were formed above, which would naturally have happened, had theſe ſpiracles ſerved as conduits to the air in reſpiration; but with all my attention I could perceive none. Some days afterwards I repeated the ſame experiment, in a manner to me ſtill more deciſive. Inſtead of covering the ſpiracles with ſoap-water, I covered each with a little bubble of air, taken from the froth of the ſame water, that the air might enter and go out more freely. But my curioſity was not more gratified: theſe bubbles, which ought to have riſen or ſunk at each expiration or inſpiration of the chryſalis, preſerved conſtantly the ſame appearance, till their pellicle becoming dry, they burſt. When the perfect inſect had iſſued from this chryſalis, I took it up inſtantly, waſhed the inſide of it, and obſerved at the ſpiracles little bundles, compoſed of a great number of very white threads, of which the longeſt were about two lines in length. Theſe appeared to me the exuvia of the pulmonary organs. I blowed on each of the ſpiracles with all my force, by means of a very ſlender tube, but my efforts could neither ſwell nor move any of thoſe fragments of the veſſels which were attached to them internally; but this muſt neceſſarily have happened, had the communication of the external air by theſe ſpiracles in the bronchiæ remained open, or had the inſect, when incloſed in its chryſalis, been able to breathe through them. It may be inferred from this, that the chryſalis of ſphinx liguſtri lives for ſome time without reſpiration, and that its two anterior ſpiracles ſerve only to facilitate the evaporation of the ſuperabundant humours, and to permit the external air to ſupply their place." Lyonet, however, admits, that it is not on the ſingle experiment here related that the knowledge of the reſpiration in inſects is founded; and that this experiment does not appear deciſive. We have unequivocal proofs of the reſpiration of inſects; a fact demonſtrated beyond all doubt in numbers of the aquatic kind, and as to lungs, he ſays, we may aſſure ourſelves that inſects poſſeſs them without being at the trouble of diſſection. The ſpiracles are called ſtigmata by the modern naturaliſts; ſtigmates of the French.

Members.

Legs.—In all inſects that are furniſhed with wings the pedes or legs amount to ſix, and never exceed that number; and the ſame is obſervable of the true feet in the larvæ of thoſe inſects; the latter have ſpurious feet to a greater amount, but the true feet do not exceed ſix. The apterous tribe in this, as in other particulars, afford exceptions: thoſe of the pediculus, pulex, lepiſma, podura, and acarus genera have only ſix legs, and theſe are attached to the body in the ſame manner as in winged inſects: the ſcorpio, aranea, and phalangium genera have eight; the cancer, if admitted, have as many; and in the oniſcus, julus, and ſcolopendra, they are far more numerous, varying from ten or twelve to twenty, fifty, or even thrice that number.

The leg of an inſect may be divided into four, or, more correctly, into five parts; coxa, the firſt joint, or haunch, at the baſe; femur, the thigh; tibia, the ſhank; tarſus, the foot; and unguis, the claw. Each of theſe parts is enveloped in a hard caſe of a horny ſubſtance, and varies in ſhape in different inſects; the form of the feet in all the kinds being admirably adapted to their mode of life, and convenience of their motion. Some of theſe are diſtinguiſhed by particular terms, as, curſorii, thoſe formed for running (and which are the moſt numerous); ſaltatorii, thoſe conſtructed for leaping; natatorii, thoſe employed in ſwimming, &c. From the different conformations of theſe limbs, it is eaſy to recognize, even in the dead inſect, the mode of life which the ſpecies is deſtined by nature to purſue. Thoſe which have the legs adapted for running or walking have them long and cylindrical: the thighs of the leapers are remarkably large and thick, with the ſhank long and commonly arched, by which means they poſſeſs great ſtrength and power for leaping: the legs are broad, ſerrated, and ſharp at the edge, in thoſe accuſtomed to dig in the earth; and ſuch as are of the aquatic kind have the legs, eſpecially the poſterior pair, long, flat, and ciliated, or fringed at the edge with hair. The leapers are well exemplified in the ſaltatorial kinds of curculio; and the ſwimmers in the genera hydrophilus and dytiſcus.

The coxa, or ſmall joint at the baſe, connects the leg to the body, and moves in a correſponding cavity of the collar or thorax in the firſt pair, or breaſt in the two poſterior ones. This part varies in form: in the cerambyx coccinella, and other tribes in which the feet ſerve for walking only, its ſhape is globular: ſuch as require that the feet ſhould have a lateral motion, and which is neceſſary to thoſe that dig into the earth, have the coxa broad and flat; this is alſo obſervable in ſome of the aquatic beetles; in the dytiſcus, the coxa of the poſterior legs is conſolidated with the trunk, and immoveable; and in the blatta, lepiſma, and others which walk very rapidly, it is compreſſed into a lamellate form.

There is more diverſity in the form of the thigh than the coxa to which it is united. The articulation of theſe two parts is internal, and is produced in ſuch a manner, that when the animal is in a ſtate of repoſe, it is parallel to the inferior ſurface of the body. It is limited to a forward and backward motion, with reſpect to the firſt piece. The nature and extent of the motions of the thigh appear to determine its form. In thoſe inſects which walk much and fly little, as the carabus, cicindela, &c., the thigh has two little prominences at the baſe, which appear to be intended for removing the muſcles from the axis of the articulation. Thoſe which require ſtrong muſcles adapted to leaping have the thigh not only thick but greatly elongated, as in the gryllus and locuſta tribes, the pulices, or fleas, &c. And in the ſcarabæi, ſcarites, and other coleoptera, and alſo in the mole cricket (acheta gryllotalpa), all which burrow in the earth, the thigh is moved with much force, and has an articulated ſurface correſponding to the flat part of the coxa on which it reſts. This part is ſometimes ſpinous.

Tibia, or ſhank, is the third joint of the legs, and moves in an angle, according to the direction of the thighs. The figure of this part depends eſſentially on the uſes to which the habits of the inſect require it to be applied; in the natatorial kinds it is uſually flat and ciliated, at leaſt the tibia of the poſterior pair, and in many others, as in a variety of the burrowing kinds of beetles, it is ſerrated. In the mantis genus, to which ſhanks of the anterior pair of legs ſerve as weapons of defence, they are broad, flat, and acute at the edge, and theſe they wield with dexterity in the manner of a ſabre. The ſhank is more frequently ſerrated or ſpinous than the thighs.

The tarſus, or foot, is the fourth joint, or laſt portion of the leg, except the claw. This part conſiſts in general of five joints: this is uſually the number in the coleoptera, hymenoptera, and diptera; in ſome of theſe, however, and alſo in the hemiptera, there are only four articulations in this part of the leg, as we obſerve in cerambyx, gryllus, and others; in libellula, forficula, &c. three: in the anterior feet of mantis and nepa only one; and in thoſe of the nymphales family of butterflies none. The figure of the tarſus is more variable than any other portion of the leg, and is in a moſt ſingular manner adapted to the inſect's mode of life. The articulations in ſuch as walk on the ſurface of the earth are ſlender, thoſe which burrow in the earth have them more robuſt. Many of thoſe which inhabit waters have them flat and ciliated at the edges, as in the hydrophilus. Others are furniſhed with briſtly tufts, or vaſcular fleſhy tubercles, which enable them to move with ſecurity on ſmooth and ſlippery bodies in any direction; an admirable example of this preſents itſelf in the common houſe fly, which "treads the ceiling, an inverted floor," with the ſame facility that other inſects walk on the ſurface of the ground. An occaſional difference in the number and form of the joints of the tarſus is ſometimes obſerved in the two ſexes of the ſame ſpecies. The motion of each joint of the tarſus is performed in a ſingle plane, and is directed by two muſcles in each joint, one of which is ſmall, and placed on the dorſal ſurface, the other larger, and ſituated beneath.

Unguis, or claw, the termination of the tarſus; in the greater number of inſects there are two claws attached to each tarſus: ſome have only one, and in others furniſhed with two, there is an intermediate proceſs forming by this means three. An appearance ſimilar to this is ſeen in the legs of the lucanus, but this, on minute examination, is found to be a diſtinct joint alſo, armed with a pair of claws, preciſely reſembling thoſe which, more obviouſly from their ſize, appear to terminate the tarſi. It is conſiderably ſmaller, but as perfectly well defined.

Reaumur, Weiſs, Borelli, and Cuvier, have publiſhed ſome curious remarks on the laws of motion obſerved in the legs of inſects, ſome of which are very intereſting. The relative proportion of the feet ſeems to determine, in a certain degree, the particular manner in which each inſect moves either in walking or leaping. When, for example, the legs are all equal, the movement is uniform, but when ſhort it is ſlow, and when long, it moves with rapidity. Thoſe inſects, therefore, which have the legs long, as in the phalangium, and ſome others, run very quickly: and, on the contrary, the acarus, pediculus, and thoſe others, which have the legs ſhort, are remarkable for the ſlowneſs of their pace. When the anterior feet are longeſt, as in certain cerambyces, their ſpeed is retarded when moving on even ground, though, in climbing, this length of the anterior legs is an advantage. When the poſterior feet are longeſt, they uſually afford the inſect the ability of leaping, as in the locuſt, acheta, and other families; but ſuch a ſtructure impedes its ſpeed in walking; and does not always enable it to leap; the inſects of the leucopſis and chalcis genus, though their poſterior thighs are very large and thick, are ſuppoſed to be incapable of this action. The latter inability is attributed to the great curvature of the legs, thoſe inſects which are truly of the ſaltatorial kind, as in the gryllus genus, being remarkably ſtraight.

Alæ, or *wings*.—Wings, the organs appropriated to flight. Theſe in different inſects vary from two to four, and are attached to the lateral part of the breaſt, cloſe to the lower margin of the thorax. They are placed to an equal amount, and in a correſponding ſituation on both ſides of the inſect, whether the number be two or four. Thoſe inſects which are furniſhed with only one pair of wings, have both of an uniform appearance and ſize. Such as have two pair moſt frequently differ, the firſt being larger than thoſe behind: there is alſo a difference in ſhape, and very commonly a conſiderable variation in the ſpots, markings, and other particulars, notwithſtanding the prevailing hues in all the wings may be the ſame. In general, the poſterior pair is paler, and the marks obſcure.

The wing properly ſo denominated ſhould be diſtinguiſhed from the elytra or wing-caſes, thoſe hard ſhelly coverings of the true wings in the alated kinds of coleoptera. Theſe wing-caſes, or ſheaths, are often confounded with the wings; but they are really not wings from their ſtructure or ſubſtance, nor do they anſwer the purpoſe of flight: they merely open to afford the true wing, concealed beneath, the power of expanſion and motion, and cloſe down upon the wing, when the inſect is at reſt, to preſerve it from injury. Of this we have ſpoken more largely in deſcribing the elytra. The ſemi-cruſtaceous wings of the hemipterous orders partake of an intermediate character between the wing-caſes and wings, as already noticed in its proper ſection. The wings and elytra in ſome inſects, and the wings and hemelytrous wings in others, are ſo intimately connected, that we conceived it requiſite, in order to avoid miſconception, to advert again to this circumſtance.

A ſkeleton of nerves, more or leſs numerous, and differing exceedingly in diſpoſition, placed between two thin and cloſely united membranes, conſtitute the true wing in inſects. This conformation is very clearly exemplified in that deſcription of wings which is uſually termed tranſparent, as in the common houſe-fly and the bee. The true wing, by means of which the inſect is enabled to fly, is always conſtructed in this manner, whatever may be its appearance externally, ariſing from a ſuperficial covering of down, feathers, hair, or any other cauſe. The variety in the form and ſtructure of the wings, in the number, figure, and diſpoſition of the nerves, or the colours with which they are adorned, is infinite. The diverſity in the diſpoſition of the nerves is evident from a compariſon of the ſimply conſtructed wing of the common houſe-fly (muſca domeſtica) with the complex wing of the panorpa, or the ephemera, or the wing of the forficula (earwig), which conſiſts of a ſeries of ſingle nerves, with the elaborately wrought lattice-work of the wing of the libellula. The whole of the lepidoptera tribe exhibit the ſuperficial coating of feathers, down, or hairs; and upon the removal of theſe, the wings are found conſtructed exactly in the ſame manner as the tranſparent wings of the other tribes. A variation in the form of the wing, as well as its texture, is manifeſt throughout all the inſect tribes of the winged kind. Thoſe of the coleoptera have two membranous wings, which fold upon each other, forming a plait, or double at their external margin; which fold is accommodated by a peculiar joint in the main rib of the wing, and the peculiar diſpoſition of the nerves in the middle of the wing contiguous. In the hemiptera the wings generally fold longitudinally, without any tranſverſe double, ſo that in expanſion theſe parts open ſomewhat like a fan: the forficula is an exception in this order, the wing in this genus being doubled acroſs as in the coleoptera. The wings of the lepidoptera are neither doubled acroſs nor folded longitudinally; they are entirely flat, and incapable of contraction and dilatation. In the papilio genus they are endowed with the power of erection, which is not the caſe in the phalæna genus, though occaſionally obſerved among the ſphinges; the phalænæ have the lower wings concealed under the anterior pair, the latter being laid in a flat poſition over them. The wings of the lepidoptera are downy, and often decorated with very beautiful colours diſpoſed in the moſt pleaſing and varied manner. The neuroptera in general have the wings flat; this is not invariable: they are conſtantly membranaceous, and reticulated with nerves. In the hymenoptera the wings are membranaceous, generally flat, but ſometimes folded, when the inſect ſettles, as in the waſp genus. The dipterous order cannot be confounded with the preceding, as they have only two wings, without any wing-caſes: they are membranaceous as in the former.

Inſects of the dipterous family, bees, and various kinds of hymenoptera, and many others, poſſeſs the powers of flying in a more perfect degree than any claſs of animals beſides; ſurpaſſing in this reſpect even the bird tribe. All inſects that are furniſhed with wings have not an equal celerity of motion in the air; the movements of the wings in ſome inſects is more circumſcribed than in others. The muſcles that move the wings are not yet very well aſcertained: they are ſaid to be ſituated in the breaſt, and to be of two kinds; the firſt of theſe are ſmall and ſhort, and are intended to extend or fold the wings, at the ſame time that they move them to and fro from the body; the others, which are ſomewhat longer, are calculated to produce theſe motions of elevation and depreſſion which the wings perform, very ſtriking examples of which are found in the two genera papilio and libellula. The wing-caſes of the coleoptera are not moved, it appears, by the pectoral muſcles like the wings.

The dipterous inſects, when flying, emit a loud buzzing ſound, occaſioned, as it is believed, by the wings and balancers ſtriking againſt each other. The noiſe of the cricket and locuſt is produced by the friction of the wings, or baſe of the wing-caſes againſt the poſterior edge of the thorax; and which is obſerved likewiſe to be the caſe with the cerambyx, leptura, and various other inſects.

In all inſects of the winged kind theſe organs preſent the greateſt diverſity, and afford characters both of genera and ſpecies leſs liable to fluctuation than common obſervers would conceive. The number, figure, conſtruction, proportion, conſiſtence, and texture of the wings have enabled naturaliſts to diſtribute inſects into principal families with conſiderable preciſion; and their minor peculiarities of ſpots, marks, and colours, have furniſhed ſubordinate characters of the utmoſt utility in defining ſpecies. Linnæus derived much aſſiſtance from an attention to theſe parts; later writers have in many inſtances regarded them more cloſely; and in the further progreſs of the ſcience, we are perſuaded theſe parts may be conſulted with much greater advantage ſtill.

There are many terms at preſent in uſe, intended to deſcribe the different kinds of wings, the principal of which ſhould be underſtood by the ſtudent in entomology.

The wing in all inſects is diſtinguiſhed, with reſpect to its ſurfaces, into ſuperior and inferior; that above is denominated the ſuperior, and that beneath the inferior. In the deſcription of wings, the terms anterior, poſterior, interior, and exterior parts, and ſometimes the diſk, occur very frequently. The anterior part or margin is that next the head; the poſterior, that towards the vent; its exterior, that towards the outer edge; and the interior, that next the abdomen: the diſk is the centre of the wing. Theſe terms are not always applied with preciſion by entomologiſts: the baſe of the wing, next the point of connection to the breaſt, is ſometimes called the anterior part; and in this caſe, every other part varies its name in a relative proportion: and this appears to be a correct method of deſcribing the parts of a wing in its natural ſtate, while the inſect is at reſt, with the wings down; but it applies only to thoſe which diſpoſe their wings longitudinally: it would be altogether inapplicable in deſcribing a papilio, in which the wings are expanded and ſtretched forward; or in the libellula, which reſts with the wings in the ſame poſition. The anterior margin of a wing is, therefore, generally underſtood as implying the coſtal edge, and which is ſo named becauſe it is formed by the main rib that extends from the baſe to the tip of the wing.

The wings are called plicatiles, when they are folded at the time the inſect is at reſt; planæ, when ſtretched out their whole length without folds, and incapable, from the ſtructure of their nerves, to be folded up; erectæ, ſuch as have an erect poſition when the inſect is at reſt, the ſuperior ſurfaces being brought in contact above the back, and the extremities oftentimes meeting, as in the butterfly tribe; patentes, thoſe like the geometra family of moths, and moſt of the libellula, which have the wings expanded horizontally when at reſt; incumbentes, ſuch as cover in an horizontal manner the ſuperior part of the abdomen, when the inſect is at reſt. Theſe differ from deflexæ, in having the outer edges declining towards the ſides, like the ridge of a houſe; reverſæ are alſo deflexæ, with this addition, that the edge of the inferior wings projects from under the anterior part of the ſuperior ones; dentatæ are thoſe with the wings indented or ſcolloped; caudatæ, thoſe in which one or more of the nerves of the poſterior wings extends beyond the margin, and forms a proceſs, ſuch as occurs in the equites family of papilio, and the genus heſperia, and in a far more remarkable manner in phalæna argus; reticulatæ, thoſe in which the veins or membranes of the wing form a kind of lattice-work, as in the genus libellula.

The colours (colores) are named in terms agreeably to their common acceptation; but according to the various forms of the ſpots, bands, ſtreaks, &c. in which they appear on the wings, they have various ſignificant appellations. Maculæ are ſpots; punctæ, dots; faſciæ, bands; ſtrigæ, ſtreaks; and lineæ, lines. Ocellus is a round ſpot, containing a ſmaller ſpot of a different colour in its centre. Stigmata is a term in the Linnæan language, introduced to ſignify a ſpot or anaſtomoſis in the middle of the wing, near the anterior margin: this is conſpicuous in moſt of the hymenoptera and neuroptera. Stigmates is a term alſo applied to the ſingle or double kidney-ſhaped ſpot ſituated in the middle of the anterior wings in many of the moth tribe, in the noctua family, and in ſome of the bombyces. Several modern naturaliſts call the reſpiratory ſpiracles at the ſides of the body in inſects ſtigmates, the application of which may create confuſion; ſtigmata, and ſtigma, ought for this reaſon to be admitted in the ſenſe Linnæus intended: the ſpiracles bear already a name ſufficiently indicative of their uſe and appearance, and do not require this alteration. Moſt of theſe terms apply only to the lepidoptera tribe, in the markings of whoſe wings the moſt beautiful colouring prevails.

Halteres, poiſers, or balancers, appendages peculiar to inſects of the diptera order, and which, with ſufficient reaſon, are deemed an eſſential character of that tribe. Theſe poiſers are two ſhort, moveable, clavated filaments, placed one contiguous to the origin of each wing. They ſeldom exceed one-tenth the length of the wing, though in certain genera they are rather longer. The capital, or head, in which the filament terminates is either roundiſh, oval, truncated at the end, or compreſſed at the ſides: in ſome inſects its ſituation is directly under a ſmall, arched, filmy ſcale, which alſo varies in ſize and form; and in ſeveral families is entirely wanting.

The exact purpoſe to which nature has deſtined theſe organs has not been hitherto aſcertained in a very ſatisfactory manner. The moſt prevalent, and perhaps in ſome meaſure the moſt conſiſtent, opinion ſeems to be, that they balance or counterpoiſe with the action of the wings, when the inſect is in flight, in the ſame manner as rope-dancers exerciſe a pole to preſerve their equilibrium. The diminutiveneſs of their ſize is a plauſible objection to this idea. Others conſider theſe as the organs of that vibratory ſound which dipterous inſects emit in flight: they compare the filmy ſcale to a kind of tambour, and liken the balancer to a drum-ſtick, which ſtriking repeatedly upon it, they conceive muſt occaſion this noiſe. In the conformation of the drum-like organs under the breaſt of ſome ſpecies of tettigoniæ, this conception is fully realized; a ſound is actually occaſioned by ſimilar means. (Vide Donov. Inſ. China.) But with regard to the diptera, it is apprehended the ſounds they emit in flight cannot be traced to this cauſe: in ſome we know it cannot, for the beſt of all poſſible reaſons, namely, that though, like others of the ſame tribe, they have balancers, they have no ſcale to ſtrike with them. It ſhould be obſerved alſo, that this buzzing ſound is obſervable in a vaſt number of inſects which have no poiſers or balancers, ſuch as waſps and bees. The two genera, aſilus and bombylius, have no ſcale, and yet the noiſe perceptible in their flight is louder than in moſt of thoſe which have both ſcale and poiſers, as in the muſcæ, for example. Nor does this noiſe iſſue from the poiſer, either by ſtriking on the ſcale, or by any other means, as muſt be admitted, ſince it is known that if the poiſers, or both poiſers and ſcales, be cut off, the ſame ſound continues to be heard from the mutilated inſects as before.

The motion of theſe poiſers, when the inſect flies, is very lively: they are longeſt in the tipula, diopſis, and aſilus; in muſca, ſcarcely apparent, and accompanied by a ſcale of large ſize.

Elytra, or wing-caſes, appertain to the coleopterous tribe: theſe are two in number, of a ſubſtance reſembling leather, for the moſt part moveable, and opening by a longitudinal ſuture along the middle of the back. The elytra are extended or raiſed up when the inſect is in flight. They do not appear to aſſiſt the inſect in its flight; the muſcles, by which they are connected to the body, have not their ſeat in the breaſt, like thoſe of the true wings; and its movement in the air is accompliſhed by means of the latter, which are tranſparent, folded between the body and elytra when at reſt, and expanded when the inſect flies. Some have the elytra united, and may with more propriety be named elytron, for it conſiſts only of a ſingle piece marked with a longitudinal line ſuperficially, inſtead of being divided by a ſuture; this is lifted up, or rather, the abdomen depreſſed downwards, to admit the paſſage of the wings laterally, when the inſect is preparing for flight. Others furniſhed with elytra, or wing-caſes, ſeem to render the term for theſe parts exceptionable; for in reality they have no wings beneath them: the number of theſe, however, is not conſiderable, and they cannot employ their elytra as organs of flight.

The ſuperior ſurface of the wing-caſes is more or leſs convex, and the lower ſurface correſpondently concave: the texture in ſome, as in ſome of the curculio and bupreſtis, ſo hard, that it is pierced with difficulty by means of a ſtrong pin; in others ſo flexible, that they ſpring into their proper form immediately after being bent double. The proportions of the elytra, compared with the body, are various, their form diſſimilar, and the diverſity of their ſurface, ariſing from dots raiſed or depreſſed, protuberances, flutings, colours, and other circumſtances, endleſs. Theſe differences in the elytra furniſh ſome excellent generical diſtinctions, and are ſtill more extenſively uſeful in conſtituting the characters of ſpecies. When the wing-caſes are ſhorter than the abdomen they are termed abbreviata, unleſs they terminate in a tranſverſe line, when they are called truncata; faſtigiata, when of equal or greater length than the abdomen, and terminating in a tranſverſe line; and ſerrata, when the exterior margin towards the apex is notched or ſerrated, as in ſome of the bupreſtis genus. The appearance of the ſurface is variouſly diſtinguiſhed; ſpinoſa is the term implying that the ſurface is covered with ſharp points or ſpines; ſcabra, rough; ſtriata, marked with ſlender furrows longitudinally; porcata, with elevated longitudinal ridges; ſulcata, with concave ridges, &c.

The want of appropriate terms for thoſe kinds of wing-covers, which partake of a middle texture between the elytra and the wings; and alſo for thoſe in which the characters of both are united, muſt be obvious in the preſent ſtate of entomology. To the firſt of theſe no ſuitable name has been given: the French "ètius molle," and "ètius preſque membranaceux," are not ſufficiently expreſſive; the firſt is deficient in preciſion, and in the other there is too much latitude. Linnæus once propoſed the term hemelytra, by which he intended to deſignate both kinds, whether, as in the grylli, thoſe parts were of an intermediate ſubſtance between leather and membrane; or, as in cimices and nepæ, one half was coriaceous, and the remainder membranaceous. The term, in this general ſenſe, could not be ſtrictly proper; it was, notwithſtanding, preferable to that of elytra, admitting the latter to be rightly applied to the wing-caſes of the coleoptera; and we are therefore the more ſurpriſed it was not afterwards adopted by that naturaliſt, or ſome other ſubſtituted. So lately as the tenth edition of the Linnæan Syſtema, the word elytra is employed indiſcriminately for the hard and ſtubborn wing-caſes of beetles, the ſoft wing-covers of the blatta, and the membranaceous reticulated wing-covers of the gryllus, all which genera were included at that time in coleoptera; and by an overſight equally extraordinary, the half-coriaceous wing-covers of the cimices, the nepæ, and notonectæ, were then confounded with the delicate covers of the aphis, thrips, and chermes, under the indiſcriminate title of wings. The diſtinction of coleoptera and hemiptera is rendered rather more clear in the laſt edition of that work, the blattæ and grylli being removed from the former to the latter order; yet the application of the word elytra to the wing-caſes of the hemiptera is not by that means rendered leſs improper. The difference in the conformation and conſiſtence of the wing-covers in the two tribes is too evident to leave this a matter of doubt. But cuſtom has ſo far ſanctioned this impropriety, that our beſt entomologiſts to this period deſcribe all theſe kinds of wing-covers under the name of elytra. Fabricius has not even attempted to correct this error in the Linnæan phraſeology: he adopts the ſame term.

Among the principal differences in the form and texture of the elytra, ſome, at leaſt, are very remarkable. In the beetle, or coleoptera tribes, theſe parts are coriaceous, very hard throughout, convex in form, and divided by a ſtraight ſuture. Thoſe of the cimex genus have the upper half only of a coriaceous texture, the lower half being ſoft and membranaceous, and the latter portion of one elytron is folded acroſs the correſponding part of the other when the inſect is at reſt. The coriaceous half of the elytra in many ſpecies is as hard and tough in texture as the entire elytra in the coleoptera, and the membranaceous part as ſoft as in the hymenoptera and diptera. In the genera blatta, forficula, acheta, and others, the elytra is of an uniform ſubſtance throughout, ſomewhat reſembling parchment; a ſimilar texture prevails in the elytra of nepa, notonecta, and naucoris genera, but rather like the cimices, there is a diſtinction between the upper and lower portions, the firſt being of a firmer texture, and thicker than the other part. The fulgora genus, like the gryllus, affords examples of another kind, thick, membranaceous, and ſtrongly reticulated elytra, divided in the middle by a longitudinal ſuture. In the tettigonia, another of the hemipterous genera, the elytra are often perfectly membranaceous and tranſparent in texture, though not in form reſembling thoſe of the hymenoptera and diptera; yet theſe are called elytra, and ſo likewiſe are the weaker and more flexible tranſparent anterior wings of the aphis, thrips, and chermes, for theſe two are included in the order hemiptera! From a due conſideration of theſe decided differences, we cannot heſitate to admit that the term elytra is not applicable to all. In a treatiſe of this kind it might, perhaps, create confuſion to introduce any other terms than thoſe in common uſe; we only intimate our perſuaſion, that reformation in the language of entomology is neceſſary. In the formation of any new ſyſtem, and which in the preſent ſtate of ſcience appears requiſite, we may reaſonably hope to ſee theſe and ſimilar objections obviated.

In concluſion of theſe remarks, it may be mentioned that nature has herſelf pointed out certain diſcriminating characters in thoſe parts called the elytra which do not ſeem to have been ſufficiently attended to, and which not only relate to their figure and appearance, but likewiſe to their utility, or the benefit the inſects derive from theſe organs. The wing-covers in the coleoptera do not, it is generally believed, in the leaſt degree, aſſiſt the inſect in flying: in the cimices, and others which have thoſe parts of a more flexible texture, they do not materially aid its celerity of motion in the air; but in thoſe which have the wing-covers completely ſupple, they concur immediately to its velocity in flight.

Sexes of Inſects.

The ſame difference of ſex exiſts throughout the inſect race as in moſt other animals. The ſexes cannot be aſcertained in the larva and pupa ſtate, except in ſome few inſtances; but when they arrive at their laſt ſtate, both kinds poſſeſs permanent characters, by which they may be eaſily determined: theſe conſiſt in a comparative difference in their ſize, and vivacity of colour, form of the wings, bulk of the abdomen, ſhape and dimenſion of the antennæ, and various other external peculiarities.

In moſt inſects the male is ſmaller than the female, their comparative difference varies conſiderably in different ſpecies. In the lepidopterous tribe the female is only perceptibly larger than the other ſex in general; in the ant it is ſix times larger than the male: in the coccus twelve or fifteen times, and in the termes the female is at leaſt two hundred times larger than the male. This latter ſex is commonly decorated with colours more lively and brilliant than the females, a diſtinction obſervable in a very remarkable degree in many of the butterfly tribe, the males of which are very beautiful, and the females obſcure. There is alſo ſome difference in colour between the two ſexes in ſome coleopterous inſects.

Many of the larger tribes of beetles (geotrupes) preſent a wide diſſimilarity in the conformation of the two ſexes: in the males the head is embelliſhed with one, two, or more diſtinct and prominent horns, and which, in a number of ſpecies, are very conſiderable in ſize; theſe are entirely peculiar to the males; the head of the female has only a few ſlight protuberances inſtead of horns, and is ſometimes even deſtitute of them.

In the moth tribe the antennæ of the male are almoſt invariably larger or more deeply pectinated than in the female, and this difference may be traced from the broad feather antennæ of the largeſt bombyces, to the ſetaceous antennæ of the noctuæ; however ſlightly the antennæ of the male appear pectinated, thoſe of the female will be found ſtill leſs ſo. The abdomen in this order is alſo ſmaller than that of the female. The colours of the wings alſo differ amazingly in the two ſexes, of which phalæna humuli (Linn.) affords a very ſtriking example, the wings of the male being of a beautiful ſnowy white; that of the female bright yellowiſh, with orange ſpots.

Another diſtinction, but which is not a general character, conſiſts in the female being apterous, or without wings, the male being furniſhed with thoſe organs of flight. Among the coleoptera we find the lampyris of this kind; in the hemiptera the blatta; among the moth tribe, phalæna antiqua, gonoſtigma, brumata, &c. Theſe wingleſs females are indeed ſo much unlike the other ſex, that no one unacquainted with inſects could believe them to be of the ſame ſpecies. The females of theſe lepidopterous inſects are not entirely apterous; they have four very minute wings attached to the thorax, in the ſame place as is occupied by the baſe of the wings in the other ſex, otherwiſe they reſemble an apterous inſect. In the aphis tribe the male has ſometimes wings, and is ſometimes without; and the female, it is ſaid, differs in the ſame manner.

Theſe are the principal external characters, by means of which the two ſexes in inſects may be diſcriminated.

Generation.

That general law of nature which prevails among the larger tribes of animated beings, and ordains an intercourſe of the two ſexes as indiſpenſable to the production of their young, does not regulate the multiplication of all inſects: there are ſome ſingular deviations to the contrary. The doctrine held by the ancient ſages of Egypt, that in certain inſects both ſexes are united, is perhaps inadmiſſible: we ought not to ſpeak with too much confidence on this ſubject, notwithſtanding the aſſurance of Linnæus, that there are no hermaphrodite inſects. The obſervations of naturaliſts leave us in no uncertainty with reſpect to another order of beings, namely, thoſe which belong to neither ſex; and indeed the exiſtence of theſe is demonſtrated daily in every hive of bees.

The myſteries of generation are only in part unveiled to the philoſophical enquirer. Some leading points appear equivocal, and remain inexplicable. This is the caſe with larger animals, where we have external circumſtances to direct our judgment. With reſpect to inſects, in particular, the hiſtory of their generation, in certain inſtances, at leaſt, is more obſcure. Many of them, like the larger animals, produce their young in conſequence of an immediate union of the ſexes. But among the numerous families which compoſe this extenſive claſs of creatures, there are ſome deviations from this ordinary courſe of nature, and theſe partaking of incidents ſo remarkable, that no poſitive and uniform concluſion of their mode of increaſe can be laid down. The notions entertained by ſome philoſophers in the middle ages, that inſects are the offspring of corruption and putridity, have no foundation in reaſon or analogy. It is impoſſible to conceive that organized bodies, poſſeſſed of life, and endowed with ſenſibility, can owe their origin to chance. But beyond this we are authorized in the belief of circumſtances, that militate very ſtrongly againſt eſtabliſhed opinions. The courſe of generation and mode of increaſe, obſerved in certain tribes of inſects, have no parallel among thoſe of the larger kinds of animated beings: we need only mention a few particulars of the aphides in ſupport of this.

Of the aphis genus there are not leſs than ſeventy ſpecies known, and the females of every one of theſe, ſo far as it has been poſſible to inveſtigate their manners, are capable of producing their young without the concurrence of the male ſex! A female aphis, brought up in the moſt perfect ſecluſion from the very inſtant of its production from the egg, will in the courſe of a few days be found in the midſt of a numerous family of females only, brought forth alive. An individual taken from theſe, or even ſelected at the moment of its birth from the brood, and kept alone, will in a ſhort time produce another brood, and in like manner a repetition of the ſame experiment will be again attended with the ſame reſults.

It would be only a natural inference drawn from the above mentioned circumſtances, that in the ſame individual of this kind the two ſexes muſt be united. This we know is not without example in the inferior order of animals, the greater part (we ſhall not ſay the whole) of the vermes tribe being probably of this deſcription. Such is not apparently the caſe however with regard to the aphis; the real truth appears ſtill more aſtoniſhing. To render theſe fertile, the intervention of the male ſeems to be requiſite in autumn, and hence the power of impregnation devolves down to the tenth, or, as ſome naturaliſts affirm, to the twenty-ſeventh generation. The eggs of the firſt, or parent brood, are laid in autumn, theſe hatch in the enſuing ſpring, and this fertile produce perpetuate the race through many generations till the autumn following; every brood, after thoſe hatched in ſpring from the egg, being viviparous.

The generality of vermes are believed to unite the two ſexes in the ſame individual, and thus poſſeſs the power of ſelf-production. Later obſervations ſeem to prove, that moſt animals of this tribe have both male and female organs, but that the union of two individuals are ſtill requiſite, each performing at the ſame time the office of male and female, and by this reciprocity of their functions both become fertile. Among the cancri, which Linnæus conſiders of the inſect race, we are aſſured ſome monſtrous luſi have been obſerved, in which the organs of both ſexes were apparent; but probably theſe might not poſſeſs the ability to perpetuate their natural race. Theſe we paſs over therefore for the preſent as irrelevant. There is no inſect, perhaps, ſuch accidents excepted, in which the two ſexes are united. We advance even this with caution, becauſe there is reaſon to imagine the contrary in certain inſtances. From our own obſervation we are perſuaded that ſome few at leaſt of the ſuppoſed vermes are the larvæ of genuine inſects. Let us for a moment imagine theſe larvæ to be really vermes! And let us farther conceive that theſe larvæ, like the true vermes, are of the hermaphrodite kind! What an extraordinary deviation from the uſual courſe of nature would ſuch a prodigy preſent!

Here, however, be it explicitly underſtood, that we do not aſſert the latter part of this obſervation as abſolutely certain. Such an aſſertion is countenanced by no opinion except our own, and ſuch opinion ought not to be advanced without being at the ſame time ſupported by argument and proof, the production of which would extend the limits of our obſervations very far beyond our preſent deſign. It is only our wiſh to intimate at this time, that there are certain animals of the ſuppoſed vermes, and which are deſcribed by Linnæus and others as appertaining to this claſs, which are in reality the larvæ of inſects; and that we are not without ſuſpicion that ſome of theſe larvæ are fertile, and produce an increaſe in a manner not very clearly known, before they aſſume their final form. Among the ſuppoſed vermes of the marine kind, the larvæ of certain coleopteræ will perhaps be recognized. Theſe are ſimply larvæ, and apparently deſtitute of any ſexual functions till they arrive at their laſt ſtate. Some of the freſh water larvæ, miſtaken for vermes, are in all probability of the ſame deſcription. But have we ſufficiently examined the inteſtinal vermes? Are any of thoſe peculiar to different animals, or man, capable of producing young vermes, like themſelves, and afterwards becoming inſects? One fact may be important, and we ſtate it upon the teſtimony of our own knowledge, that certain kinds of theſe ſuppoſed vermes, which infeſt the human race to the deſtruction of thouſands in the age of infancy, are really no other than the larvæ of inſects.

Linnæus affirms that no inſect can form an union with the oppoſite ſex, or propagate its kind till it arrives at the laſt ſtate, and offers this as a proof that gryllus pedeſtris is not a pupa which its appearance implies, becauſe it is found connected with the female. This obſervation of Linnæus is pretty generally correct, and it may be further added, that in the different ſtates, prior to the perfect condition, there are no ſexual organs, or at leaſt none that are developed. This is the fact with regard to moſt inſects, certainly not to all. Among the cimices there can be no doubt in our own mind from actual obſervation, that the ſemi-nymphs of certain ſpecies do unite with their mates, and afterwards become winged inſects. We are not without ſuſpicion that many of the grylli, like the pedeſtris, poſſeſs the ſame faculty, and are afterwards furniſhed with wings.

With reſpect to the inſects of neither ſex, or neuters, it ſhould be obſerved that thoſe appertain to ſpecies in which there are the two diſtinct ſexes beſides, as in the bee tribe. It is chiefly among the hymenopterous inſects that we meet with theſe neuters; the formicæ afford examples of other inſects of the ſame kind, and it is believed there are likewiſe neuters among the coleoptera. They are called neuters becauſe they are of no apparent ſex. Some have pretended that they are no other than females, in which the ſexual parts are not yet developed. This cannot, however, be the fact; neither can they be of the male ſex under the ſame diſguiſe, becauſe they are conſtantly diſſimilar in their characters from both, and could ſcarcely be ſuppoſed, from their appearance in many inſtances, to belong to the ſame ſpecies they really do, had not this been aſcertained by their production from the ſame brood with the two diſtinct ſexes.

Of inſects in general it may be obſerved, that the males and females of the ſame ſpecies are not unerringly faithful; they deviate occaſionally from the path appointed by nature. This is moſt obſervable in the coccinella genus. Theſe hybrid inſects are conceived to be unfruitful; they reſemble the female in form, but in point of colours and ſpots have ſome reſemblance to the male parent.

There is an accordance in the ſtructure and ſituation of the ſexual organs in inſects, whether male or female, with thoſe of larger animals, and their union is accompliſhed in the ſame manner. Theſe organs are uſually placed at the extremity of the abdomen. This is not conſtantly the caſe; there are inſects, and among thoſe the ſpiders, which have the male organs placed at the tip of the feelers, one at the extremity of each; every individual of theſe creatures being furniſhed with two. The female organ is beneath the abdomen. Another ſingularity is obſervable in the libellulæ (dragon flies), the males of which have the ſexual organ ſituated under the breaſt, while that of the female is at the extremity of the abdomen. When in union they are ſeen flying in the air, the female under the male with her ſlender body incurvated, and the tip of the abdomen bent under his breaſt.

Except at the period of their amours the ſexual organs of inſects are not perceptible, thoſe of the male at other times are drawn within the body. Their union in ſome ſpecies continues for a ſhort time only; others remain in this ſtate for hours, or even days together.

Transformation of Inſects.

Moſt animals retain during life the form which they receive at their birth. Inſects are diſtinguiſhed from theſe by the wonderful changes they undergo. The exiſtence of an inſect partakes of two, three, or four diſtinct ſtates, and in each of theſe differs moſt eſſentially in appearance, organization, and manners of living.

The ancients were not unacquainted with the ſingular metamorphoſes of inſects. Ovid has drawn many beautiful fables from this ſource. The ſongs of Anacreon afford certain paſſages to the ſame effect; and we might alſo mention others. An inquiry into the knowledge of the ancients in this reſpect might be intereſting; but we cannot now purſue the inveſtigation, as it would lead to digreſſions the limits of this article will not allow. Our ideas have been offered at ſome length in another place. (Donov. Hiſt. Inſ. China.) We ſhall only obſerve for the preſent, that they were not unacquainted with the metamorphoſes which certain inſects undergo. Their poets wantonly intermingled fable with truth, to improve their allegories; but their hiſtorians were more correct, and ſeldom formed erroneous concluſions, unleſs deceived by ſpecious appearances. In the ſixteenth century, with the revival of learning and philoſophical diſcuſſion, and from that period to the preſent, this ſubject has engroſſed much attention. The labours of Swammerdam, Goedart, Merian, Malpighi, and others, contributed materially to its advancement in the firſt inſtance. Their diſcoveries induced others to regard the transformations of theſe curious creatures with attention; and hence, in the courſe of years, their hiſtory became pretty generally underſtood. Thoſe who afterwards contributed moſt eſſentially to the improvement of this branch of entomological knowledge were Reaumur and Degeer. In the progreſs of time, other valuable works appeared in elucidation of the ſame ſubject. The moſt uſeful of theſe, perhaps, to the general reader, are thoſe denominated "Entomologi Topographici," or ſuch as relate to the inſects, with their tranſformations peculiar to, or inhabitants of particular countries. Among the number of theſe may be mentioned the two works of Merian, "Erucarum ortus, Alimentum et Paradoxa Metamorphoſis," and "Inſecta Surinamenſia." "Hiſtoire abregée des Inſectes, qui ſe trouvent aux Environs de Paris," by Geoffroy; "Naauwkeurige Waarneemingen," &c. of Admiral; Roeſel's "Inſecten Beluſtigung;" Abbot's "North American Inſects," by Smith; and Donovan's "Inſects of Great Britain."

The changes through which the greater number of inſects paſs are from the egg to the larva, from the larva to the pupa, and from the pupa to the laſt or perfect ſtate. Exceptions occur to this: for ſome inſects are viviparous; the number of theſe is not conſiderable: and there are others of the apterous or wingleſs kind, which undergo no change, iſſuing from the egg in the perfect form.

Of the Egg State.

The egg, containing the inſect in its ſmalleſt ſize, is expelled from the ovary as in oviparous animals. They are contained and arranged in the body of the inſect, in veſſels which vary in number and figure, in different ſpecies. The ſame variety is found in the eggs: ſome are round, others oval, ſome cylindrical, and others nearly ſquare. The ſhells of ſome are hard and ſmooth, while others are ſoft and flexible. It is a general matter of obſervation, that eggs do not increaſe in ſize after they are laid: among inſects we find, however, one exception to this rule, for the eggs of a ſpecies of tenthredo are known to become larger after being depoſited. The ſhell is membranaceous, which admits of this dilatation.

The eggs of inſects are of various colours; ſome are found of almoſt every ſhade of yellow, green, and brown, a few are red, and others black. Green and greeniſh are not unuſual, and they are ſometimes ſpeckled with darker colours, like thoſe of birds. Some are ſmooth, and others beſet in a pleaſing manner with little raiſed dots.

Inſects are inſtructed by nature to depoſit their eggs in ſituations where their young ones will find the nouriſhment moſt convenient for them. Some depoſit their eggs in the oak-leaf, producing there the red gall; others chuſe the leaf of the poplar, which ſwells into a red bladder: to a ſimilar cauſe we are indebted for the knob, which is often ſeen on the willow leaf, and the three-pointed protuberances upon the termination of the juniper branches. The leaves of the veronica and ceraſtium are drawn into a globular head, by the eggs of an inſect lodged in them. The phalæna neuſtria glues its eggs with great ſymmetry in rings round the ſmaller twigs of trees; others affix them to the ſurface of leaves; and again, others lodge them in the crevices of trees.

The gnat, the ephemera, phryganea, and libellula, hover over the water all day to drop their eggs: theſe hatch in the water, and continue there while in the larva and pupa form, quitting the water only when they attain the winged ſtate. The maſs formed by the eggs of the gnat reſembles a little veſſel, and floats on the ſurface. This inſect depoſits only one egg at a time; the firſt is retained by means of the legs, when dropped, till a ſecond is depoſited next to it, then a third, fourth, and further number, till the maſs becomes capable, from its ſymmetry, to ſupport itſelf upright. Many moths cover their eggs with a thick bed of hair or down, collected from their own body; others cover them with a glutinous ſubſtance, which, when hard, protects them from the ill effects of moiſture, rain, and cold. The ſolitary bees and waſps prepare neſts in the earth, hollow trees, or cavities in old walls, wherein they place a quantity of food for the ſupport of the young brood, when they break from the egg. Some of the ſpiders carry the eggs on their back in a ſmall ſilky bag. The ants are known to conſtruct neſts in the earth, in which their eggs are placed with the utmoſt care. Some depoſit their eggs in the larvæ of other inſects, chiefly thoſe of the moth and butterfly kind; and having paſſed through all their changes in their bodies, become what is termed the ichneumon fly. In the Lapland Alps there is an inſect called the rein-deer gad-fly (oeſtrus tarandi), the attacks of which are greatly dreaded by the rein-deer. It hovers all day over theſe animals, who betray every mark of fear; their legs tremble under them; they prick up their ears, and ruſh to the mountains covered with ice and ſnow, to eſcape from the fly, but often in vain; for the inſect follows, and generally finds means to lodge its egg in the back of the deer. The worm hatching penetrates the ſkin, and remains under it in ſecurity during the winter; in the year following it falls out, changed to a pupa, and becomes a winged inſect. The oeſtrus bovis is an equal terror to oxen; the hippoboſca equina to horſes; and oeſtrus ovis to ſheep: the latter inſinuates its eggs into the head of thoſe uſeful animals, through the naſal organs.

The neſt formed by the female of hydrophilus piceus, for the preſervation of their eggs, is altogether remarkable, and is deſcribed with much minuteſs by Lyonet. This neſt is whitiſh, its figure an oblate-ſpheroid, three-fourths of an inch in length, and its breadth two-thirds of its length; on the upper ſurface it is terminated by a lengthened horn-like proceſs, an inch long, ending in a point, and of a browniſh colour. In this neſt the eggs are depoſited, and left floating on the water till in due time they hatch, and the larvæ deſert the little bark contrived for their preſervation in the ſtate preceding, committing themſelves to the water. Theſe coques generally float among reeds and duckweed. The purpoſe of the conical projection is ſuppoſed to be that of ſuſtaining the caſe in an upright poſition, when aſſailed by the wind: but this is mere conjecture; we may have yet to learn its actual deſtination. Another aquatic inſect, (one of the nepa genus,) that inhabits the waters of China, exhibits a far more extraordinary inſtance of the parental care which the inſect race evince for the preſervation of their eggs. This diminutive creature, ſcarcely an inch long, and of a ſubrotund figure, with the upper and lower ſurfaces flattened, is ſeen at particular ſeaſons bearing a large cluſter of eggs on its back, which, though diſpoſed as compactly as poſſible, by being placed on one end, and having the ſides touching each other, cover no inconſiderable portion of the whole ſurface of the diſk. In this manner they are conveyed by the inſect, wherever it goes, till the larvæ hatch, and drop inſtinctively into the water; when the parent inſect caſts off the exuvia of the nidus, and reſumes its former appearance. (Donov. Inſ. China.)

Of all the productions of nature inſects are ſuppoſed to be the moſt numerous and fertile. With the exception of fiſhes and cruſtacea, they are apparently the moſt prolific. Lyonet has offered a curious eſtimate of the increaſe of inſects, taken from their eggs. From a brood of 350 eggs, which he obtained from a ſingle moth, he ſelected 80. Theſe, when arrived at their perfect ſtate, produced 15 females; and hence he deduces the following concluſion. If 80 eggs give 15 females, the whole breed of 250 would have produced 65. Theſe 65, if equally fertile, would have produced 22,750 caterpillars, among which there would have been 4265 females. Theſe, in the third generation, by the ſame mode of calculation, muſt amount to 1,492,750 caterpillars. The number would have been ſtill greater, if in the firſt inſtances a larger number of females had been ſelected.

Of the Larva State.

Coleoptera.—The larva of all the coleopterous tribes of inſects is produced from an egg, in which the growth of the creature in an embryo or infant ſtate may be eaſily traced ſome time previouſly to its birth. They are either of a heavy, ſlothful, and voracious diſpoſition, as may be obſerved moſt commonly of thoſe which paſs their lives under ground, in putreſcent ſubſtances, or the trunks of trees; or briſk and active, like the generality of thoſe in the ſucceeding or hemipterous order. Among the coleopterous larvæ of lively manners we muſt rank ſome of the terreſtrial kinds, which, though they live in the earth, are always found cloſe to the ſurface, and affect particular ſoils; and thoſe of ſands, in maritime ſituations eſpecially: to theſe we ſhould add the inhabitants of the watery element, or thoſe which, in the ſtate of larva, are of the aquatic kind; and in ſhort, all that are carnivorous: theſe being more remarkable for their activity than ſuch as are deſtined by nature to feed on plants only. A ſuccinct account of the larvæ belonging to a few of the principal genera, and a conciſe deſcription of their manners, will be ſufficient to afford an accurate idea of the modes of life purſued by the larvæ of coleopterous inſects in general.

We know nothing from actual obſervation of the larvæ, from which the larger kinds of extra European beetles are produced: the transformations of the ſpecies hercules, alcides, actæon, atlas, and goliathus, and a hoſt of other gigantic animals of the ſame kind, (the largeſt of the inſect race,) remain at preſent in obſcurity. Yet we are at no loſs to conceive what the appearance of ſuch inſects in the larva ſtate muſt really be, ſo far as we already know their affinities; becauſe, from analogy, we can conclude they muſt be ſimilar, or at leaſt, generally ſpeaking, we may preſume with ſafety they differ only in ſome ſlight degree. The transformations of the ſpecies naſicornis, a native of Europe, an inſect of large ſize, and from its conformation poſſeſſing habits ſimilar to ſome natural family of exotic beetles, will, for example, aſſiſt our concluſions as to thoſe reſembling it; and, in like manner, the transformations of other extra European kinds may be determined with ſome preciſion, from the known changes of thoſe inſects naturally allied to it, or, in other words, of the ſame natural family.

Scarabæus naſicornis, or, as it is ſometimes called, the rhinoceros beetle, from the conſpicuous horn placed erect on the head of the male, reſembles an extenſive family of ſcarabæi, the inhabitants of Aſia and Africa. The larva is hatched from an egg of a roundiſh form. The body is like that of a thick and ſomewhat broadiſh annulated worm, of a pale yellowiſh-white colour, flattiſh on the belly, and with the ſkin much wrinkled. The lateral breathing ſpiracles are very diſtinct, the head is hard and ſcaly, and armed with powerful jaws; and the three anterior rings of the body are furniſhed each with a pair of ſcaly jointed feet. It is found in the earth and in hollow trees, and ſeveral times caſts its ſkin before it changes into the pupa ſtate. The larva of the cock chafer, another of the ſcarabæi, (melolontha, Fabr.) reſembles this, except in being ſmaller: like the reſt of its family it ſpends the greater part of the time, while it remains in the larva form, in the earth, where it ſubſiſts on the roots of plants. It is two, and ſometimes three years in paſſing from the egg to the perfect ſtate.

The ſtag beetles, (lucanus,) in the larva ſtate, bear a ſtrong ſimilarity with the preceding; they reſide chiefly in rotten wood. The larvæ of ſome cerambyces reſemble theſe in being ſoft, and in having the head and feet ſcaly. It is the larva of an inſect of this genus (C. damicornis) which is eaten, and conſidered as a delicacy in the Weſt Indies. The ſpecies is a native of this and other parts of America, and it is credibly affirmed, on the beſt authority, that ſome people of fortune in the Weſt Indies keep negroes for the ſole purpoſe of going into the woods in queſt of them, and ſcooping them out of the trees. Their general length is about three inches and a half, and their thickneſs that of the little finger. Dr. Browne, in his hiſtory of Jamaica, particularly deſcribes this inſect; he informs us it is chiefly found on the plumb and ſilk cotton trees; that they are commonly called macaccos, or macokkos; and that the mode of dreſſing them, after opening and waſhing, is to broil them carefully over a charcoal fire. The epicures of theſe tranſ-Atlantic regions only imitate the epicures of antiquity: they alſo eſteemed the larvæ of the beetle tribe as a delicacy, and introduced them to their tables.

Many ſpecies of that elegant tribe of beetles, the curculiones, are the offspring of larvæ, bearing ſome reſemblance to the former: their body is covered with a wrinkled ſkin, their head with a ſcaly covering, and the three anterior rings of the body furniſhed each with a pair of feet. Theſe infeſt plants of various kinds; ſome ſubſiſting on the flowers, others the leaves, the roots, ſeeds, &c. One of theſe, the larva of curculio palmarum, deſerves notice for the ſame reaſon as that of cerambyx damicornis. This larva is about two inches long, and of an oval ſhape. It lives in vaſt numbers in the middle of the trunk of the young palm trees, and feeds on its juices. Theſe trees are ſometimes cut down, when about the height of a man, and the tendereſt part of them eaten; the worms are alſo taken care of, being conſidered as highly agreeable food when roaſted.

The larvæ of the coccinellæ have the body long, annulated, and furniſhed with ſix feet; they run briſkly over plants, and feed chiefly on plant lice. The larvæ of the genus caſſida are generally found under the leaves of plants on which they feed, to which they adhere by means of their lateral ſpines, and a briſtle at the end of their tail. They form a kind of umbrella with their excrement, under which they are ſheltered from the ſun and rain. The larvæ of the cicindelæ are ſoft and white, long ſix-footed, and have a brown ſcaly head. Theſe creatures employ great addreſs to entrap their prey: like the lion ant, in ſome degree, the larva lurks in a round perpendicular hole in the ground, with its head at the entrance, to draw in and devour whatever inſects come within reach. The larvæ of dermeſtes live in leather, fur, and other ſimilar ſubſtances, to which they do conſiderable miſchief. The larva of the ptini inſinuates itſelf into wood, and deſtroys it.

That ſimilarity in exterior characters, which we obſerve ſo prevalent in the perfect ſtate of all coleopterous inſects, whether of the terreſtrial or aquatic kinds, is not apparent in the larvæ of thoſe two natural tribes: they are in this ſtate altogether remote, and have no greater analogy in their conformation than in their manners of life, or the elements in which they exiſt.

The larvæ of the dytiſci conſtitute a link of beings cloſely allied to ſome of the neuroptera; and this reſemblance is ſo remarkable, that certain ſpecies of dytiſci and hydrophili in that ſtate differ more from each other than they diſagree with the larvæ of the libellula; theſe latter preſenting creatures of an intermediate character, and which, to an ordinary obſerver, would ſeem to unite them. Thus, the larva of libellula grandis more cloſely correſponds with thoſe of dytiſcus marginalis or punctulatus, than the latter with dytiſcus caraboides; and in external aſpect the affinity of the larva of dytiſcus caraboides may be even ſtronger towards that of ephemera marginata or hemerobius lutarius, than to either of the former. There is certainly a difference between theſe in the ſtructure of the jaws, &c.; but we ſpeak only of thoſe obvious characters and general appearances which firſt excite attention.

Dytiſcus marginalis, the ſpecies before mentioned, is common in many ſtagnant waters; and, from reſembling the ſhrimp in ſome diſtant degree, bears the name of ſquilla aquatica in the writings of Mouffet and Aldrovandus. It meaſures, when full grown, about two inches and a half in length, and is of a pale yellowiſh-brown colour, and very tranſparent. The head is large, ſomewhat flattened, and furniſhed in front with a pair of very ſtrong curved forceps, which, when magnified, are found to be perforated at the tip: theſe are the inſtruments with which it ſeizes upon its prey, and ſucks its animal juices. The legs are ſlender and ſmall in proportion to the body; the tail terminates in a trifurcated proceſs, ciliated at the margin. This larva is a fierce deſtructive creature, and not only commits vaſt depredations among the weaker kinds of water inſects, but preys alſo on the fry of fiſhes, and is for this reaſon highly injurious in fiſh-ponds. It is ſuppoſed, like ſome others of the ſame genus, to remain two years in the ſtate of larva. Dytiſcus cinereus is produced from a larva ſomewhat ſimilar, but remarkable for the length of the legs: its habits are the ſame. Caraboides is an hydrophilus, having the antennæ clavated inſtead of filiform; the body of the larva is ſhaped like the former, but on each ſide is a ſingle ſeries of plumoſe branchiæ, or breathing organs, like thoſe obſervable in the larvæ of ephemera marginata. In the firſt ſtages of growth this larva is fuſcous; when full grown, the poſterior part is greyiſh and rather pellucid. The gyrinus is another aquatic genus, and, from its form in the perfect ſtate reſembling the dytiſci, has been ſuppoſed ſimilar in that of larva; an argument, as already ſhewn, not always admiſſible. From the repreſentations given by ſome authors, it is not unlike that of H. caraboides, in the ſpecies natator, only of a more elongated form, and having four ciliated appendages at the poſterior end.

Hemiptera.—The larvæ of all hemipterous at preſent known are furniſhed with ſix legs, antennæ, and organs of the mouth, as in the perfect inſect from which they originate; and agree with them in moſt other reſpects, except in being entirely deſtitute of wings. The larvæ of the mantes are carnivorous; thoſe of the grylli feed on plants and farinaceous matter; the nepæ are aquatic, and ſubſiſt on water inſects; the cimices, inhabitants of the land, and a moſt extenſive tribe, are entirely carnivorous, and like that odious and well-known inſect of the ſame genus, (the common bug,) derive their ſuſtenance from the blood and juices, extracted by means of their proboſcis, from the bodies of other animals, thoſe of the largeſt kinds, and man not excepted.

Lepidoptera.—The caterpillars of the butterfly, ſphinx, and moth tribes form a very numerous ſeries; and theſe, from a variety of concurrent circumſtances, have been more particularly obſerved than any others. The greater part of thoſe lepidopterous inſects which come forth in the ſpring or ſummer periſh or diſappear at the approach of winter. There are few, the period of whoſe life exceeds that of a year. Some ſurvive the rigours of winter from being concealed under ground, and others remain hid in the bark of trees, or in the chinks of old walls, but the proportion of thoſe which out-live the inclemency of the winter ſeaſon is very inconſiderable, unleſs it be thoſe in the egg ſtate. Thoſe which are hatched in the autumn, and live under ground or in other places of ſecurity during winter, uſually come forth in the ſpring, take proper nouriſhment, and undergo their ſeveral changes to the perfect ſtate. The eggs, which have been carefully depoſited by the parent fly in thoſe places where they could remain in the greateſt ſafety, are alſo hatched in general by the genial influence of the ſpring, and the infant brood called into life and action.

All caterpillars are hatched from the egg, and when they firſt proceed from it are generally ſmall and feeble, but grow in ſtrength as they increaſe in ſize. The body of the caterpillar conſiſts of twelve rings; the head is connected with the firſt, and is hard and cruſtaceous. No caterpillar of the moth or butterfly has leſs than eight, or more than ſixteen; thoſe which have more than ſixteen belong to ſome other order of inſects. The ſix anterior feet, or thoſe next the head, are hard and ſcaly, pointed and fixed to the firſt three rings of the body, and are in number and texture the ſame in all lepidopterous larvæ. The poſterior feet are ſoft, flexible, or membranaceous; they vary both in figure and number, and are obſervable only in the caterpillar ſtate, the perfect inſect having only ſix feet, the rudiments of which are the ſix anterior ſcaly feet before-mentioned. Theſe ſpurious feet are either ſmooth or hairy, ſoft to the touch, or hard, like ſhagreen. On each ſide of the body are nine ſmall oval apertures, which are conſidered as the organs of reſpiration, and are called ſpiracles. The head is covered with a ſhelly ſubſtance, and on each ſide are five or ſix ſmall black ſpots, which are ſuppoſed to be the eyes. Some caterpillars grow to a very large ſize.

The caterpillar, whoſe life is one continued ſucceſſion of changes, often moults its ſkin before it attains its full growth. Theſe are the more ſingular, becauſe when it moults it is not ſimply the ſkin that is changed; for we find in the exuvia the ſkull, jaws, and all the exterior parts, both ſcaly and membranaceous, which compoſe its upper and under lip; its antennæ, palpi, and even thoſe cruſtaceous pieces within the head, which ſerve as a fixed baſis to a number of muſcles; we alſo find in the exuvia the ſpiracles, the claws, and ſheaths of the anterior legs, and in general the traces of all that is viſible in the external figure of the caterpillar.

The change in the caterpillar is effected by the creature withdrawing itſelf from the outer ſkin as from a ſheath, when it finds itſelf incommoded from being confined within a narrow compaſs. But to accompliſh this change is the work of ſome labour and time. Thoſe caterpillars who live in ſociety, and have a kind of neſt or habitation, retire there to change their ſkin, fixing the hooks of the feet, during the operation, firmly in the web of their neſt. Some of the ſolitary ſpecies ſpin at this time a ſlender web, to which they affix themſelves. A day or two before the critical moment approaches, the inſect ceaſes to eat, and loſes its uſual activity; in proportion as the time of its change approaches, the colour of the caterpillar declines in vigour, the ſkin hardens and becomes withered, and is ſoon incapable of receiving thoſe circulating juices by which it was heretofore nouriſhed and ſupported. The inſect is now ſeen at intervals with its back elevated, or with the body ſtretched to the utmoſt extent: ſometimes raiſing its head, moving it from one ſide to another, and then letting it fall again. Near the change the ſecond and third rings are ſeen conſiderably ſwollen. By theſe internal efforts, the old parts are ſtretched and diſtended as much as poſſible, an operation attended with difficulty, as the new parts are all weak and tender. However, by repeated exertions, all the veſſels which conveyed nouriſhment to the exterior ſkin are diſengaged, and ceaſe to act, and a ſlit is made on the back, generally beginning at the ſecond or third ring. The new ſkin may now be juſt perceived, being diſtinguiſhed by its freſhneſs and brightneſs of colour. The caterpillar then preſſes the body like a wedge into this opening, by which means it is ſoon torn down from the firſt to the fourth ring: this renders it large enough for the caterpillar to paſs through.

The caterpillar generally faſts a whole day after each moulting, for it is neceſſary that the parts ſhould acquire a certain degree of conſiſtency before its organs can perform their ordinary functions. Many periſh under this operation. The caterpillar always appears much larger after it has quitted the exuvia than before; for the body had grown under the old ſkin till it was become too large for it, and the parts being ſoft they were much compreſſed, but as ſoon as this ſkin is caſt off, the parts diſtend, and with them the new ſkin, which is yet of a flexible and tender texture, ſo that their increaſe in ſize at each moulting is conſiderable. Some caterpillars in changing their ſkin alter very much in colour and appearance, ſometimes the ſkin from being ſmooth becomes covered with hair, or ſpines, or tubercles, and others that are in one ſtage hairy, have the ſkin ſmooth in the next. No ſex is developed in the caterpillar ſtate.

The caterpillars of lepidopterous inſects ſeem deſtitute of all means of defence, and are the prey of birds and other voracious creatures. Nature has not, however, left the whole tribe in this defenceleſs ſtate, ſome kinds are armed with ſtrong and powerful ſpines diſpoſed in a verticillate manner round the annulations of the body, and which, if they be inſufficient to annoy others, ſerve at leaſt, in ſome meaſure, as the means of ſelf protection. There are others, chiefly the inhabitants of the warmer climates, whoſe bodies preſent an armament of ſpines not unlike that of the hedgehog or porcupine, and theſe placed in ſuch a formidable manner, as muſt either forbid the approach of other ſmall creatures, or puniſh their temerity. Some few of the North American ſpecies are of this deſcription. In others, we ſee the rings tuberculated, and every tubercle beſet with ramoſe ſpines, the branches of which intertexting with each other, form an almoſt impenetrable net-work of ſpines. Others again are thickly clothed with ſpines and hair intermingled, which may be ſufficient to guard them againſt the attack of ſome of their inferior enemies. Some ſpecies with the body covered only with a thin ſkin, and therefore apparently expoſed to the annoyance of every other, has the jaws ſo powerful, and the diſpoſition ſo ravenous and fierce, that they conſtantly attack, and moſt commonly with ſucceſs, the larva of other ſpecies much larger than itſelf. At the extremity of the body in the larva of the ſphinges, is a remarkable recurvate ſpine or horn, formidable in appearance, but harmleſs in its nature, and which is vulgarly ſuppoſed to be its weapon of defence. Theſe inſects, or at leaſt ſome of them, are not, however, without the means of annoyance, for it appears they poſſeſs the ability of diſcharging from their mouth or vent a fœtid liquor, the ſcent of which, ſhould it fall on the ſkin, cannot eaſily be removed even by waſhing, and which may be ſuppoſed powerful enough to repel other inſects. This ability in the ſphinx tribe of caterpillars is admitted on the authority of ſome credible authors; the like circumſtance is more commonly obſerved in the larvæ of ſome ſpecies of tenthredo.

The caterpillars of many inſects of the butterfly tribe feed cloſe to the ground, or under the ſurface, ſubſiſting on the lower parts or roots of plants; and for this reaſon many kinds are ſeldom ſeen, and others remain unknown. The larvæ of the ſphinx kind live chiefly on the leaves. Thoſe of the ſeſia genus are uſually denominated internal feeders, or ſuch as reſide in hollow cavities, which they form in the trunks or branches of trees, the ſubſtance of which alſo affords them nouriſhment. Many of the moth tribe are of the ſame kind, and have the ſame habits; others eat the leaves of different plants, and a few of the ſmaller ſorts feed on woollen, paper, and other ſubſtances, not of a vegetable nature. Some of the lepidopterous caterpillars are ſolitary, others live in ſociety.

Neuroptera.—The larvæ of neuropterous inſects are carnivorous, and in the vivacity of their manners exhibit a very ſtriking contraſt with thoſe of the generality of inſects. They are nearly all of the aquatic kind, paſſing their whole life, till they aſſume the winged ſtate, in the water; and are diſtinguiſhed for the peculiar addreſs with which they conſtantly wage war, not only againſt every other diminutive inhabitant of their natural element, but alſo againſt each other. Theſe larvæ are hexapode, or furniſhed with ſix feet of a ſcaly nature, and having the head protected by a ſimilar ſubſtance.

The libellulæ, or dragon-flies, form an intereſting genus of the neuroptera order, and the habits of their larvæ illuſtrate, in the ſtrongeſt manner, the nature of theſe aquatic creatures. The egg, when depoſited by the parent in the water, ſinks to the bottom, and remains there till the young inſect has acquired ſufficient maturity and ſtrength to burſt from its confinement. The larva, at firſt ſmall, increaſes to nearly half the ſize of the perfect fly, by changing its ſkin at different intervals like the caterpillars of moths and butterflies. The appearance of the little caſes containing the rudiments of the wings, at the lower margin of the thorax, denotes its change to the ſtate of pupa. The head of this larva is exceedingly ſingular, being covered with a maſk extending over the whole of the fore part of the head, with cavities in the interior ſurface to ſuit the different prominences of the face to which it is fitted with perfect neatneſs. Its form is triangular, growing ſmaller towards the bottom: in the latter part there is a knuckle which fits a cavity near the neck, and on this part it turns as on a pivot. The upper part of this maſk is divided into two pieces, which the inſect can open or cloſe at pleaſure, and it can alſo let down the whole maſk, ſhould occaſion require. The inner edges of theſe two pieces are toothed like a ſaw, and ſerve the animal as a pair of forceps to ſeize and retain its prey. This is the general principle on which theſe projecting forceps are conſtructed in the larva of the libellulæ; they differ in ſhape in the ſeveral ſpecies, but uniformly act in a ſimilar manner.

Theſe animals generally live and feed at the bottom of water, ſwimming only occaſionally. Their motion in the water can ſcarcely be called ſwimming, it is accompliſhed by ſudden jerks repeated at intervals. This motion is not occaſioned by their legs, which at this time are kept immoveable and cloſe to the body: it is by forcing out a ſtream of water from the tail that the body is carried forward, as may be eaſily perceived by placing them in a flat veſſel, in which there is only juſt water enough to cover the bottom. Here the action of the water ſquirted from their tail will be very viſible; it will occaſion a ſmall current, and give a ſenſible motion to any light bodies that are lying on the ſurface. This action can only be effected at intervals, becauſe after each ejaculation the inſect is obliged to take a freſh ſupply of water. The larva will ſometimes turn its tail above the ſurface of the water, and force out a ſmall ſtream, as from a little fountain, and with conſiderable force.

The larvæ of the ephemeræ, another of the neuropterous tribes, differ in various particulars from thoſe of all other inſects: its length, in the larger ſpecies, about an inch; the form rather long, and ſub-cylindrical, tapering a little towards the tail: the head is furniſhed with antennæ, trunk with ſix legs, abdomen with ſeveral finny plumes each ſide, and the tail with three long proceſſes. They live in the water, where earth and clay, it is affirmed, form their principal nouriſhment for the ſpace of two or three years, the time they conſume in preparing for their metamorphoſis, and which is accompliſhed in a few moments. The larva, when ready to quit that ſtate, ariſes to the ſurface of the water, and inſtantly caſting off its ſkin becomes a pupa. This is furniſhed with a kind of wings, by the aſſiſtance of which it eſcapes to the ſhore, and there ſettling, in the ſame moment, quits a ſecond ſkin, and becomes the perfect fly. In this ſtate, which has been ſo long preparing, the pleaſures it enjoys muſt be very ſenſible, if they are lively in proportion to the ſhortneſs of their duration, the inſect celebrating its nuptials, producing the fruit of them, and dying within the ſpace of a few hours; the vital principle, though ſo evaneſcent in the complete inſect, is extremely tenacious in the larva.

The phryganeæ, a genus of this order, very much reſembling in general appearance, certain families of the moth kind, are the offspring of aquatic inſects, not much unlike the larvæ above deſcribed; only that inſtead of inhabiting the waters in a defenceleſs ſtate, they conſtantly live in ſmall cylindrical caſes of their own conſtruction, which they drag after them in the water wherever they go. Theſe caſes are tubular and open at both ends: externally they are formed with ſmall bits of reed, gravel, ſmall ſhells, and other ſubſtances curiouſly cemented together, and lined with fine ſilk. The animal never quits its habitation till it becomes too ſmall for its body, when it conſtructs another. Like the hermit crab, when it is deſirous of moving from one place to another, the animal advances the fore-part of the body out at one end of the tube, ſo as to admit the free uſe of its legs, which are ſix in number, and placed contiguous to the head, and by this means it is able to crawl or walk with perfect facility at the bottom of the water. The body in moſt ſpecies is ſmooth, and the back uſually furniſhed with a tubercle, which prevents the caſe from ſlipping too forward while the animal is feeding, and which ſerves alſo to retain the caſe more firmly to the poſterior part of the body in the action of walking. Theſe, in common with other aquatic larvæ, are frequently uſed by anglers as bait, and are called cadew-worm, ſtone bait, or cod bait, and in the perfect ſtate is known by the name of ſpring fly. The larvæ of the phryganeæ prefer running waters.

Thoſe above-mentioned are the larvæ of the amphibious kinds of neuropterous inſects; there are others which live only on land, and differ much from theſe both in appearance and mode of life. Thoſe of the myrmeleon, panopa, hemerobius, and raphidia, are of the terreſtrial order. They are carnivorous as well as the aquatic kinds, preying on other inſects. The moſt extraordinary of theſe in their manners of life are ſuch as have been denominated by naturaliſts the lion-ants, or lion-piſmires (the myrmeleon of Latin writers). Of this genus there is nearly a dozen ſpecies, or, indeed, if we include the aſcalphi which Fabricius removes from that genus, there are altogether ſixteen ſpecies at preſent known. The larvæ of this family prey with the moſt ſavage ferocity on all the ſmaller kinds of inſects: it is not, indeed, this diſpoſition, ſo common to all carnivorous larvæ, that renders them remarkable, but the extraordinary and peculiar contrivances they adopt to enſnare their prey. We are beſt acquainted with the hiſtory of the ſpecies formicarius, the formica-leo of Linnæus, and this may ſerve as an example of the genus, the habits of which, ſo far as we are acquainted with them, being alike in all, with this difference, however, in their predatory powers, that formicarius is one of the ſmaller kinds, and leſs capable, from its inferiority in ſtrength and ſize, to commit devaſtation, than moſt of the extra European ſpecies, thoſe of Africa eſpecially.

Myrmeleon formicarius is found in France, Spain, and Germany, and is an inhabitant of ſandy places. The egg is depoſited by the parent inſect in the ſand, and this hatching produces a larva of an ovate form, armed with a long and powerful pair of jaws. The larva, as ſoon as produced, begins to exerciſe its talent of preparing a pitfall in the ſand, by turning itſelf rapidly round, and which, when formed, is ſomewhat funnel-ſhaped, or rather concave, with a very ſmall aperture in the centre under which the animal conceals itſelf with only its pincers advanced through the hole, ready to ſeize on any inſect that may unwarily fall into the hollow. Sometimes the whole head is protruded through the hole, but when it lies in wait the body is always concealed under the ſand. From the ſtructure of this trap, ſuch inſects as crawl to the edge or ſides are almoſt ſure to fall in, and be devoured by the larva. But ſhould the ſides of the pit not give way, or the unfortunate inſect appear to be able to make its eſcape, its mercileſs enemy immediately diſcharges from its head ſhowers of ſand, the repeated force of which is irreſiſtible; the inſect falls within reach of the larva, who, after ſucking out its juices through the tubular forceps, by a ſudden exertion throws the remains of its carcaſe out of the hollow to a conſiderable diſtance, and again, after repairing its den, renews its vigilance for prey. As the larva increaſes in ſize, it enlarges this cavity; at firſt it is only a ſlight depreſſion in the ſands half an inch in diameter, in its next ſtage it is increaſed to twice that diameter, and when the larva attains its full ſize is between two and three inches acroſs. In the preparation or enlargement of its pit, when it grows to its full ſize, it ſhews much addreſs: its operation commences by tracing an exterior circle of the intended circumference of the cavity, and continuing its motion in a ſpiral direction till it reaches the centre, thus marking each revolution in the ſand like the impreſſion of a large ſhell of the whorled kind, the breadth of each whorl correſponding with that of the inſect's body; and which, in the circumference of the whole cavity, amounts to four or five circles. After having ſufficiently deepened the cavity by a repetition of this motion, it ſmooths the ſides into a regular ſhape, by throwing out the ſuperfluous ſand by means of its forceps, which, when cloſed, together with the head, forms a convenient kind of ſhovel for the purpoſe. The grains of ſand thus diſcharged often fall to the diſtance of ten or twelve inches beyond the verge of its cavity. The depth of the cavity is uſually equal to its diameter. The ſingular larva, whoſe manners of life appear ſo intereſting when it has attained its full ſize, is about three quarters of an inch long, and has much the aſpect of a large ſpider in the form of its body: its head and legs more nearly reſemble thoſe of the pediculi of ſome particular animals, and are very ſmall, and in the ſtructure and proportion of the jaws or forceps its character is peculiar, theſe being enormous. Its general colour is pale reddiſh, very prettily variegated with diſtinct marks and ſpots of deep ferruginous both on the back and belly; the whole is beſet with a few hairs, ſome of which appear in tufts. It remains two years in the larva ſtate; in the ſummer it is active, but it is torpid during winter; when full grown it changes into a pupa, the animal previouſly enveloping itſelf in a round ball of ſand agglutinated and connected by a very fine ſilk, which it draws from a tubular proceſs at the extremity of the body: with this ſilk it alſo lines the internal ſurface of the ball. The complete inſect is furniſhed with four tranſparent ſpotted wings, and, like the larva, preys on inſects.

Hymenoptera.—The larvæ of the teredines bear the neareſt reſemblance poſſible to thoſe of ſome lepidopterous inſects, and have for this reaſon acquired the name of baſtard caterpillars, or falſe caterpillars; the ſpiral manner in which they roll themſelves up is one character that ſeems to remove them from the true caterpillar, but they are more clearly diſtinguiſhed by the number of feet, which, though varying in different ſpecies of both families, may be ſaid to be conſtantly more numerous in the tenthredo genus than in any of the lepidoptera orders. The firſt have from eighteen to twenty-two feet; the latter never more than ſixteen, including the ſpurious or poſterior ones. Theſe live chiefly on the roſe and willow trees. The larvæ of the ſirex genus is cylindrical, and furniſhed with ſix feet, and the head rounded; they perforate wood, and frequently eat their way into the bodies of other inſects, or their larva, and conſume their vitals. Theſe are the principal hymenopterous larvæ that are furniſhed with feet: the ſucceeding inſects are deſtitute of thoſe organs when in the larva ſtate.

One of the moſt curious tribes of larva among the hymenopterous genera are thoſe called the gall-flies; they are in no particular manner remarkable in appearance, but the effects they produce render them extraordinary. Every one muſt have obſerved thoſe vegetable excreſcences, of a globular form, which appear on the leaves and foot ſtalks of the oak at particular ſeaſons of the year, and which in autumn have acquired the ſize of a cherry or a ſmall plumb, its colour a bright red, and forming a pleaſing contraſt with the verdure of the leaves; theſe are the habitations formed by the punctures of the gall-fly, in which the eggs were depoſited each ſingly in its globule by the parent inſect, and each of thoſe excreſcences at this ſeaſon, on being opened, will be found to contain a larva; a ſmall worm of a cylindrical form and without feet. There are an amazing number of ſpecies of the gall-fly (cynips) that conſtruct their dwellings, and ſubſiſt on the juices of the oak, and many others that attack in like manner the maple and the willow. The larva is found like a nucleus, in a ſmall cavity immediately in the centre of each excreſcence.

The manners of the ichneumon, as popularly deſcribed, are fully known, and the hiſtory of the ichneumon flies ſeems to accord in a peculiar degree with all that has been fabulouſly related of the former. They are entirely paraſitical, and derive their ſuſtenance, till they arrive at the perfect ſtate, from the vital juices of other inſects. Their eggs are depoſited only in the bodies of other living inſects, generally thoſe of the caterpillar kind. The female, ſelecting her victim, faſtens upon it, plunges her abdominal tube into the body, and, in deſpite of all reſiſtance, maintains her hold till ſhe has lodged her ſtore of eggs. In the courſe of a few days the young larvæ, which reſemble minute maggots, are hatched. Theſe nouriſh themſelves with the juices of the caterpillar, which, notwithſtanding it affords ſuſtenance to the paraſitical brood, continues to move about, and feed till the time of its change into the chryſalis ſtate, when the larvæ creep out by perforating the ſkin in various directions, and form little oval ſilken caſes, the whole of which with the ſpinning forms an envelope to the withered remains of the inſect from which they derived nurture. The latter inevitably periſhes from the injury ſuſtained; in a ſhorter or longer period, according to the ſpecies, the ichneumons appear in a perfect ſtate. This paraſitical family, when produced, are found to be either entirely of the winged kind, or to conſiſt both of alated and apterous inſects, the females in certain ſpecies being deſtitute of wings. Theſe are, notwithſtanding, perfect inſects, as they never acquire thoſe organs afterwards, and being beſides, after an intercourſe with the other ſex, in a condition to depoſit fertile eggs, and thus perpetuate the breed. The apterous females attack caterpillars and other inſects in the ſame manner as the winged kinds, and depoſit their eggs in the living body.

So far as we are acquainted with the natural hiſtory of the ſphex tribe, the larvæ of theſe are lodged in the bodies of other inſects, in a manner ſimilar to that adopted by the ichneumons, with this difference, that the ſphex generally deſtroys the principle of life in thoſe creatures it attacks, inſtead of leaving them to linger through a tedious exiſtence of torture. Theſe inſects are very abundant in wood and hedges, and the larvæ feed chiefly on dead inſects, in the bodies of which they are produced from the egg. Some ſpecies dig holes in the earth with their fore feet, in which they bury their dead inſects, conſiſting chiefly of ſpiders and caterpillars, having previouſly depoſited their eggs therein; theſe holes are carefully cloſed with earth or clay, through which the larvæ force a paſſage when hatched. The larvæ are vermiform. The manners of theſe inſects is ſtrongly exemplified in the ſpecies figulus, a native of Upſal, and which is deſcribed by writers with conſiderable attention. This ſphex inhabits the holes in old wooden partitions, abandoned by other inſects, the interior of which the female cleanſes by gnawing the ſurface of the cavity throughout, and prepares it for the reception of her victim, by placing a piece of clay in the bottom. She then ſeizes on a ſpider, which having killed, and faſtened upon the clay, ſhe next proceeds to the depoſition of the egg, which is lodged in the dead body. This laid ſhe cloſes up the opening with clay. The larva hatched from the egg reſembles the maggot of the bee, and which, having devoured the food provided for it, ſpins itſelf a ſilken web, and changes to the pupa ſtate. In this manner each female inſect prepares ſeveral ſeparate holes, in each of which a dead inſect and an egg are depoſited. The larvæ of waſps and bees are ſoft, without feet, and feed on the nectar and honey collected by the parent inſects. The larvæ of the ants are alſo well known. The three latter mentioned families live in ſocieties, and with thoſe already noticed form the principal kinds of hymenopterous inſects.

Diptera.—Theſe larvæ vary much in different genera. Commonly they appear like a ſmall worm, the likeneſs to which is heightened by the animal having no feet, and in ſome ſpecies by the head being ſoft, like the body. Others differ in having the head ſcaly. The larva of the oeſtri, or gad-flies, depoſits its eggs in various parts of the bodies of cattle, which, when hatched, produce the moſt painful tumours. Some lay their eggs under the ſkin of cows or oxen, which they perforate for that purpoſe: others enter the inteſtines of horſes by the vent; and others, again, depoſit them in the noſtrils of ſheep. The larva of oeſtrus bovis is brown, and conſiſts of eleven ſegments, with tranſverſe rough interrupted lines. That of equi, known by the name of bots, depoſits its eggs on the hairs of horſes, and always on thoſe parts which are moſt likely to be licked with the tongue, and are thus conveyed into the ſtomach. The eggs of hæmorrhoidalis are laid on the lips of horſes, occaſioning a titillation, which cauſes the animal, when attacked by it, to move its head violently, and gallop about with every ſymptom of diſtreſs: this larva is carried into the inteſtines like the former, and is voided with the dung when its period of change to the pupa ſtate approaches.

In the genus tipula the larvæ are ſoft, cylindrical, and truncated at the head: theſe feed on the roots of plants. The larvæ of the different natural tribes, comprehended among the Linnæan muſcæ, exhibit ſome very diſſimilar appearances in form and habit. Generally, they poſſeſs a worm-like aſpect, ſometimes blunt at the anterior part, and acute behind, and at others pointed at both ends. Many live in watery places and devour inſects; others feed on decaying animal matter, or on the juices of vegetables. The larvæ of muſca vermileo preys on inſects, and in its mode of entrapping its prey imitates the manners of myrmeleon formicarius, like that ferocious inſect forming a circular den in the ſands which it inhabits, and watching in an aperture at the bottom for the unwary inſects that unfortunately wander too cloſe to its cavity. But of all the peculiarities related of the muſca tribe, nothing appears in any degree ſo extraordinary as the hiſtory of the larva of muſca tenax, recorded on the authority of Linnæus, and ſanctioned by that of Fabricius. The larva is repreſented as a brown maggot with a long tail, which latter is extenſile, and conſiſts of a double tube, the exterior annulated into numerous ſegments, and the interior ſlender and terminated by a circle of hairs, ſurrounding a ſpiracle. This maggot is ſeen in muddy ſtagnant waters, drains, and other ſimilar places; and is, according to Linnæus, a frequent inhabitant of the turbid pulp uſed in the operation of paper making. Hence it is often in this ſtate expoſed to the action of the wooden mallets uſed in this proceſs, as well as ſqueezed in the ſtrongeſt preſſes, and yet it ſurvives uninjured theſe ſeemingly deſtructive operations.

This circumſtance is deſcribed in a paper entitled "Miracula Inſectorum," inſerted in Am. Acad. 3. p. 331, and though purporting to be the production of Emanuel Avelin, obtained the ſanction of Linnæus. The ſame obſervation is confirmed in the "Syſtema Naturæ;" and is repeated in this place as a moſt extraordinary trait in the hiſtory of this inſect, without deeming ourſelves in the leſt reſponſible for its veracity.

The tabani nouriſh themſelves with the blood of horſes and cattle; and ſome think the larvæ are aquatic, though Degeer aſſerts they live under ground. The larvæ of culices (gnats) are very curious in their conformation: the body conſiſts of nine ſegments, which become gradually ſmaller from the head towards the extremity. The head is very large, and furniſhed on each ſide with a pair of pointed forceps, or hooks, with which it ſeizes its prey. The tail terminates in a tubular opening, at the tip of which are four ovate ſcales, two of which exceed the others in ſize. At the end of the body, near the tail, is a ſmall elevated reſpiratory tube, which the creature frequently raiſes above the ſurface of the water, while the head remains ſuſpended downwards. The colour of the larva is browniſh, extremely pellucid, and its motions remarkably lively. The larva, when firſt hatched, is extremely minute, and in the ſpace of fourteen days from its birth attains its full ſize, its length being then about half an inch. The painful ſenſation occaſioned by the ſting of the gnat, or, in other words, its ſucking proboſcis, is well known, and hence we are taught to conſider the gnat as an inſect ſubſiſting only on the blood of other animals: this is not, however, the opinion of ſome naturaliſts, who, reflecting on the myriads of theſe creatures, with which every watery place is infeſted, conclude they could not find ſufficient ſuſtenance, unleſs they ſubſiſted equally on the juices of vegetables and animals. Whatever may be the truth in this reſpect, the weapons of annoyance with which nature has furniſhed the larva indicate very clearly to us that in that ſtate, at leaſt, it is of the carnivorous kind. We ſhall laſtly mention the hippoboſcæ, a dipterous genus in the Linnæan ſyſtem, and which, unlike thoſe before adverted to, do not appear to have any larva; they are the produce of an egg which partakes of the two-fold character of being at the ſame time an egg and a pupa. The female, at diſtant intervals, depoſits an egg, which in magnitude is nearly equal to the whole bulk of its parent's body: the figure of this egg is oval, with an excavated depreſſion at the lower end; the colour, at its firſt excluſion, is milk white, except a large black ſpot on the fore part, from which it afterwards becomes brown, and then of a jet black, with a very high poliſh. This change in colour marks the progreſſive advancement of the inſect incloſed towards its maturity of formation, the parts becoming gradually developed. The egg depoſited in autumn acquires its deepeſt colour in the ſummer following, at which time the inſect burſts from its confinement in the winged form.

Aptera.—No inſect of this order, except the common flea, are ſuppoſed to undergo thoſe ſucceſſive changes which are uſual in moſt other inſects. They are almoſt entirely produced from the egg in their perfect form, and cannot therefore be ſaid to have any larva. In the flea, however, the ſmall worm which correſponds with the larva in other inſects is clearly aſcertained; and if we may place ſufficient reliance on the evidence of certain naturaliſts, one or two more of the apterous genera exiſt for a ſhort period in a ſtate ſomewhat analogous either to the larva or pupa. Leeuwenhoek obſerved that the mite was oviparous, laying very ſmall oval whitiſh eggs, from which proceeded the young animals, reſembling their parents in all reſpects, except in the number of their legs, theſe being only ſix in number, inſtead of eight; and after they caſt their ſkin another pair of legs appear, a fact that evidently implies two periods of transformation, the firſt of which may be compared with that of larva. An advancement, or progreſſive increaſe in the number of feet, is alſo well known to take place in ſpecies both of the julus and ſcolopendra genera, after they are produced from the egg ſtate. The julus ſabuloſus, when firſt excluded, is furniſhed with three pair of legs, which are ſituated at each ſide near the head: ſome days after about fourteen become viſible, and the remainder, to the amount of one hundred and twenty on each ſide, are gradually acquired afterwards. The ſame remark will apply to certain ſpecies, if not the whole of the ſcolopendræ genus. Scorpions are produced by the female parent in a living ſtate; they are at firſt very ſmall and white, and become of a darker hue in a few days: theſe, like the ſpiders, caſt their ſkin as they increaſe in ſize.

Of the Pupa ſtate.

By this term, as underſtood in the very extenſive ſenſe Linnæus propoſes, we comprehend that ſtate of an inſect which ſucceeds the larva and precedes the pupa, without any regard to the particular appearance it aſſumes in this ſtage of transformation. From this latitude of meaning it includes, therefore, with equal preciſion, and no leſs propriety, ſtates of the moſt diſcordant character. It alike implies the uncouth grub incaſed in its ſhelly repoſitory, and immured in the earth, ſluggiſh, almoſt deſtitute of motion, or the appearance of any other animal function, with the lively half-winged locuſt, or the cicada, animals ſporting in the full enjoyment of life. The bot, impriſoned in its oval covering, without the leaſt external ſign of animation, is termed a pupa. The moth, quieſcent and abſtinent for months, concealed in its ſhelly covering in the earth, or ſuſpended aloft in its ſilky envelope to the branch of a tree, is a pupa; and we denominate thoſe pupæ alſo which have the wings only half expanded; though, like the nimble-footed cimex, they are perpetually roving, and deriving ſuſtenance from the blood of other animals; and ſo alſo the reſtleſs libellula, which is continually traverſing the watery element, with the facility of fiſhes in ſearch of prey. Surely the difference between theſe is too great to be defined by any ſingle term.

Writers have obſerved, that before the time of Linnæus this ſtate of transformation was known only by the term chryſalis, a word derived from the Greek, and expreſſive of that golden luſtre peculiar to certain butterflies; but this appearance not being general, the word was changed by Linnæus to that of pupa, in alluſion to the indiſtinct reſemblance which many inſects in that ſtate bear to a child ſwathed or dreſſed in ſwaddling clothes. Theſe obſervations are certainly incorrect, for the word nymph, implying exactly the ſame fanciful compariſon, was in uſe before the time of Linnæus; the earlier authors ſo named one particular tribe of inſects in this ſtate, namely, thoſe having all their limbs incloſed within a ſkin: Linnæus adopted the idea but changed the word to pupa, and aſſigned it indiſcriminately to all inſects in that period of transformation from which the perfect fly is produced.

If we take a retroſpective view of the ſtate of entomology before the time of Linnæus, and conſider attentively the terms by which the different ſtates of inſects were then known, there does not appear much reaſon to commend the alterations which he has introduced. From the labours of Swammerdam, Reaumur, Roeſel, Liſter, Ray, and others, the transformations of inſects were then generally known, and particular terms had become eſtabliſhed by which the ſeveral ſtates, appearances, &c. might be diſcriminated. Theſe were not ſufficiently numerous, and of thoſe in uſe ſome were leſs expreſſive than could be wiſhed; but it is ſtill not to be concealed that ſome, at leaſt, were preferable to thoſe introduced by Linnæus. This is the more to be regretted, as Linnæus wrote under favourable circumſtances, and on his authority the introduction of a few expreſſive terms would have been attended with particular advantage. For inſtance, we ſhould have conceived it deſirable if he had deſignated this ſtate of inſects, which he calls pupa, by different terms, applying to each particular family a name at once expreſſive of their ſtate, and the order to which they belong. When, in the works of his predeceſſors, we read either of the aurelia, nymph, or ſemi-nymph, we know that in a word it implies the ſame ſtate as Linnæus means by pupa, with this additional information, that it is either of the dormant kind, like the moth, or active, like the nepæ, &c.; the Linnæan name conveys no ſuch additional information; it applies without diſtinction to all, and merely intimates its ſtate of transformation.

Perhaps the alteration of the word chryſalis to pupa may be thought by ſome an amendment; we do not diſapprove of it, but object to the very indiſcriminate ſenſe in which it is employed. As it applies to the nymphs of one family deſcribed by earlier writers, it is admiſſible; to others it is not. Or if the term pupa were adopted in its moſt extenſive ſenſe, to comprehend this ſtate throughout the whole race of inſects ſubject to this period of transformation, the want of terms to diſtinguiſh the particular tribes of which they conſiſted would be equally felt. The general manner in which the term pupa is applied by Linnæus, and the inconſiſtency attending it, cannot be more fully exemplified than by the following circumſtance. Linnæus, we are told, changed the word chryſalis to pupa, becauſe the former implied a golden appearance not obſervable in all the ſpecies; yet he applies the word pupa, which he defines as alluding to the appearance of a child in ſwaddling clothes, ſuch as we ſee in the moth and butterfly tribe, to the blatta, gryllus, cimex, and a hoſt of other active creatures which exhibit no ſuch reſemblance, and which bear no relation whatever to the others either in manners or aſpect! The firſt of theſe were called by old writers nymphs, the latter ſemi-nymphs; but theſe diſtinctive terms are confounded by Linnæus under the ſingle term pupa. Surely the impropriety is as great in the alteration made as in the error it is deſigned to remedy.

To obviate, in ſome degree, the confuſion ariſing from this general adoption of the word pupa, Linnæus propoſed afterwards to divide them, according to their form, into five families, to each of which he aſſigns a trivial or ſecondary name.

Theſe diſtinctions are not objectionable, but are rather too few in number, and they are certainly not expreſſed in terms ſuitable for general uſe. Nor does Linnæus himſelf appear ſatisfied with them, for although they are inſerted with definitions at ſome length in the "Fundamenta Entomologia," they are not adopted in the "Syſtema Naturæ," and are for this reaſon rather to be regarded as matter of curioſity than of utility. The pupæ are divided into ſections, according to the following circumſtances. When confined in a caſe of a globular form, which has no reſemblance to the inſect it contains, it is called coarctata, or ſtraightened, the examples of which are the muſci and oeſtri; obtecta, diſguiſed or ſhrowded, when the inſect is wrapped up in a ſhelly covering of ſuch a form that the part which contains the head and thorax may be diſtinguiſhed from that wherein the abdomen is lodged, as in lepidopterous inſects. It is termed incompleta when the pupa has perceptible wings and feet, but cannot move them: ſemi-completa, theſe can walk or run, but have only the rudiments of wings. The difference between the pupa and the larva of this claſs is very inconſiderable; in the firſt ſtate they have no wings, and in the pupa the wings begin to be developed as in the graſshopper: completa, in which the egg may be conſidered analogous to the pupa, the inſect being produced in its perfect form from the egg without paſſing through any other change.

Swammerdam divides inſects into four claſſes, the characters of which are founded principally upon their appearance in this ſtate of transformation, and the particulars attendant thereon.

The firſt of theſe comprehends thoſe inſects which, after being fofmed in their egg without the aid of food, and which, after having acquired, by the evaporation of the ſuperabundant humidity, the neceſſary conſiſtency, quit that ſtate, and iſſue from the ſhell under the form they are to retain during life, without undergoing any other transformation, as inſtanced in the ſpider.

The ſecond conſiſts of thoſe inſects which, after leaving the egg, are without wings, but with all the other members, as in the perfect inſect; in this ſtate they eat and grow, paſs into the nymph form, and from that iſſue with perfect wings, and with the ability to propagate their ſpecies. The dragon flies, graſshoppers, and cimices are of this family.

The third includes all kinds of butterflies and moths. They iſſue from the egg which lay in a diſguiſed ſtate and without food; the ſecond ſtate eats and grows, and the members of the animal into which it is to be transformed are formed under the ſkin, which it at laſt quits and becomes a nymph, and then after the evaporation of the ſuperfluous humidity produces the perfect inſect.

The fourth family, after having arrived at the nymph ſtate, like thoſe before-mentioned, does not diveſt itſelf of the ſkin in order to enter into that ſtate, but aſſumes the form of a nymph under its ſkin, where it continues ſhut up, till quitting two ſkins, at once it comes forth in its perfect ſtate. This is the metamorphoſis which ichneumons undergo. Theſe are the four families into which Swammerdam divides inſects, and the explanations he affords; and theſe, with ſome improvements and modifications, form the baſis upon which the pupæ are arranged by many of the continental naturaliſts at this time.

The following obſervations on the ſame ſubject by Lyonet deſerve attention. "By the term nymph (ſays this writer) is meant a ſtate of imperfection, attended ſometimes with inactivity, inaction, abſtinence, and weakneſs, through which the inſect paſſes, after having attained a certain bulk, and in which its body receives the preparatives neceſſary for its paſſing to a ſtate of perfection, all the external parts of the inſect are then found enveloped, either with their natural ſkin, or with a fine membrane, or with a hard and cruſtaceous cruſt. In the firſt caſe the limbs of the inſect remain free, it preſerves its power of acting, it eats, and its form is little different from what it was before. In the ſecond caſe the limbs of the inſect are folded over the breaſt but ſeparate; it can neither eat nor act, it retains hardly any traces of its former figure, and has only a confuſed reſemblance to that which it is going to aſſume. In the third caſe, the cover brings all theſe parts of the animal into one maſs; it makes it equally incapable of eating and acting; it has no reſemblance either to what it formerly was, nor what it is to be. Theſe three ſorts of change are evidently very different, and yet we have only two words in our language (French) to diſtinguiſh them by. We ſay of the inſects in the two firſt caſes, that they are changed into nymphs, and of thoſe in the laſt caſe that they have aſſumed the form of chryſalids. To theſe terms it would be proper to add a third, in order to mark the difference between the two firſt. It might be done I think very conveniently by allowing the laſt to retain the name of nymph, and calling thoſe of the firſt kind ſemi-nymph, or demi-nymph, a name which would not perhaps be inapplicable to them, conſidering the ſmall degree of change they have undergone. Graſshoppers, which, inſtead of the long wings they acquire, have ſtill only on their backs the ſmall caſes in which theſe wings are formed, are nymphs of this kind; they may properly be called ſemi-nymphs. Thoſe who have had an opportunity of examining a bee hive, cannot fail to have remarked bees ſtill imperfect in the ſhut cells; theſe are the nymphs of the ſecond order. The ſilk-worm furniſhes a well known example of inſects under the form of chryſalis.

"Inſects which undergo no other metamorphoſis than that which has converted them from the ſoft ſubſtance of an egg to a well formed and living body, are thoſe which conſtitute the firſt claſs of transformations ſpoken of. They increaſe in ſize, the greater part caſt their ſkin; ſome of their parts acquire greater ſize than the reſt, and ſometimes take a different colour from what they had before. This is almoſt the only change they undergo. The tranſformations of the inſects of the other three claſſes do not terminate here; after having caſt off their ſkins for the moſt part ſeveral times, and after having acquired their deſtined bulk, all become either ſemi-nymphs, nymphs, or chryſalids. They paſs a certain time under this form, and upon quitting it aſſume that of a perfect inſect, capable of generation. It is from the diverſity which takes place in theſe three ſorts of changes that the principal characters, which diſtinguiſh the inſects of the ſecond from thoſe of the third, are taken."

The inſects of the ſecond claſs are thoſe that paſs through the ſtate which Lyonet calls ſemi-nymphs. They do not undergo a transformation which is entirely complete, but in their laſt change they have ſtill generally all the members they had before, without having acquired any others, except they have wings; and as already remarked the ſemi-nymph differs very little from the animal which produced it. What always diſtinguiſhes it is, that there are ſeen upon its back at the baſe of the thorax the caſes in which the wings are formed, which before that appeared but little, and often not at all. In other reſpects it walks, runs, leaps, and ſwims as before. The difference between the ſemi-nymphs, and the winged inſect which it produces, is not always ſo obſcure. In ſome ſpecies it is ſo large that it is with difficulty we can diſcover its firſt form. But the greater part in their laſt ſtate differ chiefly in the wings.

The inſects of the other two claſſes do not enjoy the ſame advantages as the other. They loſe the uſe of all their members when they enter upon their transformation, and have no reſemblance to what they were before. An animal of theſe two claſſes which before had no legs, or had five, ſix, ſeven, eight, nine, or ten pairs, has now no more than three pairs, which, with the wings and antennæ, are folded up under the breaſt and remain immoveable.

What diſtinguiſhes theſe two laſt claſſes from each other is, that the inſects of the third claſs quit their ſkin, when they change into nymphs or into chryſalids, and that thoſe of the fourth change into nymphs under their ſkin, which hardens round them, and forms a caſe.

Reaumur found, in the transformation of inſects of the fourth claſs, a character that ſeems to diſtinguiſh it eſſentially from the reſt, namely, that they changed into nymphs without quitting their ſkin. He diſcovered that they undergo one transformation more than other inſects; becauſe before they become nymphs, they aſſume under their ſkin an elliptical form, or that of an elongated ſpheroid, in which no part of the animal is diſcernible; that in this ſtate the head, thorax, wings, and legs of the nymph are incloſed in the interior cavity of the abdomen, from which they iſſue ſucceſſively by the anterior part, nearly in the ſame manner as the extremity of the finger of a glove, which has been drawn in, is puſhed out again. Thus, the inſects of this claſs are not ſolely diſtinguiſhed from others by their changing into nymphs under their ſkin, but principally in undergoing a double transformation before they become nymphs.

Bergman diſtinguiſhes three kinds of pupa, which he calls chryſalids, nymphs, and ſemi-nymphs. The firſt he deſcribes as hard and motionleſs, that does not eat, and ſhews obſcurely the members of the future inſect; the nymph is tender, lying at reſt, not eating, and which ſhews clearly the ſeparate members of the future inſect; the ſemi-nymph is furniſhed with legs, and runs, eats, and is hardly different from the larva, except in having the rudiments of the wings, which the larva wants.

This inquiry, if duly purſued, would lead to much farther digreſſion. From what is already advanced we preſume it will be apparent, that the writers prior to the time of Linnæus, or cotemporary with him, (for thoſe alone are mentioned,) are not agreed in their manner of diſtinguiſhing inſects in this third ſtate of transformation; and that their appearance is ſo various in different tribes, while in this ſtate, that they ought to be diſtinguiſhed by ſeveral, inſtead of a ſingle name. Fabricius, one of the moſt conſiderable entomological writers ſince the time of Linnæus, employs the word pupa in the ſame general ſenſe as the latter; but he is the principal late continental writer worthy of conſideration, who has imitated this example. The French naturaliſts chiefly follow Lyonet, with ſome ſlight variation. This arrangement is ſtill ſuſceptible of much improvement, but is notwithſtanding perhaps the moſt perſpicuous yet propoſed. To the chryſalis properly ſo called, namely, thoſe of the butterfly tribe, this name given to them by the Greeks is retained; the reſt of thoſe which have their members enveloped in a common ſkin are called nymphs, and are divided into three or four families, according as thoſe parts are more or leſs viſible through the exterior membrane. The term féve (bean) is alſo introduced, to expreſs in a general manner this ſtate of the inſect, when of an oblong form, and diſtinguiſhed only by a few annulations and eminences. Inſects in the third ſtate, which differ only from the perfect form in having half-wings, are called ſemi-nymphs.

In the preſent ſection, to avoid confuſion, it may be more convenient to adopt the Linnæan term, and under this head deſcribe ſuch of the leading differences in inſects as are obſervable in this ſtate of transformation.

Coleoptera.—The nymphs or pupæ of this order have commonly the limbs detached or not laid under the exterior envelope cloſe to the body, as in lepidopterous inſects. Moſt of them bury themſelves in the earth previouſly to this change; ſome form cells in decayed trees, others perforate ſeeds and nuts, and great numbers remain in the dung of animals, or other filthy ſubſtances, where the larvæ have been nouriſhed. Their appearance, while in this ſtate, is nearly the ſame in all, an emollient pupa of a whitiſh colour tinged more or leſs with browniſh, and in form remotely reſembling that of the moth kind, but with the limbs diſtinct. The mutations of ſcarabæus naſicornis affords an intereſting deſcription of the pupa of a coleopterous inſect, and may ſerve as an example for the reſt of the tribe. When the time approaches for this larva to change into the pupa form, it penetrates deeper into the ground than the larva had done before. Having found a proper place, it forms with the poſterior feet a poliſhed cavity, in which it remains for ſome time immoveable; after this, by voiding excrementitious ſubſtances, and the evaporation of moiſture, it diminiſhes in ſize, and the ſkin becomes furrowed and wrinkled, as if the animal were partly ſtarved. If diſſected at this time, the head, belly, and thorax may be diſtinguiſhed. While ſome external and internal parts are changing by a ſlow accretion, others are gently diſtending by the force of its impelled humours. The body, contracting itſelf while the fluid is propelled towards the fore parts, forces the ſkull open in three parts, and the ſkin in the middle of the back is ſeparated by means of an undulating motion of the inciſions of the back; at the ſame time the eyes and the horns, &c. caſt off the exuvia. During this operation, a thin watery humour is diffuſed between the old and new ſkin, which renders the ſeparation eaſier. The proceſs going on, the larva is at laſt diſengaged from its ſkin, and the limbs and parts are by continual unfolding transformed into the pupa ſtate: after which it twiſts, and compreſſes the exuvia at the vent, and throws it towards the hinder parts under the belly. The pupa is at this time very delicate, tender, and flexible, and affords a curious ſpectacle.

The pupa of this beetle weighs, a little time after its change, much heavier than it does in the beetle ſtate, which is alſo the caſe with the bee and the hornet, which latter have been known to weigh ten times as much as the inſect when perfect. If the ſkin be taken off at this time, many curious circumſtances may be noted, but what claims our attention moſt, is, that the horn which is ſo hard in the male beetle when in a ſtate of maturity, that it may be ſharpened on a grind-ſtone, in the pupa is quite ſoft and like a fluid. How long this particular remains in this ſtate is uncertain, ſome beetles of the ſame kind reſt in this form the whole winter, more particularly thoſe who quit the larva ſtate in autumn. Some beetles go through all the ſtages of their exiſtence in a ſeaſon, while others remain two or three years even in the pupa ſtate.

When the proper time for their final change arrives, all the muſcular parts grow ſtrong, and are thus able to ſhake off their laſt integuments, which is performed exactly in the ſame manner as in the paſſage of the inſect from the larva to the pupa ſtate, ſo that in this laſt ſkin, which is extremely delicate, the traces of the pulmonary tubes that have been pulled off and turned out again become viſible.

Hemiptera.—The pupæ in this order are the ſemi-nymphs of the old writers, and reſemble the perfect inſect in ſize and figure, but are without wings. The rudiments of theſe members, of larger or ſmaller dimenſions in different ſpecies, are ſituated at the poſterior parts of the thorax. They have the ſame manners, and ſubſiſt on the ſame food as the perfect inſects; and we have reaſon for ſuſpecting that ſome at leaſt of theſe are not deficient in any of the animal functions.

Lepidoptera.—When the caterpillar of a butterfly or moth has attained its full growth, ſome writers affirm, that the rudiments of the perfect fly may be diſtinguiſhed upon accurate inveſtigation beneath the ſkin. This is aſſerted by Swammerdam, who declared he could demonſtrate all the parts of the future butterfly in a caterpillar near the change. To diſcover this, it is directed, that the caterpillar be taken at the time the ſkin begins to open, when it is to be drowned in ſpirit of wine or ſome ſtrong liquor, and to be left therein for ſeveral days, that it may take more conſiſtency and harden itſelf, the ſkin of the caterpillar muſt be then removed, which will be eaſily accompliſhed, and the incloſed moth will appear. The rudiments of the future inſect are extremely tender, and ſhould be touched with the utmoſt delicacy, when the legs, antennæ, and other parts, may be unfolded and diſplayed to view. The parts of the moth or butterfly are not exactly diſpoſed in the ſame manner in the body of the caterpillar, as when left naked in the chryſalis. The wings are ſaid to be longer and narrower, being wound up in the form of a cord, and the antennæ are rolled up on the head, but in a very different manner from what it is in the perfect inſect, and different from that in which it lies in the chryſalis; ſo that it is by a progreſſive and gradual change that the interior parts are prepared for the moth and pupa ſtate; and even the eggs, hereafter to be depoſited by the perfect animal, are to be found both in the caterpillar and pupa, the whole arranged in their natural and regular order.

Many of the chryſalides of the butterfly tribe poſſeſs a peculiar luſtre in colour and brilliancy, reſembling gold. It is not an appearance common to all butterflies, it is confined to certain ſpecies, and is not ſeen in any of the pupæ belonging to the moth tribe. This colour does not appear immediately in the chryſalides, but is aſſumed by degrees as the incloſed inſect acquires conſiſtency. It owes its ſplendour to the luſtre of the white or light colour of the incloſed animal ſhining through the yellow tranſparent membrane of the caſe, as M. Reaumur has deſcribed in his work. This metallic appearance ſeems to have afforded a favourable pretext to the alchemiſts of former days, who were weak enough to draw deluſive hopes from this appearance, and conceive it would afford them gold.

The following very curious and indeed inſtructive deſcription of the chryſalis of a butterfly is given by our countryman Liſter, nearly half a century before the ſcience of entomology had made any conſiderable progreſs on the continent of Europe, and from which it would appear, that in his time the knowledge of that ſcience was in a great meaſure confined to this country: it is from his annotations on the works of Goedartius.

"The middle ſtate or diſguiſe of a butterfly is called by the Greeks chryſalis, or a thing gilt, as the word importeth: the Latin hath left us no name that I know of: we have tranſlated it aurelia. The Latins, however, call the caterpillar eruca; which is a word (as I gueſs from a place in Vitruvius), which ſignifies in the old Tuſcan language viride æris, and thence borrowed to ſignify a caterpillar: for ſome caterpillars there are, which I have ſeen in Languedoc feeding on a certain common tithymal, very notably painted with a ſea-green colour, or blue. So that as the gilding of ſome few chryſaliſes gave a denomination to all; in like manner, the blue colour of ſome one caterpillar gave the name to all the reſt: as for the gilding itſelf, I take it to be nothing elſe but the ſcum of an evaporated juice between the ſkin of the caterpillar and the ſhell of the chryſalis, which laſt it covers."

The butterfly remains only a ſhort time in the chryſalis ſtate, the interval between the larva and perfect ſtate ſeldom exceeding ten, twenty, or thirty days. Theſe chryſalides are commonly ſuſpended by means of a few ſilken threads with the head downwards to the leaves or ſtems of trees, or againſt palings, &c. The chryſalis of the "common garden white" is a familiar example of this mode of ſuſpenſion, and of the brilliant appearance which this order of inſects aſſume in this ſtate.

The moth tribe remain much longer in the pupa form, and evince more care towards themſelves, in making choice of a ſituation adapted to this defenceleſs ſtage of life. The caterpillar having acquired its full ſize, ſeeks for a proper place in which it may remain in ſafety during this period, and having made choice of this, prepares for the important change. Some ſpin webs or cones in which they incloſe themſelves, others conceal themſelves in little cells which they form under ground, &c. Preparatory to the change the larva ceaſes to take any food, empties itſelf of all the excremental matter which the inteſtines contained, voiding at the ſame time the membrane which ſerves as a lining to theſe of the ſtomach. It generally perſeveres in a ſtate of reſt and inactivity for ſeveral days about this time. In proportion as the change into the pupa form approaches, the body is obſerved to extend and contract itſelf very often: the hinder part is firſt diſengaged from the ſkin, and after a while the ſkin is entirely caſt off.

The caterpillar, thus ſtripped from its ſkin, is called the pupa; the exterior covering gradually becomes hard, while the interior remains ſo ſoft that the ſlighteſt touch will decompoſe them. The exterior covering is at firſt covered with a viſcous fluid, which thickening and drying up, forms a thin ſkin or coat capable of reſiſting external injuries. Thoſe who are deſirous of tracing the various members of the future butterfly or moth in the pupa, ſhould examine it before this fluid dries up.

The length of time an inſect remains in the pupa form varies much in different ſpecies. As ſoon as the incloſed animal acquires ſufficient ſtrength to break the bonds of its confinement, it makes a powerful effort to eſcape. The moth frees itſelf from the pupa with greater facility than the pupa from the caterpillar; for the caſe of the pupa becomes ſo dry, when the moth is near the time of throwing off its covering, that it will crack and break to pieces if it be only gently preſſed between the fingers; and very few of the parts will be found, on examination, to adhere to the body. Hence, when the inſect has acquired a proper degree of ſolidity, it does not require any great exertion to ſplit the membrane which covers it: a ſmall degree of motion, or a little inflation of the body, is ſufficient for this purpoſe; theſe motions reiterated a few times enlarge the hole, and afford the moth room to eſcape from its confinement. The opening through which they paſs is always at the ſame part of the ſkin, a little above the trunk, between the wings and a ſmall piece which covers the head: the different fiſſures are generally made in the ſame direction. If the outer caſe be opened, it is eaſy to diſcover the efforts the inſect makes to emancipate itſelf from the ſhell. When the operation begins, there ſeems to be a violent agitation in the humours contained in the little animal; the fluids being driven with rapidity through all the veſſels, the limbs and various parts of the body are put in motion, and by repeated efforts it breaks through the brittle ſkin that envelopes it. Thoſe incloſed in cones or caſes, after burſting through the pupa covering, have another difficulty to overcome, that of piercing through the incloſure, which, in many inſtances, is of a ſtronger texture than the caſe of the pupa. For the accompliſhment of this, moſt inſects are provided with a liquor, which they diſcharge from the mouth upon that part of the cone through which they intend to eſcape, and this ſo moiſtens and weakens it, that after a ſhort time they force their paſſage through with ſome facility. Some inſects not provided with this fluid leave one end of their cone weaker than the reſt, and cloſe it only with a few threads, ſo that a ſlight effort of the head enables the inſect to burſt from its priſon.

The butterfly or moth, on emerging from the pupa, is moiſt and humid, the abdomen ſwollen, the antennæ bent down, and the wings crumpled, ſmall, and ſhapeleſs. Theſe parts gradually change and aſſume their deſtined form. The wings extend, and the fibres, which were at firſt flexible, become hard and rigid like bone. In proportion as the fibres loſe their flexibility, the fluids which circulate within them extend, and the wings ceaſe to act; ſo that if any extraneous circumſtance arreſts the progreſs of this fluid through the fibres, at the firſt inſtant of the moth's eſcape, the wings immediately become crippled, and never afterwards aſſume any other form. Theſe parts expand with ſuch rapidity, that the naked eye cannot entirely trace their developement. The wings, which at one inſtant are ſmall and like four little buds at the ſides of the thorax, in a few minutes after acquire their full ſize, ſo as to be nearly five times as large as they were before. Nor are they the wings only which are thus increaſed: all their ſpots and marks, heretofore ſo indiſtinct and ſmall as to be ſcarcely diſcernible, are proportionally extended, ſo that what before appeared as only ſo many unmeaning and confuſed points, become diſtinct and beautiful ornaments. When the wings are unfolded, the tongue rolled up, the mouth ſufficiently dried, and the different members ſtrengthened, it takes its flight. Moſt inſects, ſoon after they have attained their perfect ſtate, void an excrementitious ſubſtance, which ſome ſuppoſe to be the laſt they eject during life.

If the moth be now opened down the belly, and the fatty parts which fill it be removed, the groſs artery or heart will be viſible, and the contractions and dilatations, by which it puſhes forward the liquor it contains, may be eaſily obſerved. One of the moſt remarkable circumſtances is, that the circulation of this fluid in the moth is directly contrary to that which took place in the caterpillar. In this it moved from the tail to the head, whereas in the moth its current is from the head to the tail. The inteſtines are now formed in a more delicate manner, and ſuited to a purer aliment than that on which it ſubſiſted before its change into the pupa: the caterpillar devoured the groſſer parts of vegetables; the nutriment of the perfect inſect is the nectar of flowers. Many internal parts of the caterpillar diſappear in the pupa, and many that could not be before perceived are at length rendered viſible. And thus the creature, which heretofore crept on the earth, flies freely through the air, and, far from creating averſion by its foul appearance, now attracts attention by the elegance of its form and beauty of colour.

The induſtry of the caterpillar in the conſtruction of its cocoon, or other repoſitory, in which it paſſes the time deſtined for it to remain in the pupa ſtate, is highly worthy of remark. Some caterpillars, towards the time of their change, ſuſpend themſelves from the branch of a tree, with the head downward, and are transformed in this poſition. Many of the moth kind cover with threads that part of the branch from which it means to ſuſpend itſelf: it places theſe in different directions, and then covers them with other threads ſucceſſively, till the cone in which it is to become a pupa is finiſhed. The caterpillar hooks itſelf by the hinder feet to this hillock; and when it has found by ſeveral trials that it is ſtrongly fixed thereto, throws itſelf forward, letting the body fall with the head downwards. Soon after it is thus ſuſpended it bends the fore part of the body, which poſture it retains for ſome time; then ſtretching the body, again in a little time bending it, and ſo on, repeating this operation till it has formed a ſlit in the ſkin upon the back. Part of the pupa ſoon forces itſelf through this, and extends the ſlit as far as the laſt cruſtaceous feet: the pupa then forces upwards the ſkin, by means of its little hooks, and the motion of the body, till it has ſlipped it off to that part from which the caterpillar had ſuſpended itſelf.

The mode of ſuſpenſion adopted by ſome inſects is very different from that purſued by others. Some fix themſelves in an horizontal poſition, by means of a girdle, which they tie round the body, ſo as to ſupport the caterpillar, and yet leave it at full liberty to effect the changes: others ſuſpend themſelves in webs, in temporary habitations, formed by weaving together two or three leaves of the plant on which they feed, by means of ſilken threads. The induſtry of thoſe which ſpin cones or caſes, in which they incloſe themſelves, in order to prepare for their transformation, is very generally known from the familiar hiſtory of the common ſilk-worm, an inſect from which man derives the moſt eſſential benefits. In northern Europe theſe advantages are ſcarcely known, and are eſteemed valuable only in proportion as they contribute to the luxury of dreſs; becauſe our woollens are better ſuited to the viciſſitudes of the climates. But in a far more extenſive portion of the habitable globe, ſilk conſtitutes an article of the firſt neceſſity in uſeful clothing; and hence the labours of this induſtrious little creature become in the higheſt degree important and beneficial to the human race.

The ſilky tiſſues of this inſect are ſpun by the caterpillar, for the ſole purpoſe of enveloping and ſuſpending itſelf in ſecurity during its pupa ſtate. The ſubſtance of which the ſilk is formed is a fine yellow tranſparent gum, contained in two reſervoirs that wind about the inteſtines, and which, when unfolded, are about ten inches long: they terminate in two exceeding ſmall orifices near the mouth, through which the ſilk is drawn or ſpun to the degree of fineneſs which its occaſions may require. This apparatus has been compared to the inſtrument in uſe for drawing gold and ſilver into threads. Each thread proceeds from the two reſervoirs at the ſame time, but they are united as the thread forms; ſo that, if examined by the microſcope, it will be found to conſiſt of two cylinders or threads glued together, with a groove along the middle, and in which ſometimes even a ſeparation may be perceived.

When the ſilk-worm is near the time of change to the pupa, the reſervoirs of ſilk are full, and it is preſſed by its ſenſations to relieve itſelf from this incumbrance. Having made choice of a convenient ſituation, the operation of ſpinning commences. At firſt it throws out ſome looſe thread, which ſerves to ſupport the future ſuperſtructure: upon theſe it forms an oval of a looſe texture, conſiſting of what is called flos ſilk; and within this it forms a firm and more conſiſtent ball of ſilk. It is now incloſed within the circumference of the ſpheroid, the interior of which is the ſcene of its further operations: in this it is ſeen reſting on its hinder parts, and with its mouth and fore legs directing and faſtening the threads. Theſe threads are not directed in a regular circular form, but are ſpun in different ſpots, in an infinite number of zig-zag lines; ſo that, when wound off, it proceeds in a very irregular manner. This thread, when meaſured, has been found to be about three hundred yards long, and ſo fine that eight or ten are generally rolled off into one by the manufacturer. The ſilk-worm uſually employs about three days in finiſhing this cone; the inſide is generally ſmeared with a kind of gum, which is deſigned to keep out the rain. It next aſſumes the pupa form, in which it remains from fifteen to thirty days, in different climates, before the moth is produced. When the inſect intends breaking from the cocoon, it moiſtens one end of the cone, and by frequent motions of the head looſens the texture of the ſilk, ſo as to form a hole without breaking it. See Silk-Worm, *Phalæna Mori*.

From a ſeries of experiments made by Reaumur on the ſilk of this inſect and that of the ſpider, in order to aſcertain their comparative excellence, it was found that the thread would bear the weight of thirty-ſix grains, while that of the ſpider could not ſuſtain twelve grains, breaking under its weight. There are ſilks ſpun by other inſects, with which we are little acquainted, that in point of ſtrength far exceeds that of the common ſilk-worm. The popular opinion, that the ſilk worn in different parts of the world is the ſole produce of this ſpecies (phal. mori), is erroneous. This kind of ſilk is generally eſteemed for its peculiar beauty and delicacy of texture. There are others leſs coſtly, which, from their ſuperior ſtrength, are better adapted to common wear, and are for this reaſon in more general uſe in ſome parts of the globe. The ſilk obtained from the cocoons of the two ſpecies of bombyces paphia and cynthia are of this kind, as appears from an intereſting paper on theſe inſects by Dr. Roxborough, F.L.S., inſerted in the ſeventh volume of the Tranſactions of the Linnæan Society.

Theſe inſects bear the names of tuſſeh and arrindy ſilk-worms in India: both exceed the common ſilk-worm in ſize, the firſt eſpecially, which is one of the largeſt of the attaci family of bombyies, and the ſilk of which appears to be more valuable than that of the other kind.

The tuſſeh ſilk-worm is found in ſuch abundance over many parts of Bengal, and the adjoining provinces, as to have afforded the natives from time immemorial an ample ſupply of a moſt durable coarſe ſilk, commonly called tuſſeh ſilk, which is woven into a kind of cloth called tuſſeh doot'hies, much worn by the Bramins, and other ſects of Hindoos. This ſubſtance would no doubt be highly uſeful to the inhabitants of many parts of America, and the ſouth of Europe, where a cheap, light, cool, and durable dreſs, ſuch as this ſilk makes, 'is much wanted. The caterpillar, when full grown, is about four inches in length, and bulky in proportion; its colour green, with a lateral ſtripe of yellow edged with red. The plate in which the caterpillar is repreſented, if we miſtake not, is engraven from a drawing executed by an Indian artiſt, and muſt be received with ſome allowance for inaccuracy; but from this we may collect that it has a ſingle ſeries of yellow oval dots beneath the lateral line, (amounting to ſix or ſeven in number,) which are perhaps its ſpiracles; and theſe, in the deſcription, are denominated ſpecks of gold colour. When theſe are ready to ſpin, each connects, by means of the recent glutinous filament of which the caſe is made, two or three leaves of the jujube tree, the vegetable on which they feed. Theſe connected leaves form an exterior envelope, which ſerves as a baſis to ſpin the complete caſe or cocoon in; and "beſides this," ſays the writer, "the caſe is ſuſpended from a ſtrong branch of the tree in a wonderful manner by a thick, ſtrong, conſolidated cord, ſpun of the ſame materials from the bowels of the animal." It remains nine months in the pupa ſtate. The inſect, when produced, expands to the breadth of five or ſix inches, and thoſe of the female to eight inches.

There is another kind of wild ſilk-worm produced in the Burbhoom hills, which is ſaid to be more capable of being domeſticated; and a fourth ſort, a ſuppoſed variety of the tuſſeh-worm, in the hills near Bauglipore, the cocoon of which is ſmaller than that of either of the two firſt mentioned.

The arrindy ſilk-worm ſtill remains to be noticed. This is of a ſpecies altogether different from the former, and is the bombyx cynthia of entomologiſts. This inſect, known to the Hindoos by the name of arrindy in ſome parts, and in others arrundi, appears to be peculiar to the interior parts of Bengal; and it is preſumed, may be even confined to the two diſtricts Dinagepore and Rungpore, where the natives breed and rear it in a domeſtic ſtate, as they do the common ſilk-worm. The food of the caterpillar conſiſts entirely of the leaves of the common ricinus or palma chriſti, which plant is cultivated abundantly over every part of India, on account of the oil obtained from the ſeed. The Hindoos call this plant arrindy, and hence is derived the name of the inſect. The caterpillar, when full fed, is about three inches long; the colour pale green; and each ſegment verticillated with a few conic tubercles diſpoſed in a ſingle line. The cocoon is white or yellowiſh, of a very ſoft and delicate texture, about two inches long, and three in circumference, and pointed at each end. There is a wide diſtinction between this ſpecies and B. paphia, in the period it remains in the pupa form; this requiring at the utmoſt not above twenty days, inſtead of nine months, to complete its laſt transformation.

The filaments of which the cocoon is compoſed are ſo exceedingly delicate, that it is ſaid to be impracticable to wind off the ſilk: it is therefore ſpun like cotton. The cotton, thus manufactured, is wove into a coarſe kind of white cloth, of a ſeemingly looſe texture, but of incredible durability; the life of one perſon being ſeldom ſufficient to wear out a garment made of it, ſo that the piece deſcends from mother to daughter. Some of the Indians, however, have a method of ſpinning the ſilk of this ſpecies, and the proceſs is related as follows. Four or five of the cocoons are faſtened to a piece of wood, with ſomething heavy to make it ſpin round, while ſuſpended by the thread. When they let out a ſufficient quantity of the cocoons from their hand, it is twiſted by this piece of wood ſpinning round; and when well twiſted, it is wound round the wood, and another length let out of the hand. The cocoons are ſpun wet, but only with cold water. The cloth is woven in ſmall pieces in a loom: its uſes are for clothing for both men and women; it will conſtantly wear ten, fifteen, or twenty years. This ſilk muſt be always waſhed in cold water; for if put into boiling water, it will tear like old rotten cloth. Some manufacturers ſeem to be of opinion that ſhawls, and other ſilken articles of dreſs, equal in quality to any manufactured in India, could be fabricated with this material. There is reaſon to apprehend that this ſilk is highly valued in India; nor can we entertain the leaſt diſtruſt of its want of durability, ſince it is well known that the coverings of their palanquins are of this particular kind of ſilk.

On further inveſtigation and reſearch into the hiſtory of the larger ſpecies of the bombyx tribe, we are perſuaded others will be found to form cocoons or pupa ſpinnings, which, with proper attention and culture, may hereafter be productive of ſimilar advantages. We are not ignorant that in other parts of Aſia, and in America, there are many ſpecies that ſpin in the ſame manner an envelope round the pupa; and ſome of theſe at leaſt, we muſt ſuppoſe, capable of producing a ſilk of beauty and durability equal to ſome of thoſe in preſent uſe. We ſhould not be ſurpriſed to learn that bombyx atlas, the moſt conſiderable in magnitude of all the moth tribe, is expreſsly reared in China for the ſake of its ſilk. We ſuſpect this to be the truth. It would be deſirable alſo to aſcertain whether the cocoons of the ſpecies heſperus, cecropia, cytherea, promothea, and ſome others, could not be beneficially employed in the production of ſilk. Mr. Abbot, in his Inſects of North America, ſpeaks generally of ſome attempts being made to fabricate the ſilk of one or two of the larger moths of that country; the cloth prepared from which is repreſented as ſtrong and durable: but he expreſſes doubt how far the experiment might be uſeful, as the inſects which produce the ſilk are not abundant. This objection might eaſily, we ſhould imagine, be obviated by cultivation: inſects are highly prolific, and if they could be reared in what may be termed a domeſticated ſtate, could be produced in any numbers.

Among a variety of other curious information which this paper conveys, the following circumſtances appear ſo amuſing, and ſeem to reflect ſuch new light on the hiſtory of theſe uſeful inſects, that we cannot refrain repeating them. The cocoons of this inſect, bombyx paphia, feed on the leaves of a plant called byer by the Hindoos (rhamnus jujuba), and likewiſe on the plant they call aſſeen (terminalia alta glabra of Roxb.). They are annual, remaining nine months in the pupa ſtate, and three months in that of the egg and caterpillar. The ſpecies cannot be domeſticated, nor can the natives even retain any for ſeed. The hill people ſay, they go into jungles, and under the byer and aſſeen trees they find the excrement of the inſect; on which they examine the tree, and, on diſcovering the ſmall worms, they cut off branches of the tree ſufficient for their purpoſe, with the young brood on the branches. Theſe they carry to convenient ſituations near their houſes, and diſtribute the branches on the aſſeen tree, in proportion to the ſize of them; but they put none on the byer tree. The Parieahs, or hill people, guard the inſects night and day, while in the worm ſtate, to preſerve them from the crows and other birds by day, and from bats by night. As ſoon as the moth pierces the caſes, it eſcapes; nor do the people prevent this, as they have learnt by experience that it cannot be kept alive more than a few days, and that retaining it would not be attended with any advantage.

To wind off theſe cocoons, the natives put them into a ley made of plantain aſhes and water for about two hours; after which they take them out of the ley, and put them in their wet ſtate into an earthen pot: thoſe which are properly ſoftened are firſt applied to the reel, and ſo on as the cocoons become ſoft, for four or five days, till the whole are wound off. The implement uſed for taking off the thread is a ſmall common reel of four bars. The cocoons are laid in a ſmooth earthen diſh without water; the reel is turned by the right hand, whilſt the thread of four or five cocoons paſſes over the left thigh of the ſpinner, and he gives the thread a twiſt with his left hand upon his thigh. The thread is exceedingly apt to come off double and treble for ſeveral yards together, which is not regarded by the natives, as breaking off double threads would diminiſh the produce, and moreover would occaſion loſs of time: a very even thread, however, with care may be reeled off. The bughy ſilk-worm feeds indifferently on byer or aſſeen leaves.

The jarroo cocoon is the pupa ſpinning of an inſect cloſely allied to the preceding, but whether a diſtinct ſpecies or variety, from the knowledge we at preſent poſſeſs, ſeems difficult to determine. Theſe are called the jarroo cocoon, from being produced in January, the coldeſt month of the year; and the natives affirm, that they are different from the bughy. The jarroo will eat the byer leaf, if it cannot get the aſſeen; but will always prefer the latter, and will produce better cocoons when fed on it. The ſilk is duller in colour. The natives are able to retain part of the jarroo cocoons for ſeed. Theſe they hang out on the aſſeen trees, when the proper ſeaſon of the moth arrives. The males, when hatched, invariably fly away; but the females remain on the trees. Theſe are not impregnated by the males bred along with them, but in ten or twelve hours, or perhaps two or three days, a flight of males arrive, ſettle on the branches, and impregnate the females; and it is worthy of remark, that the hill people conſider it good or ill fortune, in proportion to the ſpeedy or tardy arrival of theſe male viſitors. The purpoſes of nature accompliſhed, the males expire, and the females live only long enough to depoſit the eggs in ſafety on the branches of the trees. Theſe males are ſuppoſed by the natives to come from a vaſt diſtance: it is affirmed even, that by marking the wings of a number of males, previouſly to letting them fly, their progreſs in queſt of the females has been traced to the diſtance of one hundred miles and upwards. This, though remarkable, is not more extraordinary or unworthy of credit than the circumſtance (if truly ſtated), that the males and females of the ſame brood never aſſociate together in any manner, when they enter the fly ſtate; the males regularly flying off in ſearch of another brood of females, and leaving thoſe of their own family to the embraces of another flight of males.

There is a caterpillar which forms its ſilken cone in the ſhape of a boat turned bottom upwards, whence it is called by Reaumur "coque en batteau." It conſiſts of two principal parts, each of which is framed by itſelf, and formed of an innumerable quantity of minute ſilk rings; in the fore part there is a projection, in which a ſmall crevice may be perceived, which ſerves when opened for the eſcape of the moth; the ſides are framed with ſo much art, that they open and ſhut as if framed with ſprings; ſo that the cone from which the fly has eſcaped appears as cloſe as that which is ſtill inhabited.

Thoſe caterpillars which do not ſpin a cone ſupply that want with various materials, which they form into a habitation to ſecure them from injury while in the pupa ſtate: ſome form a covering with leaves and branches tied or made faſt together, others connect the leaves with great regularity: many ſtrip themſelves of their hairs and form a mixture of hair and ſilk, others conſtruct a cone of ſand or earth, cementing the particles together with a kind of glue:

ſome gnaw the wood into powder, or like ſaw-duſt, and cement it together; and others make caſes in holes, which they form in the trunks of trees.

The period of their change into the chryſalis or pupa ſtate is very regular in moſt inſects, unleſs in ſeaſons peculiarly unfavourable. Some change in May, others in June, July, Auguſt, and September, and the time of emerging from the ſtate of pupa is fixed with no leſs preciſion. This is a fact well known to every practical entomologiſt. Some remain in the pupa ſtate only twelve or fifteen days, others twenty or thirty, and theſe are chiefly of the butterfly tribe. Thoſe of the moth kind are commonly much longer, ſome remaining in this ſtate only two or three months, others ſix, nine, or twelve, ſome two years, and others even it is known ſo long as three years. Lyonet has remarked, that the periods of change to the chryſalis ſtate is not ſo conſtant, but that a degree more or leſs will affect it. The ſame inſect, he ſays, which in the middle of ſummer would have acquired its utmoſt ſize in leſs than three weeks, will require as many months, and even much more if it comes forth at the end of the ſeaſon. And again, he obſerves, that ſuch a nymph or chryſalis which in ſummer will change into a winged inſect in fifteen days, will employ ſometimes ſix, ſeven, or eight months for the ſame purpoſe, merely from having gone into the chryſalis ſtate a few days later than thoſe which have changed ſo rapidly. That particular incidents may occaſionally juſtify theſe remarks of Lyonet, we ſhall not diſpute, but this can be only underſtood of ininſects hatched in ſeaſons of unuſual inclemency, or under circumſtances in the higheſt poſſible degree uncongenial to their transformations. Irregularities will ariſe from this cauſe. In general, however, the appearance of every ſpecies (whoſe hiſtory is once correctly aſcertained) whether in the larva, pupa, or winged ſtate, may be determined by the time of the year. Moſt inſects perform all their changes within the courſe of twelve months, and are found in their ſeveral ſtates at particular periods annually; others have two broods in the courſe of that time, and conſequently appear in the ſame ſtate at two different periods of the year.

Neuroptera.—Some of this order are ſemi-nymphs, as the libellulæ and ephemeræ, in which the rudiments or half-wings are developed, and which eat and purſue the ſame manners of life as the larva. Others are like the nymphs of the coleopterous order in appearance, and lie dormant in the ground, generally in caſes conſtructed of extraneous materials. The myrmelion forms a hollow ball of ſand for this purpoſe.

Hymenoptera.—In the pupa of the cynips the limbs are partially diſcloſed in its external figure, and it remains in the central cavity of the gall in which it lives during the ſtate of larva, while in the pupa form. The tenthredo forms a kind of exterior caſe or envelopement, within which it aſſumes the pupa form, and which in ſome kinds reſembles the texture of thin parchment. The pupa of the ſirex is quieſcent, and is uſually found lodged in timber: this has the limbs diſtinctly formed. The pupæ of the ichneumons are incloſed in oblong ſilken cones. Thoſe of the waſps and bees are well known. In the ants the limbs are diſtinct.

Diptera.—The pupæ of the tipulæ are uſually cylindrical like the larva, and quieſcent; many of the muſcæ appear of an elongated egg ſhape, without any ſegmental diviſions, and totally devoid of motion. The pupa of the culex is curiouſly incurvated and ovate, with reſpiratory tubes, through which it breathes; it is an inhabitant of the waters. The egg of the hippoboſcæ ſerves in lieu of a pupa, or in other terms the hippoboſcæ are oviparous, and have no pupa.

Aptera.—As the individuals of this order are produced with few exceptions in the perfect form from the egg, they have no pupa, at leaſt the common flea is the only inſtance to the contrary; this undergoes the uſual transformations from the egg to the perfect ſtate; its pupa reſembles that of ſome coleopterous inſects when magnified.

Imago: the final or perfect ſtate which all inſects aſſume after paſſing through the ſucceſſive changes from the egg, the larva, and pupa form; which latter it quits in the imago ſtate. This might, with more ſimplicity, be termed the winged ſtate, were it not that ſome inſects, after quitting the pupa, are apterous, or without wings. In the imago form the inſect is in every reſpect perfect in all its parts, and poſſeſſed of every function which nature has intended the ſpecies to enjoy.

Habitation of Inſects.

Inſects are of two kinds, aquatic and terreſtrial, and their habitation muſt be conſidered ſeparately.

Some live only in watery places, appearing occaſionally on the ſurface of that element, and which very rarely plunge themſelves in, or if they fall in, either riſe again immediately to the ſurface or periſh. Others live only in water, and cannot ſubſiſt out of it. Many, after having lived in the water while in the larva and pupa ſtate, come out afterwards with wings, and become entirely terreſtrial. Some undergo all their transformations in the water, and then become amphibious. Others again are born and grow in the water, but remain during the pupa ſtate on dry land, and after they attain their perfect form live equally in air and water. There are, laſtly, ſome who live at the ſame time occaſionally both in the water and on land, and which, after their transformation, ceaſe to be aquatic.

Among the inſects which remain on the ſuperficies of the water, are ſome ſpiders which run with great addreſs and agility, without moiſtening their feet or their body. There are aquatic cimices which ſwim or rather run on the water with great velocity, and by troops, as may be often ſeen on the ſurface of ſtill water. Some walk ſlowly on the ſurface. The gyrinus moves ſwiftly and in circles. The nepæ are of that kind which live only in the water, and cannot ſubſiſt out of it, or at leaſt can remain out of it only a ſhort time. The number of thoſe which, after having lived in the water, leave it when in a winged ſtate is very great: among theſe are the libellula, the ephemera, the phryganea, culex, tipula, and ſome other ſpecies of muſcæ; all theſe are of the aquatic kind, both in the larva and pupa ſtate, but when they have aſſumed their perfect form are entirely terreſtrial, and would be drowned therein. The kinds moſt ſtrictly amphibious are the water beetles, ſuch as the dytiſcus and hydrophilus; theſe remain in the water all day, but towards evening come upon the ground and fly about, plunging themſelves again into the water at the approach of ſun-riſe: the larvæ of theſe inſects are entirely aquatic; but when the time of their pupa ſtate arrives they deſcend into the earth, where they make a ſpherical caſe, thus becoming entirely terreſtrial, and in the perfect ſtate are amphibious.

Moſt inſects of theſe tribes prefer ſtagnant waters, others thoſe of a purer nature, and we have inſtances of certain inſects which inhabit, with perfect convenience, ſprings of a warm and mineral nature. At the baths of Abano, in the Venetian ſtates, is a ſpring of this deſcription, impregnated with ſulphur, in which ſmall water beetles are ſeen ſwiming about, and which die on being taken out and plunged into cold water.

Many inſects that live under the ſurface of the earth in the perfect ſtate crawl out occaſionally, as the mole cricket, and ſome of the aptera, as the julus and ſcolopendra; theſe are generally found in the earth under ſtones, or beneath rotten wood in damp ſituations. Some inſects remain under-ground part of their life, but quit that ſituation after their change, as in the coleoptera. A vaſt number of others live in animal ſubſtances of every kind. The habitation of ſome, as the myrmeleon formicarius, is curiouſly conſtructed in the ſands.

There is a ſpecies of ſpider found in Jamaica (aranea venatoria) which burrows in the earth like a rabbit; it is of a ſize very far ſurpaſſing the largeſt of the European ſpiders, and is not uncommon there. This creature forms a hole twelve or fifteen inches deep, of a cylindrical ſhape, rather more than an inch in diameter, and which it lines with a thick coat to prevent the earth from tumbling in. The aperture is cloſed with a kind of lid or door attached by a ſingle hinge, and which open outwardly, falling down and ſhutting the aperture by its own gravity. Into this the ſpider retires with its prey, and devours it in ſafety, as few inſects can penetrate into its cell. Theſe neſts or caſes form a complete habitation, ſhould the ſands in which they are conſtructed give way.

Inſects of the lepidopterous order are very rarely carnivorous; there are inſtances of this, but theſe are uncommon. Their food and that of many other inſects are of the vegetable kind, and their habitations are trees and plants. The oak and the willow among trees, and numbers of different plants among herbage, are the natural habitation of inſects in great abundance. Some live in the roots, others in the wood; in the leaves, and in galls formed therein; in flowers; in fruit; and in grain. Some caterpillars form a kind of hammock, in which they eat and go through their various changes; while others conſtruct a tent, under which they live till they have conſumed the ſurrounding herbs, when they leave their abodes and pitch their tents in another ſpot, where they can find abundance.

Many inſects aſſociate together all their lives, others only for a certain period. Thoſe who live together proceed from the ſame moth who depoſited the eggs near each other, or laid them in a heap, and thus formed a kind of neſt. Theſe are generally hatched about the ſame time, and live together, forming a kind of republic. Theſe ſocieties include two, three, or four hundred individuals, and uſually live incloſed in a large web, like the lackey moth, (phal. neuſtria) and the ermine moth. Of theſe ſocial caterpillars there are ſome kinds which never quit the ſociety to which they belong, but paſs into the pupa form in the ſame neſt. One of the moſt remarkable of theſe caterpillar communities is that of the bombyx proceſſionea. Theſe live on the oak ſeparate till they arrive at a certain age, when they aſſociate together, and do not quit their ſociety till they acquire their perfect form. As the number of the caterpillars thus aſſembled is conſiderable, the neſt is alſo very large. They remain in their habitation till ſun ſet. When they go out one of the body precedes the reſt as a chief, whom they regularly follow. When the leader ſtops the reſt do the ſame, and wait till it goes on again before they recommence their march. The firſt file generally conſiſts of a ſingle caterpillar, which ſeries is ſucceeded by a double file, theſe by three in a row, which are then followed by files of five, and ſo on. They keep cloſe to each other, not leaving any interval either between the ranks or between thoſe in each rank, all following their captain in compact order, whether in a ſtraight or irregular courſe. After they have taken their repaſt they return to the neſt in the ſame order as they ſet out. This conduct is regularly purſued till they are full grown, when each ſpins a cone for itſelf in the neſt. It has been remarked, that though theſe caterpillars proceed often very far from the neſt, it is by no means difficult for them to get back again, becauſe they ſpin a thread in their route. The firſt leads the way, the ſecond follows ſpinning, the third ſpins after the ſecond, and ſoon forming thus a path of threads.

Upon the ſame tree, ſhrub, or plant, we often find numbers of caterpillars which have no affinity to each other, and of which the actions of one have no influence over the manners of the other; they may in this reſpect be conſidered ſolitary. There are others who ſeem ſtill more independent of each other even than theſe, becauſe they ſhun all intercourſe, conſtructing lodgments formed of leaves tied together with conſiderable ingenuity, in which they live as in an hermitage. The operation by which theſe caterpillars tie the leaves together is far ſurpaſſed by another kind, who fold and bend one part of the leaf till it meets the other. Theſe are again excelled by thoſe who roll the leaves which they inhabit. For this purpoſe the caterpillar makes choice of part of a leaf which it finds in ſome degree bent; here its work commences, the caterpillar moving the head with great velocity in a curved line, or rather vibrating it like a pendulum, the middle of the body being the centre on which it moves. At each motion of the head a thread is ſpun and fixed at that part to which the head ſeems to be applied. The threads are extended from the bent to the flat part of the leaf, and the curvature which is to be given to it. There is another ſpecies of which it is obſerved, that at each new thread it ſpun, the edges of the leaf inſenſibly approached to each other, and were bent more and more, in proportion as the caterpillar ſpun new threads; when the laſt thread was ſpun, that which preceded it was looſe and floating in the air. To effect this the caterpillar, after it has fixed a thread to the two edges of the leaf, and before it ſpins another, draws it towards itſelf by the hooks of its feet, and by this means bends the leaf; it then ſpins another leaf to maintain the leaf in this poſition, which it again pulls towards itſelf, and repeats the operation till it has bent the leaf in its whole direction. It now begins again placing the threads further back, upon the bent part of the leaf, and by proceeding in this manner it is rolled up; when it has finiſhed this buſineſs it ſtrengthens the work by faſtening the ends of the leaf together. The habitations thus formed are open at both ends, and within which the inſect feeds in ſafety. At the approach towards the pupa ſtate, the caterpillar lines the rolled leaf with ſilk, that the rougher parts may not injure it.

A great number of the ſmaller larvæ require an artificial covering to protect them. Some inhabit the interior part of leaves in which they form large oval or circular ſpaces; others form a kind of gallery within, which in ſome is ſtraight, in others crooked. Many of the tineæ are found lodged in cylindrical tubes or caſes, which they form of different ſubſtances cloſely woven with fine ſilken threads. The ſmall caterpillar found in neglected woollens and other ſimilar articles is of this kind, living in a cylindrical caſe, and producing a ſmall moth.

The phryganea larvæ conſtruct caſes ſomewhat ſimilar in form, and which are alſo open at both ends; in theſe the larvæ reſide, the outſide is formed of different ſubſtances, ſuch as bits of reed, ſtone, gravel, and ſmall ſhells, which they arrange and manage with ſingular dexterity. When they walk they only advance a few of the anterior rings of the body, training the caſe after them. When they are about to aſſume the pupa form they cloſe up the ends with ſilken threads.

But the habitations of theſe inſects, though conſtructed with ingenuity, are in no manner comparable with the architectural fabrications of many other inſects, as thoſe of the waſp, the bee, the common ant (formica), the white ant (termes), &c. The ſtructure of the neſts conſtructed by the common waſp, and the common honey bee, cannot be unknown to any reader. Among the habitations of the ſolitary, or thoſe called the wild bees, there are many which deſerve remark. Some of the bee tribe penetrate into the earth, where they form ſmall contiguous cavities, in each of which they depoſit an egg, with a ſufficient quantity of proviſions for the ſuſtenance of the larva. There is one kind whoſe neſt conſiſts of ſeveral cells artfully let into each other, but not covered with a common incloſure; each cell conſiſts of two or three membranes, inexpreſſibly fine, and placed over each other. The cavity in which the neſt is placed is ſmeared over with a layer of matter, like that of which the cells are formed, and apparently ſimilar to that viſcous humour which ſnails ſpread in their paſſage from one place to another. An egg is depoſited at the bottom of each cell, where, after it is hatched, the grub finds itſelf in the midſt of a plentiful ſtock of proviſion, for in each cell there is placed a quantity of paſte, or a kind of wax, which is to ſerve as food for the worm, and as ſupport to the wall of the cell.

Another ſpecies that forms its neſt under ground makes a perpendicular hole in the earth about three inches deep and cylindrical, till it comes within three-fourths of an inch of the bottom, when it begins to open wider. The ſuitable proportions being given, the bee proceeds to line with tapeſtry not only the whole of the inſide, but alſo the entrance; the ſubſtance with which it is lined is of a crimſon colour, and appears as very beautiful. This lining is formed of fragments of the flowers of the poppy, which the bee cuts out curiouſly, and then ſeizing them with her legs conveys them to her neſt. If theſe pieces are rumpled, ſhe preſſes them ſmooth, and then affixes to the walls of her cell; or if the piece ſhe has cut and tranſported is found too large, ſhe clips off the ſuperfluous parts, and conveys the ſhreds out of the apartment. After the bee has lined the cell, ſhe fills it nearly half an inch deep with a kind of paſte, proper to nouriſh the larva when hatched from the egg. When the bee has amaſſed a ſufficient quantity of paſte, ſhe folds the tapeſtry over the paſte and the egg, which is by this means incloſed as it were in a bag of paſte; and the bee then fills up with earth the empty ſpace that is above the bag. Another of the bee tribe is ſaid to conſtruct its neſt in the ſame way, with this difference only, that the lining is of the corolla of the roſe.

The carpenter bee (apis centuncularis) conſtructs her neſt in pieces of wood, whence the name; in this ſhe perforates long cylindrical hollows, which ſhe divides into ſtages, and depoſits her eggs, each incloſed in a curious cylindrical caſe formed of leaves, not quite an inch in length, and leſs than half an inch in diameter, and theſe are diſpoſed endwiſe one above another to the amount of ten, twenty, or more, the cylindrical perforation in the wood being two or three feet long, or ſometimes more. They bore the wood moſt commonly in the longitudinal direction of its ligneous fibres, but this is not always the caſe. There are ſeveral ſpecies of this order in appearance much like each other. The leaves which form the lining of the caſes in one ſpecies is that of the roſe.

The former are called the carpenter bees on account of the holes which they bore in the wood; there is another which bears the name of maſon bee, from the peculiar ſtructure of the neſt. Their manner of building is this: the bees collect with their jaws ſmall parcels of earth and ſand, which they glue together with a ſtrong cement, which is furniſhed from the proboſcis; and of this they form a ſimple but commodious habitation, which is generally placed along walls that are expoſed to the ſouth. Each neſt reſembles a lump of rude earth of about ſix or ſeven inches diameter, thrown againſt the wall; the labour of conſtructing an edifice of ſuch magnitude muſt be conſiderable, as the bee can only carry a few grains at a time. The exterior form is rude and irregular, but the art exhibited within more than compenſates for the ruggedneſs of the external appearance. The interior is divided into twelve or fifteen cells, ſeparated from each other by a thick wall; in each of theſe an egg is depoſited by the parent bee. The cells are conſtructed progreſſively, for when one is finiſhed ſhe places an egg in it, with a ſufficient quantity of honey to nouriſh the larva; ſhe then builds another, and ſo proceeds till all her eggs are depoſited. When the young are hatched the ſtrength of their jaws enable them to penetrate through their cells with perfect eaſe.

There is a ſpecies of ſphex called the ichneumon waſp, whoſe manner of conſtructing the neſt is ſtill different from either of thoſe before mentioned. This little creature generally begins its work in May, and continues its labours through the greater part of June. The object of her labour ſeems at firſt to be the digging of a hole a few inches deep in the ground, in the conſtruction of which ſhe forms however a hollow tube above ground, the baſe of which is the opening of the hole, and which it raiſes as high above ground as the hole is deep below; it is formed with great care, reſembling a coarſe kind of fillagree work, conſiſting of the ſand drawn from the hole. The ſand out of which ſhe excavates her cell is nearly as hard as a common ſtone. This it readily ſoftens with a penetrating liquor, with which ſhe is well provided; a drop or two of it is imbibed immediately by the ſand on which it falls, which is inſtantly rendered ſo ſoft, that ſhe can ſeparate and knead it with her jaws and fore feet, forming it into a ſmall ball, which ſhe places on the edge of the hole as the foundation ſtone of the pillar ſhe is about to erect; the whole of it is formed of ſuch balls, ranged circularly, and then placed one above the other. She leaves her work at intervals, probably in order to renew her ſtock of that liquor which is ſo neceſſary for her operations; theſe intervals are of ſhort duration; ſhe ſoon returns to her work, and labours with ſo much activity and ardour, that in a few hours ſhe will dig a hole two or three inches deep, and raiſe a hollow pillar two inches high. After the column has been raiſed to a certain height perpendicularly from the hole, it begins to curve a little, which curvature increaſes till it is finiſhed, though the cylindrical form is preſerved. She conſtructs ſeveral of theſe holes, all of the ſame form and for the ſame purpoſe. It is evident the hole was dug in the ground to receive the egg, but the purpoſe of the tube of ſand is not very apparent. By attending to the labours of the waſp, one end, however, may be diſcovered; it will be found to ſerve the purpoſe of a ſcaffold, and that the balls are as uſeful to the waſp as materials to the builder, and are therefore placed as much within her reach as poſſible. She uſes it to ſtop and fill up the hole after ſhe has depoſited an egg in the cell, ſo that the pillar is then deſtroyed, and not the leaſt remains left in the neſt. The parent inſect generally leaves ten or twelve worms as proviſions for the young larva.

In all theſe fabrications there is a degree of ingenuity in deſign, and exactneſs of execution, which, independently of the labour required in their conſtruction, excites our admiration. The talent, if it may be ſo expreſſed, of the inſect race, is more obviouſly diſplayed in the formation of the dwellings than in moſt other particulars of their hiſtory. It is a pleaſing ſubject of inquiry, and extremely worthy of attention, but for an elementary diſcourſe we have, perhaps, already purſued theſe obſervations to a due extent, and ſhall therefore conclude with a conciſe account of one other, which, from its ſtupendous dimenſions, the order, regularity, and beauty of its architectural deſign, and inimitable convenience to the purpoſes for which it is intended, cannot fail to excite the aſtoniſhment of every obſerver; it may be anticipated that the alluſion is to the buildings of the termites. Theſe diminutive inſects, known more generally by the name of the white ants, though, technically ſpeaking, they are entirely of a diſtinct genus, are natives of the Eaſt Indies, Africa, and the ſouthern parts of America. They live in ſocieties, each of which is compoſed of ſome thouſand individuals, all of whom are accommodated in the ſame habitation. Their ſtructures are of a pyramidal form, riſing to the height of ten or twelve feet, and covering no inconſiderable extent of ground at the baſe. They uſually build in the plains ſeveral contiguous to each other, and from their ſize and form may ſometimes be miſtaken at a diſtance for the huts of the natives.

Theſe neſts are ſo common all over the iſland of Bananas, and the adjacent continent of Africa, that it is ſcarcely poſſible to ſtand on an open place where one of theſe buildings is not to be ſeen. The domes are ſo ſtrong that they will eaſily bear the weight of three or four men ſtanding on them at once, and ſhelter the interior from every attack of the weather. The interior is divided with the utmoſt regularity into an immenſe number of apartments, arched chambers, magazines, and avenues leading to them; and the centre, on a level with the ground, contains the royal apartment, in which the queen reſides, ſurrounded by the nurſery, &c. The white ant is the termes fatale: there are two, if not more, ſpecies beſides, namely, deſtructor and arda, both inhabitants of Africa, which build neſts of a ſimilar form, but of much ſmaller ſize. See the article TERMES.

Food of Inſects.

Inſects feed on all kinds of vegetable and animal ſubſtances. There is ſcarcely any production of theſe two kingdoms which does not ſerve for food to ſome kinds of inſects. They may therefore be conſidered under two heads; thoſe which live on vegetables alone, and thoſe ſupported chiefly on animal food. The organs of the mouth point out the very wide diſtinction nature intended in this reſpect, ſome being adapted to the purpoſes of maſtication, others to that of ſuction only; ſome, like ruminating animals, have two ſtomachs, others only one; the alimentary canal in ſome is ſhort, in others long, and upon the whole, their internal conformation, as well as external form, preſents the moſt ſtriking differences, each being in a peculiar manner adapted to the nature of the food upon which the animal ſubſiſts.

There is yet another circumſtance well worthy of remark; in all thoſe inſects which undergo material change, the transformation of their external figure is accompanied with an entire revolution in their internal ſtructure and economy; the larvæ deſtined to feed on vegetables, or the grub on carrion, after effecting their transformation, preſent no longer the ſame appearance within; parts adapted to their former mode of life, and inapplicable to their preſent one, totally diſappear, and other organs, either before not exiſtent, or which remained concealed, are now developed. The ſtomach of the butterfly, when in the larva ſtate, is adapted to the reception and digeſtion of its vegetable food, as its organs of maſtication are to its previous preparation; but this ſtomach and this mouth both diſappear in the butterfly, and other organs make their appearance; its mode of life is totally changed; it derives its ſuſtenance from the nectar of flowers, and its whole conformation is adapted to its new mode of life. Theſe arguments are not inferred from a few ſolitary inſtances; they are exemplified in numberleſs examples: nothing is more common than to find the larvæ ſubſiſting on food altogether different from that which ſupports the ſame inſect in the winged ſtate.

Among thoſe numerous tribes which feed on vegetables, ſome ſink into the earth, where they feed on the roots of graſs, and do conſiderable injury to gardens. The food of others is dry and hard; they pierce the wood, reduce it to powder, and then feed on it: in this manner many of the cerambyx tribe and other coleoptera feed in the larva ſtate. Some attack the leaves, eating the whole ſubſtance, except the principal nerves; while others feed only on the parenchymous parts which are contained between its ſuperficial membranes, forming paths and galleries within. Theſe inſects are not always content with the leaf; ſome eat the flowers, and even this food is too groſs for many; the bee, the butterfly, the muſca, and a hoſt of others, feed only on the nectareous juices, or the farina which they collect from flowers, or the delicious fluids of fruits. Corn and other grain are not free from them; they divide the produce with us, or often deprive us of large quantities. They inſinuate their larvæ into the moſt tender parts, and each oftentimes deſtroys more than would be ſufficient to feed fifty of them. We frequently find the larvæ of ſome inſects in pears, plumbs, peaches, and other fruit. There, indeed, appears ſcarcely any part of a plant which does not ſerve as food to different inſects; each has its appropriate food, and though the parent animal does not, perhaps, ſubſiſt on the ſame vegetable, yet ſhe inſtinctively depoſits her eggs on that particular ſhrub or plant which will be food for her young: Some more voracious than the reſt feed upon all with equal avidity; the migratory locuſt, gryllus migratorius, is a ſtriking example of this. The ravages of this inſect have been at particular times ſo extenſive as to lay waſte the vegetation of whole diſtricts, of even kingdoms; an inſtance is mentioned in the Amœnitates Academicæ, in which they over-ran all Sweden, and devoured all the plants, inſomuch that cattle periſhed with hunger, and men were forced to abandon their country, and fly to the neighbouring regions. Similar reſults have ariſen from the ravages of locuſts in various parts of the world at various periods, as appears from the moſt credible hiſtorians. The ſacred writings are not ſilent on this ſubject. In the year 593 of the Chriſtian era theſe animals appeared in ſuch vaſt numbers, as to cauſe a famine in many countries. Syria and Meſopotamia were over-run by them in 677. In 852 immenſe ſwarms took their flight from the eaſtern regions into the weſt, and deſtroyed all vegetables, not even ſparing the bark of trees, and the thatch of the houſes, after devouring the crops of corn, graſs, &c. Their daily marches were obſerved to be about twenty miles each, and it is ſaid their progreſs was directed with ſo much order, that there were regular leaders among them, who flew firſt and ſettled on the ſpot which was to be viſited at the ſame hour the next day by the whole legion; their marches were always undertaken at ſun-riſe. In 1541 incredible hoſts afflicted Poland, Wallachia, and all the adjoining territories, darkening the ſun with their numbers, and ravaging all the fruits of the earth. The years 1747 and 1748 afforded a memorable inſtance of the ravages of theſe animals in Germany and other parts of Europe, as far north as England. In the eaſtern parts of the world ſuch flights of locuſts appear more frequently than in Europe, and it is often found neceſſary for the governors of particular provinces to command a certain number of the military to take the field againſt armies of locuſts with a train of artillery.

The far greater number of inſects feed, however, more diſcriminately; ſome are confined to one particular plant, and others only to two or three kinds; and neither in many caſes will eat any other food; they often periſh in the midſt of abundant vegetation, becauſe they cannot procure that kind which is their natural food. The quantity of food which a caterpillar will devour is aſtoniſhing; that which feeds upon the cabbage (papilio braſſicæ) deſtroys in twenty-four hours more than twice its weight. If larger animals required a proportionable quantity of food, the earth would not be able to nouriſh its inhabitants. It ſhould, however, be remembered, that it is only during one period of their lives that they are ſo voracious, or ſubſiſt on ſuch food; after they quit the larva form they are nouriſhed in a different manner.

A vaſt number of inſects reject vegetabes in the larva ſtate, and live only on animal food; ſome ſeeking that which is beginning to putrefy, while others delight in that which is entirely putrid, or on the dung of animals. Some attack and feed on man himſelf, while others are nouriſhed by his victuals, clothes, furniture, and habitation; and again others prey on his cattle. No animal whatever is exempt from theſe depredators. Some ſubſiſt on the blood and humours of quadrupeds, others of birds, and a great proportion of them prey on inſects of other kinds, or often attack their own, and thus perpetuate an endleſs war among each other.

Every larger animal has its appropiate lice, which feed on and infeſt it: theſe in ſize or voracity bear no regular proportion to the animal they ſubſiſt upon. Thoſe of man are diminutive in the extreme, compared with thoſe which torment ſome animals. The hippoboſcæ and the tick, though not in technical terms the lice of the animals they infeſt, have the ſame habits, and draw nouriſhment from the body in the ſame manner; and theſe, in comparative bulk with the victims of their depredation, are an hundred, nay even, in ſome inſtances, a thouſand times larger than theſe uncleanly vermin in man. Some are not content with the blood and juices which they ſuck from animals; they ſeek their food in the fleſh, and that while full of life and health. The oeſtri, or gad-flies, are familiar examples of this, the larva feeds upon the fleſh beneath the ſkin in cattle. The parent lodges its eggs in the fleſh by making a number of little wounds, in each of which it depoſits eggs, ſo that every wound becomes a neſt, and the eggs are hatched by the heat of the animal. Here the larva finds abundance of food, and is at the ſame time protected from the changes of the weather, and they undergo their transformations in ſecurity. The parts they inhabit are often diſcovered by a lump or tumour which they occaſion; this ſuppurates, and is filled with matter, in which the head of the larva is always found plunged. When the time of change arrives the larva drops out, and ſeeks a convenient place in the ground, where it paſſes to the pupa ſtate. The ravages of the larva hatched from the ichneumon eggs, in the body of the caterpillar, are ſtill more deſtructive, as they entirely deſtroy the vitals of their victims. The number of inſects which are of a carnivorous diſpoſition is very great; and it is among theſe we find the traces of the greateſt art and cunning, as well for attack as defence. Every one is acquainted with the dextrous arts of the ſpider, to ſeize his prey, the curious neſt he ſpins, and the central poſition he aſſumes in order to watch more effectually the leaſt motion communicated to its tender threads when the incautious inſects ſettle upon it. D.

ENTONNER, *Fr.* in *Roman Catholic Churches*, is announcing to the choir the tone or ſound with the organ, or the voice of the officiating prieſt, with which a chant, hymn, pſalm, or anthem is to begin. In our cathedrals this is done for the reſponſes by a canon, vicar choral, or by a ſingle note on the organ.

ENTORSIS, in the *Manege*. See PASTERN.

ENTOYER, or ENTOIRE, in *Heraldry*, is uſed to expreſs a bordure, charged entirely with things without life. See BORDURE.

ENTRACQUE, in *Geography*, a town of Italy, in the principality of Piedmont, on the Geſſo; 5 miles S.S.E. of Demont.

ENTRA'CTE, *Fr.* the ſpace of time which elapſes between the end of one act of a drama and the beginning of another; and during which the repreſentation is ſuſpended, while the action is ſuppoſed to be advancing elſewhere. The orcheſtra fills up this ſpace by performing a ſymphony, which ſupplies the place of what uſed, in England, to be called an *act-tune*.

It does not appear that the Greeks ever divided their dramas into acts; conſequently, they had no act-tunes. The repreſentation was never ſuſpended on their ſtage empty from the beginning of the piece to the end.

The Romans, leſs intereſted in theſe exhibitions than the Greeks, were the firſt who divided their pieces into ſeveral diſtinct parts, the intervals of which afforded a relaxation to the attention of the ſpectators; and this cuſtom has been continued elſewhere ever ſince.

But as the entract was intended to ſuſpend the attention, and give ſome repoſe to the mind of the audience, the ſtage ſhould have remained vacant. But the interludes with which the vacuity was formerly filled furniſhed an interruption in a very bad taſte, which infallibly injures the piece in breaking the thread of the action.

However, Moliere himſelf did not ſee ſo ſimple and obvious a truth; the ſpaces between the acts of his laſt pieces were filled with interludes.

The French, whoſe public ſpectacles have more reaſon than enthuſiaſm in them, and who dread being long kept in ſilence, have ſince reduced their interacts to their due ſimplicity, and it is to be wiſhed for the perfection of the drama that they were imitated, in that particular, every where elſe.

The Italians, whom an exquiſite ſenſibility often guides better than reaſon, have proſcribed the dance of the dramatic action (ſee OPERA); but by an inconſiſtence ariſing from the too long duration which they allow to their repreſentations, they fill their interacts with ballets, which baniſh them from the piece in repreſentation, and if they avoid the abſurdity of a double imitation, they give into an equal abſurdity by a tranſpoſition of ſcene, and by haraſſing the ſpectator from object to object, they make him forget the principal action, loſe the intereſt, and, in order to give pleaſure to his eyes, rob him of thoſe of the heart.

They began, however, to feel (in 1768) the defect of this monſtrous aſſemblage; and after having already almoſt driven intermezzi from their ſtage, they will doubtleſs, ere long, get rid of the dance, reſerving it only as a brilliant and detached ſpectacle at the end of the grand piece.

But though the ſtage remains vacant during the interact, it is not to be underſtood that the muſic ought to be ſilenced; for at the opera, where it conſtitutes the principal exiſtence of every thing, the ſenſe of hearing ought to be ſo connected with that of ſight, that as long as the ſtage is ſeen the harmony ſhould be heard, which is ſuppoſed inſeparable from it; ſo that its concurrence may not appear afterwards foreign or new, but united with the melody of the vocal performers. Chiefly from Rouſſeau.

The difficulty which preſents itſelf on this ſubject, is to ſuggeſt what the compoſer ought to dictate to the orcheſtra when nothing is doing or tranſacting on the ſtage: for if the ſymphony, as well as all dramatic muſic, is only a continued imitation, what is it to ſay when nobody ſpeaks? What ought it to do when there is no action? "I anſwer to that (ſays Rouſſeau) that though the ſtage is vacant the heart of the ſpectator is not; there ought to remain a ſtrong impreſſion of what has been ſeen and heard. It is for the orcheſtra to cheriſh and ſuſtain this impreſſion during the interact, that the ſpectator at the beginning of the enſuing act may not find himſelf as cold as at the beginning of the piece, but that the intereſt may be as much linked in his mind as the events are in the action repreſented.

By this means the muſician will always have an object of imitation, either in the ſituation of the perſonages, or in that of the ſpectators. Theſe ſhould hear nothing from the orcheſtra but expreſſions of what they have felt, identified with what they hear; and their ſituation will be ſo much the more delicious, as there ſhall be a more perfect accord between that which ſtrikes their ſenſes and which touches the heart.

An able muſician will draw from the orcheſtra another advantage, which will contribute to give the repreſentation all the effect poſſible, in conducting the ſpectator, by degrees, to the ſtate of mind the moſt favourable to the effect of the ſcenes which are going to be repreſented in the following act.

The interact has no fixed duration; but it is ſuppoſed to be more or leſs conſiderable, in proportion to the time neceſſary for that part of the action, which is paſſed behind the ſcenes. However, that duration ſhould have its bounds of ſuppoſition, relative to the hypothetic duration of the whole action; and the real bounds relative to the duration of the whole repreſentation.

This is not the place to examine whether the rule of 24 hours is well founded, and if it ought never to be violated. But if we would give to the ſuppoſed duration of an interact bounds regulated by the nature of things, I ſee no other rule than that of the time during which no ſenſible and regular change happens in nature, which cannot be made apparently tranſacting on the ſtage during the interact. Now this time being 12 hours, which compoſe a day or a night, if that is exceeded, there is no longer any poſſibility of illuſion during the ſuppoſed length of the act."

This is reviving the old contention concerning the unities, which have never been received as a law in this country. And as to act-tunes analogous to the buſineſs of the drama, it is an idea which was executed by Purcell in many of the plays of Dryden and Congreve; and Arne, when compoſer in ſalary at Drury-lane theatre, compoſed very pleaſing and appropriate act-tunes to many of the ſtock plays, which never were printed, but preſerved in MS. in the archives of the old theatre; but we ſuppoſe that the ſtrains of Orpheus or Amphion might be as eaſily recovered now as theſe compoſitions.

ENTRAIGUES, in *Geography*, a ſmall town of France, in the department of the Aveyron, chief place of a canton, in the diſtrict of Eſpalion, with a population of 1748 individuals. It is ſituated near the place where the river Truyere falls into the Lot, 18 miles S. of Aurillac. Its canton contains 6 communes, and 6691 inhabitants, on a territorial extent of 147½ kiliometres.—Alſo, a ſmall town of France, in the department of the Iſére, chief place of a canton, in the diſtrict of Grenoble, with a population of 521 individuals. The canton contains 10 communes and 4988 inhabitants, on a territorial extent of 355 kiliometres.—Alſo, a ſmall town of France, in the department of Vaucluſe, 6 miles N.E. of Avignon.

ENTRAILS, the inteſtines or guts of an animal. See INTESTINES.

Menage derives the word from the barbarous Latin, *interalia*, formed of the Greek, εντερον, *inteſtine*.

ENTRAILS is alſo uſed, in a more extenſive ſenſe, for the viſcera, or all the parts contained in the cavities of the bodies of animals. See VISCERA.

The aruſpicina of the ancients was employed in conſidering the entrails of victims; as the heart, lungs, liver, &c. See ARUSPICES, &c.

ENTRANCE, in *Sea Language*, is a name often given to the foremoſt part of a ſhip under the ſurface of the ſea.

ENTRANCE *of hounds*, a phraſe uſed by our *Sportſmen*, to expreſs the inſtruction of theſe creatures in the art of hunting. They are ſaid to be entered when they are thoroughly taught this.

The time of entering of hounds is when they are about twelve months old; when they are firſt brought up from their walks, they ſhould be kept ſeparate from the pack: they are then to be taught to take the water and ſwim; they are to be laid abroad in the heat of the day, to enure them to fatigue and exerciſe; and they muſt be frequently led through flocks of ſheep, and warrens, to uſe them to be under command, and to know that they are to run at nothing but what the huntſman orders. They muſt be carefully inſtructed each to know his own name, and to underſtand the voice of the huntſman, and the notes of the horn uſed in hunting; and finally, to uſe their own language in a proper manner. When young hounds well know and anſwer to their names, they ſhould be put into couples, and walked out amongſt ſheep; and if any be particularly ſnappiſh leave the couples looſe about their necks in the kennel, till they are more reconciled to them. If any of them ſhould be very troubleſome, couple them to old hounds, always avoiding coupling two dogs together, if poſſible, and taking care that the couples be tight enough to prevent their heads being ſlipped out of the collar. After being walked out frequently amongſt the ſheep, they may be uncoupled, a few at a time, and ſuch as offer to run after them ſhould be well chaſtiſed; the cry of *ware, ſheep*, will afterwards ſtop them, without further application of the whip; proper attention will ſoon make them aſhamed of it; but if once ſuffered to taſte the blood, it will be difficult to reclaim them. If young and old hounds are aired together, let the former be in couples; they are always ready for miſchief, and idleneſs may induce even the latter to join in it. It may be as well to air the young hounds in that country where they are deſigned to hunt, as they thus acquire ſome knowledge of it, and if at any time they ſhould be left behind, they will more readily find their way home. Young hounds ſhould be entered as ſoon as you can; in woodlands and graſslands, it will of courſe be earlier than in corn countries. Sport in fox-hunting cannot be ſaid to begin before October; but in the two preceding months, a pack is either made or marred.

The beſt time of entering them is about noon; and it ſhould be in a fair warm day; for if they be entered in the morning, they will give out when the heat of the middle of the day comes on, and betake themſelves to ſhady places to reſt and ſleep. Accordingly it is ſaid that hounds ſhould be entered in the heat of the day, and about October or November, for hare-hunting, the weather being then temperate, and young hares that have not been hunted are then more eaſily taken for their encouragement. A neceſſary caution is alſo added, never at the entering of young hounds to help them to kill the hare with grey-hounds, for this will deter the hounds from putting their noſes to the ground, or trying to hunt her themſelves. Take the moſt advanced, that the game may not ſtand long before them, and let them be well rewarded when all is over. This ought to be repeated at leaſt once a week, for two months ſucceſſively; by this means they will be ſo fleſhed and ſeaſoned with what game you may enter them at, that they will never afterwards leave off the purſuit. Hounds, after two years old, ſhould be hunted three times a week, if they feed well, and may be kept out the greateſt part of the day to try their ſtoutneſs. The new hounds ſhould always be entered with the beſt and ſtauncheſt hounds that can be had; and there is not to be one barking dog ſuffered in the field on this occaſion.

Whatever chace the hounds are intended for, it has been ſaid that the hare is the beſt game to enter them at, becauſe in this chace, they will learn all the turns and doubles that they can poſſibly meet with in any other kind, and how to come to the hollo. They will learn alſo from this chace, to have a perfect and nice ſcent, and hard feet, by being uſed to highways, beaten paths, and dry hills.

On the other hand, it has been more reaſonably maintained, that young hounds ſhould always be entered at their own game; becauſe it is a ſtrange contradiction to enter them at a hare, and then to cut them to pieces for afterwards hunting the hare. This, it is ſaid, is laying a foundation for future cruelty and vexation. Moſt dogs like that ſcent beſt, which they were firſt blooded to; and if the blood of the fox be of ſo much ſervice, that of the hare cannot be deemed a matter of indifference. It is, therefore, without doubt moſt rational to uſe them to that ſcent *only*, which it is intended they ſhould hunt. It has been aſſerted, that the way to render hounds ſteady from hare, is to encourage them to hunt her. The advantage reſulting from this kind of paradoxical practice is ſaid to be, that hounds are thus taught to hunt, and made to learn obedience; but the ſurer method to make hounds obedient is calling them over often in the kennel, to accuſtom them to their names, walking them out frequently amongſt ſheep, hares, and deer, from which they are to be ſtopped, to make them know a "rate;" and by this practice they will learn obedience. Nature will inſtruct them how to hunt: art is only neceſſary to prevent their hunting what they ought not to hunt. Should any young hounds be very fond of hare, let ſome be found ſitting, and ſtarted before them, they will ſoon be checked and ceaſe to run after them. If they are to be ſteadied from deer, they ſhould often ſee deer, and they will not regard them. After this probation, a cub ſhould be turned out before them, with ſome old hounds to lead them on, and they will not long give trouble. After young hounds ſtoop to a ſcent, are become handy, know a "rate," and ſtop eaſily, put them, a few only at a time, into the pack after the old ones have been hunted and had blood; let them be taken the firſt day where they are certain of finding. Hounds ſhould be low in fleſh when hunting commences; becauſe the ground being generally hard at that ſeaſon, they are liable, if luſty, to be ſhaken. If foxes are plentiful, take the young, with ſome of the ſteadieſt of the old hounds, where there is leaſt riot, and ſhould you there find a litter of foxes, the young hounds will be ſo much improved as to need little ſubſequent inſtruction. If any cubs be ran to ground, and blood be not then wanted, let them be brought home, and they will be ſerviceable, ſhould blood be neceſſary at any time for the young hounds. Frequent hallooing is of uſe with young hounds, as it keeps them forward, prevents their being loſt, and from hunting after the others: the more, therefore, a fox is ſeen and hallooed, the better. Young hounds are thus made eager, and taught to exert themſelves. At their firſt entering, hounds cannot be encouraged too much: when they are handy, love a ſcent, and begin to know what is right, it will be ſoon enough to chaſtiſe them for doing wrong; in which latter caſe, one ſevere beating will ſave much trouble. The whipper-in ſhould uſe his voice as well as his whip, when he flogs a hound, and take care that the ſtroke precedes the "rating;" and he ſhould remember, that the ſmack of the whip is often as ſerviceable as the laſh to one who has already felt it. The day after young hounds have had blood is a proper time to take them where there is riot, and if they merit it, to chaſtiſe them: it is always beſt to correct them, when they cannot help knowing what they are corrected for. When hounds go out for this purpoſe, it ſhould be at a late hour; as the worſe the ſcent is, the leſs inclinable will they be to run it, and the ſtopping of them will be more eaſy and immediate. Upon the day when a fox is propoſed to be turned out, young hounds ſhould draw ſmall covers and furze brakes, where are hares or deer; a little rating and flogging, before they are encouraged to vermin, teaches them both what they ſhould not and what they ſhould do. A hound that hears a voice which has often rated him, and the whip he has often felt, ought to ſtop: when hounds are rated, and do not anſwer the rate, they ſhould be coupled up immediately, and made to know the whipper-in. A moſt eſſential point in rendering hounds obedient is to make them underſtand you; and therefore the language ſhould be appropriate and uniform. Young hounds ſhould be hunted in large covers to tire them out, provided the whipper-in can eaſily get at them; but when there is much riot there are no openings, the purpoſe will not be anſwered, unleſs you have a body of old hounds to carry on the right ſcent: for the young hounds, as ſoon as the ground becomes foiled, will be ſcattered about the cover, hunting old ſcents, and will not proceed faſt enough to tire themſelves. Beſides, every fox-hound will leave a bad ſcent of a fox for a good one of either hare or deer, unleſs he has been made ſteady from both. Young hounds are all given to riot; but the better they are bred, the leſs trouble will they be likely to give: high bred fox-hounds love their own game beſt: they ſhould have little reſt; one day they ſhould be hunted in large covers, where foxes are plentiful; the next, they ought to be walked out amongſt hares and deer, and ſtopped from riot; and the day following, be hunted again as before. By this management young hounds will ſoon become ſteady. At firſt young hounds ſhould be entered to vermin only; and they ſhould be uſed as early as poſſible to the ſtrongeſt and thickeſt woods and furzes, and they will ſeldom be ſhy of them afterwards. By being awed from hare and deer, and being taught to hunt only vermin, hounds will ſtop at a word, becauſe that word will be underſtood by them; and a ſmack of the whip will ſpare the inhuman trouble of cutting hounds in pieces for faults, which, if entered at hare, they have been invited to commit.

In hare-hunting the hounds, when firſt entered, muſt have all the advantages given them that can be. When the hare is put up, from her form, it muſt be obſerved which way ſhe went, and the ſcent muſt be left to cool a while, and then they muſt be laid in, and helped as much as can be, by wind, view, hollo, or pricking the paſſage; nor will it be amiſs, for the firſt time, to give them a hare tired the ſame morning in her courſe.

Some are of opinion, that the beſt way to enter young hounds is, to take a live hare, and trail her upon the ground, ſometimes one way, and ſometimes another, and then to draw her off to a convenient diſtance, and hide her, that the dogs, taking the ſcent, may follow all the traces through which ſhe was drawn, and at length find her.

It has been ſaid, however, that beating the hare up from her ſeat is a ſhorter way than trailing her from her feed to her form. Great exactneſs was formerly obſerved in the firſt entering of hounds, not to uncouple them repeatedly in the ſame ſort of ground, leſt by being uncoupled conſtantly in an open field, they would be at a loſs what to do when turned into a cover. It was a received opinion, that according to the places where hounds were firſt entered, they would ſhew a preference: *e. g.* if entered in a champaign country, they would always hunt better there than in covers, marſhy, or mountainous grounds. Hence it was deemed right to uſe them to every ſort of ground, and diverſity in the country was ſtrongly recommended, that they might be perfect in all. Some lands, which were of a glutinous and greaſy ſhining mould, never bore any ſcent, and there the huntſman was to help out the dogs by pricking the hare. In plains and downs where the graſs was ſhort, and the ſcent dried immediately, there alſo he was allowed to follow his game by the eye, in order to aſſiſt the noſe of the hounds. Some of the early ſportſmen never permitted the hare to be hallooed, or the hounds to be aſſiſted when they were at fault, but ſuffered them to work it out by themſelves; and this, though tedious, was conſidered a ſure way to aſcertain the goodneſs of the hounds: others took all advantages, and killed them as ſpeedily as poſſible. The method of rewarding the young hounds was curious. The hare, after being laid upon the graſs, and bayed by the hounds, was ſkinned before them; and after the gall and lights were taken away, which were ſuppoſed to make the hounds ſick, the huntſman, who carried a wallet with bread cut in ſmall pieces, dipped them in the blood, and with the entrails gave them to the hounds; the hare was afterwards diſtributed, and if any young hound was fearful to come in among the reſt, he had the head given him by himſelf. After this feaſt, the hounds had bread given them to prevent ſickneſs.

The huntſman ought very well to underſtand the nature and diſpoſition of his hounds, in finding out the game; for ſome hounds are of that temper, that when they have found the ſcent, they will run forward with it, not making any noiſe, nor ſhew of the tail; others, when they have found a head, will ſhew the game; and ſome, having found the footings of the beaſt, will prick up their ears a little, and either bark, or only wag their ears, or the hinder part of their bodies. This difference of natural diſpoſition, the huntſman is particularly to obſerve in the young and newly entered pack, otherwiſe he will never underſtand them, nor ever be able to hunt them to any credit or advantage.

For entering the hound at hart or buck, he ſhould be in the prime of greaſe, for then he cannot ſtand up, or hold the chace ſo long. The foreſt pitched upon ſhould have all the relays at equal diſtances, as nearly as may be; but then the young hounds ſhould always have ſome old ſtaunch ones to enter them, and they ſhould be led to the fartheſt and laſt relay, and the hart or buck ſhould be hunted to them. Being come up, the old hounds ſhould be uncoupled; and when they have found the hart, and well entered the cry, then the young ones are to be uncoupled alſo; and if any of them are found to lag behind, they muſt be whipped and beaten forward.

In whatever place the hart is killed, the neck ſhould be immediately flayed, and the hounds rewarded; for it is beſt always to do this while the fleſh is hot. Another very good method of entering hounds at the buck, is to take one in the toils or nets, and to wound one of his legs, ſo as to diſable him from running either very ſwiftly or very far: then let him looſe, and firſt let a blood-hound trace the creature, then let looſe all the young hounds; and when they have run down the animal, reward them with the neck.

Some enter their hounds with a toil; but this is a bad way; for the hart being in this caſe always in ſight, and not able to run an end, makes a great number of doubles and turnings: this is very different from the chaces they are to meet with afterwards; and when they find a hart run in the common way, ſtraight forward, and out of ſight, they will leave the chace, as unlike that by which they were taught. Daniel's Rural Sports. See Hunting.

ENTRASME, in *Geography*, a ſmall town of France, in the department of Mayenne; 6 miles S. of Laval.

ENTRAVES, Entravons, in the *Manege*. See Locks.

ENTRE Ambos os Rios, in *Geography*, a town of Portugal, in the province of Entre Minho Douro; 8 miles S.S.W. of Amarante.

Entre *Minho Douro*, a province of Portugal, ſo called from its ſituation between the rivers Minho and Douro, bounded on the north by Gallicia, a province of Spain; on the eaſt by Trazos Montes and Spain; on the ſouth by the province of Beira, from which it is ſeparated by the Douro; and on the weſt by the Atlantic ocean; and extending from 40° 50′ to 42° N. lat., and from 8° 55′ to 7° 55′ W. long., being 70 miles in length and 52 in breadth. It contains 963 pariſhes, 1460 churches, 1130 convents, 6 ſea-ports, and 804,000 inhabitants. This is the moſt northerly, the moſt fertile, and the moſt populous territory in the kingdom. Its numerous and fine vallies are ſhaded by beautiful trees, and watered by limpid ſtreams. Its air is pure and healthy; and it produces corn, wine, oil, and flax in abundance, with a great number of ſheep, and plenty of game and fiſh. The principal towns are Braga, Oporto, Viana, Amarante, Guimaræns, Ponte de Lima, and Pezo de Regna. Its chief rivers are the Minho, Lima, Neiva, Cavado, Ave, and the Douro or Duero, augmented by the Tamega; all of which run weſtward to the ſea.

ENTRECASTAUX, a ſmall town of France, in the department of the Var, near Barjols.

ENTRE'E, *Fr.*, the overture to a ballet, and ſometimes the beginning of the dance itſelf. In the firſt operas in France, the overture was called the entrée.

ENTREPAS, in the *Manege*, is a broken pace, or going, properly a broken amble, that is, neither walk nor trot, but has ſomewhat of an amble. This is the pace, or gait, of ſuch horſes as have no reins or backs, and go upon their ſhoulders, or of ſuch as are ſpoiled in their limbs.

ENTREVEAUX, in *Geography*, a ſmall town of France, in the department of the Lower Alps, chief place of a canton in the diſtrict of Caſtellane, with a population of 1326 individuals. It is ſituated at the foot of the Alps, on the river Var, near Glandeves. N. lat. 44° 1′. Its canton has a territorial extent of 197½ kiliometres, eight communes, and 2694 inhabitants.

ENTRICOMA, from εν and θριξ, *hair*, in *Anatomy*, the name of the outer edge of the eye-lid, on which the hairs grow.

ENTRIES, amongſt *Hunters*, thoſe places in thickets through which deer are found lately to have paſſed; by means whereof their bigneſs or ſize is gueſſed at; and at which the hounds or beagles are put to them for the view.

Entries, *Books of*, in *Law*, are ancient and modern, and contain tranſcripts of proceedings that have been had in ſome particular actions; the principal of ſuch are neceſſary for gentlemen educated to the profeſſion of the law.

ENTRING *a Ship*, in *Sea Language*, the ſame with boarding her. See Boarding.

Entring-*Ladder*, in a *Ship*, is of two ſorts; one is uſed by the ſhip's ſides, in a harbour, or in fair weather, for perſons to go in and out of the ſhip: the other is made of ropes, with ſmall ſtaves for ſteps, and is hung out of the galley to enter into the boat, or to come aboard the ſhip from thence, when the ſea runs ſo high that they dare not bring the boat to the ſhip's ſide for fear of ſtaving her. See Gang-way.

Entring-*Ropes*. See Rope.

ENTROCHUS, in *Natural Hiſtory*, the name of a genus of foſſils of a very regular figure and ſtructure, ſuppoſed by many authors to be lapides ſui generis, and ſtones in their native ſtate. They are, however, in reality, the foſſile remains of ſome marine animal, probably either of the echinus, or of the ſtar-fiſh kind, filled like the foſſile ſpecies of the echini, with a plated ſpar. Our imperfect knowledge in the animal hiſtory has not yet been able to aſcertain to what creature they really belong; but their analogy, with the other animal remains, found in the foſſile world, plainly evince, that they are of that origin. They are cylindric columns, uſually about an inch in length, and are made up in a number of round joints, like ſo many ſmall wheels or ſegments of cylinders. Theſe joints, when found ſeparate, and naturally looſe, as they ſometimes are, are called trochitæ. They are all ſtriated, from the centre to the circumference, and have a cavity in the middle, which is ſometimes found empty, but more frequently filled up with various matter, of the nature of the ſtratum, in which they have lain, or of other of the native foſſile ſubſtances.

The entrochi are compoſed of the ſame ſort of plated ſpar with the aſteriæ, and the ſpines and ſhells of the foſſile echini: and this is in theſe uſually of a blueiſh-grey colour, and very bright and gloſſy, where freſh broken. They are ſubject to accidental injuries, like the other extraneous foſſils, which have been formed in animal moulds, and are frequently met with compreſſed, or crooked.

That the entrochi are of marine origin, is evident from this, that they have not unfrequently ſea-ſhells found adhering to them; and when theſe are broken off, there remain on the entrochi no deficiencies, but the ſhells themſelves ſhew that they have been formed upon, and have grown to the entrochi, there being always natural hollows in them to anſwer to that part of the entrochus from which they have been ſeparated; whence it appears very plainly, that theſe entrochi, however altered ſince in their ſubſtance, were, however, exiſting in their preſent ſhape, in thoſe very ſeas where theſe ſhells had their growth.

There are not unfrequently found among the entrochi, larger or ſmaller fragments of plated bodies.

We meet with the entrochi of all the ſizes, from that of a pin's head to a finger's length, and the thickneſs of one's middle finger. They are, in ſome places, found looſe upon ploughed lands; in others, they are lodged in great quantities in the ſtrata of clay, and very often in ſtones of different kinds, and different hardneſs.

Mr. Parkinſon, in his ſecond volume of "Organic Remains," treats very largely of this claſs of animals; and Mr. William Martin, in his recent and valuable work, the "Petrificata Derbienſia," has paid conſiderable attention to the curious remains of this kind which Derbyſhire affords: among which he enumerates, 1ſt, the even-jointed entrochite (Entrochites lævis); 2d, the convex-jointed entrochite (E. prominens); 3d, the warted entrochite (E. verrucoſus); and 4th, the ring-jointed entrochite (E. cannulatus).

Entrochi abound in ſome particular beds of the firſt or upper lime-ſtone rock of the Derbyſhire lime-ſtone or toadſtone ſeries, and from hence the beautiful figured marbles are principally obtained, at Ricklow-dale, Bricks, and High-low, near to Monyaſh; at Foolow, Calver, Lexley in Aſhover, Crick-Cliff, and other places. The three other lime-ſtone rocks, which lie below the above, contain ſome few beds with a ſprinkling of entrochi in them; but they are very inferior in number or ſize to thoſe in the upper rock.

Entrochi are alſo found in ſmall numbers, in the yellow or magneſian range of lime-ſtone, which traverſes the country from Wetherby in Yorkſhire to near Nottingham; appears again at Bredon, Cloud's-hill, Barrow-hill, and Gracedieu in Leiceſterſhire; again at Ruſhall and Walſall; between Wolverhampton and Dudley in Staffordſhire; at Abberley in Worceſterſhire, &c.

The foſſil deſcribed by Mr. Walcot, in his "Petrifications found near Bath," p. 46, under the name of an entrochus, is more properly a trochus or top-ſtone, very different from the entrochi of which we have been ſpeaking: it belongs to the Bath free-ſtone ſtrata.

Entrocho *Aſteriæ*, the name given by authors to a peculiar kind of entrochus, differing from the common kind, in having a ſtellar cavity inſtead of a round one, in its centre.

Entrochus *Pyramidalis*, a name given by ſome writers to the ortho-ceratites, or tubulus marinus concameratus, a ſpecies of ſhell-fiſh, not known to us in its recent ſtate, but very common in the ſtones brought over from Sweden for pavements. Klein. de Tubul. Marin. p. 7. See Tubuli *Concamerati*.

Entrochus *Ramoſus*, the name of a foſſile body, the ſeveral parts of which reſemble the entrochi; but as they are joined together in this body when perfect, they ſhew themſelves in their proper light, and a ſight of them in this ſtate is ſufficient to explode the opinion advanced by ſome perſons, of the entrochi being of a vegetable nature; or, as they have pleaſed to call them, "rock-plants." The foſſil has evidently once been a ſtella-marina, or ſea ſtar-fiſh, conſiſting of twenty rays at the extremity of the body. The manner of inſertion of theſe has been this: the body is of a pentagonal figure, and from this there have ariſen five rays; theſe, at their extremity, have been divaricated, each into two, ſo as to make the number ten in the ſecond progreſſion; and each of theſe laſt being again divaricated into two at its extremity; the third and laſt progreſſion is of twenty rays. All this is eaſily diſtinguiſhable in the foſſil, when perfect, and ſeems to have been the whole figure of the animal while living. The prototype, or living animal, however, is not found; but this is not an accident peculiar to this foſſil, the cornua ammonis, and conchæ anomiæ, with many other bodies that have been once evidently ſhell-fiſh, being no where at this time found in their recent ſtate, though ſo very numerous in the foſſile world. This remarkable foſſile ſtar-fiſh is the body called by ſome authors, lilium lapidium. Keppeler's Epiſt. ad Klein de Entrochis.

ENTROCHORUM Radix. See Radix.

ENTROPIUM, (from εν and τρεπω, *to turn*,) a ſurgical diſeaſe, in which the eyelid turns inward towards the eye, ſo as to occaſion, by the friction and irritation of the eyelaſhes, chronic ophthalmy, and various inconveniences. See Trichiasis.

ENTRUSION, in *Law*. See Intrusion.

ENTRY, or Entrance, in its general ſenſe, denotes a door, gate, paſſage, &c. through which to enter, or arrive within a place.

Entry, in *Book-keeping*. See Book-keeping.

Entry, *Bill of*. See Bill.

Entry, is ſometimes alſo uſed to denote a duty or impoſt laid on commodities imported into a ſtate, either by land or ſea.

The duties of entry, or importation, are paid according to a tariff ſettled for that purpoſe. Where the duty of entry of any commodity is not fixed by the tariff, it is paid by eſtimation, *i. e.* in proportion to what ſome other commodity of nearly the ſame quality and value uſes to pay. In making entries inwards, it is uſual for merchants to include all the goods they have on board the ſame ſhip in one bill, though ſometimes there may happen to be upwards of twenty ſeveral kinds; and in caſe the goods are ſhort entered, additional or port entries are now allowed; though formerly the goods ſo entered were forfeited. As to bills of entry outwards, of including goods to be exported, upon delivering them and paying the cuſtoms, you will receive a cocket, which teſtifies your payment thereof, and of all duties for ſuch goods. If ſeveral ſorts of goods are exported at once, of which ſome are free, and others pay cuſtoms, the exporter muſt have two cockets, and therefore muſt make two entries. Entries of goods, on which a draw-back is allowed, muſt likewiſe contain the name of the ſhip in which the goods were imported, the importer's name, and time of entry inwards. The entry being thus made, and an oath taken, that the cuſtoms for theſe goods were paid as the law directs; you muſt carry it to the collector and comptroller, or their deputies; who, after examining their books, will grant a warrant, which muſt be given to the ſurveyor, ſearcher, or land-waiter, that they may certify the quantity of goods; after which the certificate muſt be brought back to the collector and comptroller, or their deputies, and oath made, that the ſaid goods are really ſhipped, and not landed again in any part of Great Britain. See Debenture, Importation, and Exportation.

Entry, alſo denotes a ſolemn reception, or a ceremony performed by kings, princes, ambaſſadors, legates, &c. upon their firſt entering a city, or their return in triumph from ſome expedition.

Entry, in *Law*, ſignifies the taking poſſeſſion of lands or tenements by the legal owner, when another perſon, who hath no right, hath previouſly taken poſſeſſion of them. See Possession.

In this caſe the party entitled may make a formal, but peaceable entry thereon, declaring that thereby he takes poſſeſſion; which notorious act of ownerſhip is equivalent to a feodal inveſtiture by the lord (ſee Investiture); or he may enter on any part of it in the ſame county, declaring it to be in the name of the whole (Litt. § 417.); but if it lies in different counties, he muſt make different entries; for the notoriety of ſuch entry or claim to the *pares* or freeholders of Weſtmorland, is not any notoriety to the *pares* or freeholders of Suſſex. Alſo, if there be *two* diſſeiſors, the party diſſeiſed muſt make his entry on *both*; or if *one* diſſeiſor has conveyed the lands with livery to *two* diſtinct feoffees, entry muſt be made on *both* (Co. Litt. 252.); for as their *ſeiſin* is diſtinct, ſo muſt alſo be the act which diveſts that ſeiſin. If the claimant be detained from entering by menaces or bodily fear, he may make *claim*, as near to the eſtate as he can, with the like forms and ſolemnities; which claim is in force for only a year and a day. (Litt. § 422.) And this claim, if it be repeated once in the ſpace of every year and day (which is called *continual claim*) has the ſame effect with, and in all reſpects amounts to, a legal entry. (Litt. § 419, 423.) Such an entry gives a man ſeiſin, (Co. Litt. 15.) or puts into immediate poſſeſſion him that hath right of entry on the eſtate, and thereby makes him complete owner, and capable of conveying it from himſelf by either deſcent or purchaſe. This remedy by entry takes place in three only of the five ſpecies of ouſter, *viz.* abatement, intruſion, and diſſeiſin (Co. Litt. 237, 238.); for as in theſe the original entry of the wrong-doer was unlawful, they may therefore be remedied by the mere entry of him who hath right. But, upon a diſcontinuance or deforcement, the owner of the eſtate cannot enter, but is driven to his action; for herein the original entry being lawful, and thereby an apparent right of poſſeſſion being gained, the law will not ſuffer that right to be overthrown by the mere act or entry of the claimant. Yet a man may enter on his tenant by ſufferance; for ſuch tenant hath no freehold, but only a bare poſſeſſion; which may be defeated, like a tenancy at will, by the mere entry of the owner. But if the owner thinks it more expedient to ſuppoſe or admit ſuch tenant to have gained a tortious freehold, he is then remediable by writ of entry, *ad terminum qui præteriit*. (Co. Litt. 57.) On the other hand, in caſe of abatement, intruſion, or diſſeiſin, where entries are generally lawful, this right of entry may be *tolled*, that is, taken away by deſcent. Deſcents, which take away entries (Litt. § 385—413.) are, when any one, ſeiſed by any means whatſoever of the inheritance of a corporeal hereditament, dies, whereby the ſame deſcends to his heir; in this caſe, however feeble the right of the anceſtor might be, the entry of any other perſon who claims title to the freehold is taken away; and he cannot recover poſſeſſion againſt the heir by this ſummary method, but is driven to his action to gain a legal ſeiſin of the eſtate. In general it appears, that no man can recover poſſeſſion by mere entry on lands, which another hath by deſcent. And this title of taking away entries by deſcent is ſtill further narrowed by the ſtatute 32 Hen. VIII. c. 13. which enacts, that if any perſon diſſeiſes, or turns another out of poſſeſſion, no deſcent to the heir of the diſſeiſor ſhall take away the entry of him that has right to the land, unleſs the diſſeiſor had peaceable poſſeſſion five years next after the diſſeiſin. But the ſtatute extendeth not to any feoffee or donee of the diſſeiſor, mediate or immediate. (Co. Litt. 246. 256.) By the ſtatute of limitations it is enacted by ſtatute 21 Jac. I. c. 16, that no entry ſhall be made by any man upon lands, unleſs within 20 years after his right ſhall accrue: and by ſtatute 4 and 5 Ann. c. 16, no entry ſhall be of force to ſatiſfy the ſaid ſtatute of limitations, or to avoid a fine levied of lands, unleſs an action be thereupon commenced within one year after, and proſecuted with effect. Moreover, this remedy by entry muſt be purſued, according to ſtatute 5 Ric. II. ſt. 1. c. 8. in a peaceable and eaſy manner; and not with force or ſtrong hand. For, if one turns or keeps another out of poſſeſſion forcibly, this is an injury of both a civil and criminal nature. The civil is remedied by immediate reſtitution; which puts the ancient poſſeſſor *in ſtatu quo*; the criminal injury, or public wrong, by breach of the king's peace, is puniſhed by fine to the king. Blackſtone's Comm. b. iii. See FORCIBLE *Entry*.

ENTRY, *writ of*, is a poſſeſſory remedy, which diſproves the title of the tenant or poſſeſſor, by ſhewing the unlawful means by which he entered or continues poſſeſſion. (Finch. L. 261.) This writ is directed to the ſheriff, requiring him to "command the tenant of the land that he render (in Latin, *præcipe quod reddat*) to the demandant the land in queſtion, which he claims to be his right and inheritance; and into which, as he ſaith, the ſaid tenant had not entry but by (or after) a diſſeiſin, intruſion, or the like, made to the ſaid demandant, within the time limited by law for ſuch actions; or that upon refuſal he do appear in court on ſuch a day, to ſhew wherefore he hath not done it. This is the original proceſs, the *præcipe*, upon which all the reſt of the ſuit is grounded; wherein it appears, that the tenant is required, either to deliver ſeiſin of the lands, or to ſhew cauſe why he will not. This cauſe may be either a denial of the fact, of having entered by or under ſuch means as are ſuggeſted, or a juſtification of his entry by reaſon of title in himſelf, or in thoſe under whom he makes claim; whereupon the poſſeſſion of the land is awarded to him who produces the cleareſt right to poſſeſs it.

Writs of entry are of divers kinds, diſtinguiſhed into four degrees, according to which the writs are varied. The *firſt* degree is a writ of entry *ſur diſſeiſin*, that lieth for the diſſeiſee againſt a diſſeiſor, upon a diſſeiſin done by himſelf; and this is called a writ of entry in the nature of an aſſiſe. The *ſecond* degree, by ſome reckoned the firſt, is a writ of entry *ſur diſſeiſin in le per* and lies againſt the heir by deſcent, who is ſaid to be in the *per*, as he comes in by his anceſtor; and ſo it is if a diſſeiſor make a feoffment in fee, gift in tail, &c. The feoffee and donee are in the *per* by the diſſeiſor. The *third* is a writ of entry *ſur diſſeiſin in le per and cui*, where the feoffee of a diſſeiſor maketh a feoffment over to another; when the diſſeiſee ſhall have this writ of entry ſur diſſeiſin, &c. of the lands in which ſuch other had no right of entry, but by the feoffee of the diſſeiſor, to *whom* the diſſeiſor demiſed the ſame, who unjuſtly and without judgment diſſeiſed the demandant. (1 Inſt. 238.) Theſe three degrees thus ſtate the original wrong, and the title of the tenant who claims under ſuch wrong. If more than two degrees (that is, two alienations or deſcents) were paſt, there lay no writ of entry at the common law. For, as it was provided, for the quietneſs of men's inheritances, that no one, even though he had the true right of poſſeſſion, ſhould enter upon him who had the apparent right by deſcent or otherwiſe, but he was driven to his *writ of entry* to gain poſſeſſion; ſo, after more than two deſcents or conveyances were paſſed, the demandant, even though he had the right both of poſſeſſion and property, was not allowed this *poſſeſſory* action, but was driven to his *writ of right*, a long and final remedy, to puniſh his neglect in not ſooner putting in his claim, while the degrees ſubſiſted, and for the ending of ſuits, and quieting of all controverſies. (2 Inſt. 153.) But by the ſtatute of Marlbridge, 52 Hen. III. c. 30, it was provided, that when the number of alienations or deſcents exceeded the uſual degrees, a new writ ſhould be allowed without any mention of degrees at all. Accordingly a new writ, or a *fourth*, has been framed, called a writ of entry in the *poſt*, which only alleges the injury of the wrong-doer, without deducing all the intermediate title from him to the tenant; ſtating it in this manner; that the tenant had not entry unleſs *after*, or ſubſequent to, the ouſter or injury done by the original diſpoſſeſſor; and rightly concluding, that if the original title was wrongful, all claims derived from thence muſt participate of the ſame wrong. Upon the latter of theſe writs it is (the writ of entry *ſur diſſeiſin* in the *poſt*) that the form of our common recoveries of landed eſtates is uſually grounded. See FINE and RECOVERY.

This remedial inſtrument of writ of entry is applicable to all the caſes of ouſter (ſee OUSTER), except that of diſcontinuance by tenant in tail, and ſome peculiar ſpecies of deforcements. Such is that of deforcement of dower, by not aſſigning *any* dower to the widow within the time limited by law; for which ſhe has her remedy by writ of *dower, unde nihil habet*. (F. N. B. 147.) See DOWER. But in general the writ of entry is the univerſal remedy to recover poſſeſſion, when wrongfully withheld from the owner. It would, therefore, be endleſs to recount all the ſeveral diviſions of writs of entry, which the different circumſtances of the reſpective demandants may require, and which are furniſhed by the laws of England. (See Bracton, l. 4. tr. 7. c. 6. § 4. Britton, c. 114. fol. 264.) Of theſe the moſt uſual were, 1. The writ of entry *ſur diſſeiſin*, and of intruſion (F. N. B. 191. 203.), which are brought to remedy either of the ſpecies of ouſter. 2. The writs of *dum fuit infra ætatem*, and *dum fuit non compos mentis* (Ibid. 192. 202.) which lie for a perſon of full age, or one who hath recovered his underſtanding, after having, (when under age or inſane,) aliened his lands; or for the heirs of ſuch alienor. 3. The writs of *cui in vita*, and *cui ante divortium* (Ibid. 193. 204.) for a woman, when a widow or divorced, whoſe huſband during the coverture hath aliened her eſtate. 4. The writ *ad communem legem* (Ibid. 207.) for the reverſion, after the alienation and death of the particular tenant for life. 5. The writs *in caſu proviſo*, and *in conſimili caſu*, (Ibid. 205, 206.) which lay not *ad communem legem*, but are given by ſtat. Gloc. 6 Edw. I. c. 7. and Weſtm. 2. 13 Edw. I. c. 24, for the reverſioner after the alienation, but during the life of the tenant in dower or other tenant for life. 6. The writ *ad terminum qui præteriit* (Ibid. 201.) for the reverſioner, when the poſſeſſion is withheld by the leſſee or a ſtranger, after the determination of a leaſe for years. 7. The writ *cauſa matrimonii prælocuti* (Ibid. 205.) for a woman who giveth land to a man in fee or for life, to the intent that he may marry her, and he doth not: and the like in caſe of other deforcements. Theſe writs are plainly and clearly chalked out in that moſt ancient and highly venerable collection of legal forms, the "regiſtrum omnium brevium," or regiſter of ſuch writs as are ſueable out of the king's courts, upon which Fitzherbert's "Natura Brevium" is a comment.

In the times of our Saxon anceſtors, the right of poſſeſſion ſeems only to have been recoverable by writ of entry (Gilb. Ten. 42.); which was then uſually brought in the county-court. The proceedings in theſe actions were not then ſo tedious, when the courts were held, and proceſs iſſued from and was returnable therein at the end of every three weeks, as they became after the conqueſt, when all cauſes were drawn into the king's courts, and proceſs iſſued only from term to term, which was found exceedingly dilatory, being at leaſt four times as ſlow as the other. Hence a new remedy was invented, in many caſes, to do juſtice to the people and to determine the poſſeſſion in the proper counties, and yet by the king's judges. This was the remedy by *aſſiſe*, which ſee. Blackſt. Comm. b. iii. For other particulars on the ſubject of this article, ſee Jacob's Law Dict. by Tomlins.

Entry *Iſland*, in *Geography*, one of the Magdalen iſlands in the gulf of St. Lawrence. N. lat. 46° 18'. W. long. 61° 20'.—Alſo, an iſland in the Pacific ocean, about nine leagues N. from Cape Tierawite and under the ſame ſhore, which may be diſtinctly ſeen from Queen Charlotte's Sound, at the diſtance of about ſix or ſeven leagues. The name was given to it by lieutenant Cook, who paſſed it in January 1770.

ENTYPOSIS, from ἐντυπόω, *I make an impreſſion*, in *Anatomy*, the articulation of the ſhoulder with the arm.

ENTZERSTORFF, in *Geography*, a town of Germany, in the archduchy of Auſtria; ſix miles S. of Laab.—Alſo, a town of Germany, near the conflux of the rivers Reſtinpach and Reiſenpach; 10 miles W.N.W. of Bruck.

Entzerstorff in *Logenthal*, a town of Germany, in the archduchy of Auſtria; two miles S.E. of Corn Neuburg.

Entzerstorff or *Statl-Entzerſtorff*, a caſtellated town of Germany, in the archduchy of Auſtria, on the north ſide of the Danube, belonging to the biſhop of Freyſingen; 24 miles W. of Preſburg and nine E. of Vienna.

ENVERMEU, a ſmall town of France, in the department of the Lower Seine, chief place of a canton in the diſtrict of Dieppe, with a population of 896 individuals. The canton contains 40 communes and 13,402 inhabitants, on a territorial extent of 265 kiliometres.

ENVELOPE, in *Fortification*, denotes a mount of earth ſometimes raiſed in the ditch of a place, and ſometimes beyond it, being either in form of a ſimple parapet, or of a ſmall rampart bordered with a parapet.

Theſe envelopes are made where weak places are only to be covered with ſingle lines, without advancing towards the field, which cannot be done but by works which require a great deal of room: ſuch as horn-works, half-moons, &c. Envelopes are ſometimes called ſillons contregards, conſerve, lunettes, &c.

ENVIRON, among *Military Men*, relates to that complete inveſtment of a town, or fortreſs, which utterly precludes the acquiſition of ſupplies, or of reinforcements, and, in a general ſenſe, may be ſaid to be the baſis of a blockade. When we ſay that a place is environed, we are not indiſcriminately to conclude, that any circumvallation has taken place; but, that the country round is ſo completely poſſeſſed by the enemy, as to render any attempt to afford ſuccour to the inhabitants unavailing. Thus, if there be ſeveral paſſes leading to a town ſituated in a valley, ſurrounded by mountains inacceſſible, or impaſſable in every part, except at thoſe paſſes; or if a town ſtands on a peninſula, of which the iſthmus is cut off by the enemy, who likewiſe poſſeſs the navigation of the circumferent waters, ſuch towns are, to all intents and purpoſes, environed; and, if the blockade be duly ſupported, muſt in time ſurrender merely from a want of ſupplies.

If, however, the enemy ſhould not be ſtrong enough to keep the inhabitants within cloſe bounds, or if, notwithſtanding the whole of the adjacent country may be under his controul, ſupplies may be attainable from the exterior, whether by connivance among the peaſantry, or by the operations of enterpriſing partizans, then the place cannot be ſaid to be environed. When we conſider the many chances ariſing in favour of ſuch garriſons as make a good defence, it ſhould appear to be the beſt policy, as well as the moſt honourable conduct, to hold out to the very utmoſt, and never to ſurrender except under the laſt extremity. As to being environed, or blockaded, it is ſometimes a very important advantage gained by the defending power, becauſe it muſt prove a complete diverſion, by cauſing a very large force to be occupied in ſhutting up a comparative hand-full.

It, however, very rarely happens, that towns are, properly ſpeaking, environed: the old ſyſtem of circumvallation is now obſolete, except in very confined caſes, and where there is no army in the field capable of raiſing the ſiege. We have, indeed, a recent inſtance of a large city, namely, Saragoſſa, having been environed; but it was under moſt peculiar circumſtances; for the place fell rather from a want of an adequate force to cope internally with the aſſailants, though, on the other hand, the want of ſupplies was ſeverely felt. If any thing could ſtrengthen the recommendation we have juſt given, of continuing a defence to the laſt moment, ſurely the noble example ſhewn by that loyal and illuſtrious, but moſt unfortunate city, muſt ſerve as a ſtimulus, and prompt every perſon in charge of a beſieged fortreſs, or town, to deſpiſe the efforts of the environing army, and to ſell every inch of ground at the higheſt price that valour can impoſe on a ſuperior force.

Thoſe who undertake a blockade, by completely environing a town, &c. have a moſt arduous taſk to perform. They have not only to oppoſe the ſallies of the garriſon, but to keep a very ſharp look-out againſt exterior attacks, which may often be ſo effectually made, by an enterpriſing partizan, as to coerce a very numerous army to conſiderable relaxation, ſuch, indeed, as muſt prove favourable to the defenders. When we conſider theſe circumſtances, we ſhall be leſs ſurpriſed at the great loſſes ſuſtained by beſiegers, who, as well as the beſieged, ſuffer under all the diſadvantages attendant upon fixed camps; whereby not unfrequently the moſt deſtructive diſeaſes are engendered.

ENVIRONNE', in the *French Heraldry*, is when a lion or other figure is environed, or encompaſſed round with other things. Environné with ſo many bezants, &c. in orle.

ENULA, in *Botany*. See Inula.

ENULION, from ἐν and οὖλον, the *gums*, a word uſed by ſome medical writers for the fleſh of the gums.

ENUMERATION, the act of enumerating, or counting. At the time of our Saviour's birth, Auguſtus Cæſar had commanded an enumeration to be made of all the world, or rather of all the people under his empire: though ſeveral able authors are of opinion, that the cenſus, tax, or enumeration mentioned by St. Luke, did not extend to the whole empire, but only to the people of Judæa. See Perizonius de Cenſu Judaico, and Berger de Viis Militaribus.

At Rome, it was an uſual thing to have an enumeration made of all the families: the firſt of theſe was under Servius Tullius, when the men amounted to eighty thouſand. Pompey and Craſſus made another, when they reached to four hundred thouſand. That of Cæſar did not exceed one hundred thouſand; ſo that the civil wars muſt have deſtroyed three hundred thouſand Roman citizens. Under Auguſtus, in the year 725, the Roman citizens throughout the empire were numbered at four millions ſixty-three thouſand. In the year of Rome 746, the citizens, being numbered again, were found four millions two hundred and thirty-three thouſand. In the year 766, being the laſt year of Auguſtus's reign, that prince, together with Tiberius, made another enumeration of the citizens of Rome, when they were found four millions one hundred and thirty-ſeven thouſand perſons.

Claudius made a new computation in the year of Chriſt 48, when, as Tacitus relates it, the Roman citizens throughout the whole empire amounted to ſix millions nine hundred and ſixty-four thouſand; though others repreſent the number as conſiderably greater. A very rare, yet indiſputable medal of Claudius, never yet made public, expreſſes the preciſe number in this liſt made by Claudius, which was called oſtenſio, to be ſeven millions of people fit to bear arms, beſide all the ſoldiers on foot in the armies, which amounted to fifty legions, fifty-ſeven cohorts, and ſixty ſoldiers. After this enumeration, we find no more till that of Veſpaſian, which was the laſt.

ENUMERATION, in *Rhetoric*, denotes a part of the peroration, wherein the orator, collecting the ſcattered heads of what has been delivered throughout the whole, makes a brief and artful rehearſal or recapitulation thereof. See RECAPITULATION.

ENUMERATION is alſo a rhetorical figure: for which ſee APARITHMESIS.

ENUMERATION *of the parts*, amounts to the ſame with what we more uſually call diſtribution. In this part of rhetoric, the orator acquaints his hearers with the ſeveral parts of his diſcourſe, upon which he deſigns to treat. See DISTRIBUTION and PARTITION.

ENUNCIATION, a ſimple expreſſion or declaration of a thing, in terms either of affirmation or denial.

The ſchoolmen uſually diſtinguiſh three operations of the underſtanding; apprehenſion, enunciation, and reaſoning.

ENUNCIATION, among *Logicians*, denotes the ſame as propoſition.

ENUNCIATION, which, without violation of etymology, might be applied to ſignify the whole act of ſpeech or delivery of language, is, in conformity with the theory and ſyſtem laid down under the article ELOCUTION, confined to the utterance and combination of the elements, and the conſequent pronunciation of ſyllables, words, &c. as contradiſtinguiſhed from the tones, and tuning of the voice, and all that belongs to the melody of ſpeech.

The perfection of enunciation conſiſts in the following particulars; 1. *Diſtinctneſs*, or the clear and perfect formation of the reſpective elements by right motions and poſitions of the organs of the mouth, accompanied by proper degrees of energy and impulſe to impreſs thoſe elements fully and contradiſtinctly on the ear. 2. *Articulation*, or the act of combining and linking together of the reſpective elements, ſo as to form them into intelligible ſyllables and words, capable of being again combined into clauſes and ſentences for the proper conveyance of our ideas, thoughts, and determination. 3. *Implication*, or the combination and apparent union of words in oral utterance, which are graphically ſeparated; and by which, without injury to the intelligible diſtinctneſs of the reſpective words, all differences of auditory impreſſions are removed between monoſyllabic and polyſyllabic compoſition in language.

The faults immediately oppoſed to diſtinctneſs are, 1. *Mumbling*, or an indolence or want of preciſion in the action of the lips, affecting, of courſe, principally the labial ſounds, but impeding, to a certain degree, the clear progreſs of the ſpecific impulſes given to other elements, by the interior organs of the mouth. 2. *Thickneſs*, or indolence and imperfection in the action of the tongue, and affecting, more or leſs, the whole or part of the lingual ſounds. 3. *Drawling*, which reſults from indolence or inaptitude of the whole organs of ſpeech, vocal as well as enunciative. Theſe are defects of lethargy, or deficiency of organic action. Thoſe that follow are of another deſcription. 4. *Mouthing*, a pompous but dull ſpecies of indiſtinctneſs, which reſults from affectedly purſing up the mouth, and conſequent drawing the cheeks too cloſe upon, or even between the teeth, during the act of ſpeaking: it is one of the unſucceſsful theatrical means of aiming at ſublimity and pathos. 5. *Cluttering*, a ſpecies of St. Vitus's dance of the organs; hurrying them with too much rapidity and indeciſion from one elementary poſition to another, before the reſpective elements are completely formed, or have had time to make their reſpective impreſſions diſtinctly on the ear. This laſt is one of the fruitful ſources of impediment of ſpeech.

The faults oppoſed to articulation and implication are, a *fau-ul-ter-r-ring he-e-ſi-i-ta-a-tion*, a *púl,ſá,tive ín,tér, rúp,tion*, (ſuch as is almoſt univerſally obſervable in the early reading of ſchool boys, and which ſome people in their reading never get rid of as long as they live,) and a pè-dán-tìc fòr-má-lì-ty', ſuch as was ridiculed in a gentleman, who, aſking his friend if he came to town in his *cha-ri-ot*, was anſwered, no, ſir, I came in my *co-ach*. But the contradiſtion, and even oppoſition, thus marked between diſtinctneſs and articulation, though ſo indiſpenſible to the intelligible treatment of the ſubject of elocutionary ſcience and inſtruction, is ſo little authorized by thoſe who have hitherto treated upon theſe ſubjects, that the writer of this article deems it neceſſary controverſially to refer to thoſe authorities, and to ſtate the objections to the cuſtomary and confuſed phraſeology which they have ſanctioned. Among theſe, ſome have defined the term articulation as if it embraced the whole art and practice of enunciative utterance, as the ingenious, and generally ſpeaking, profound and accurate Mr. Gough,—"Articulation," ſays he, "is the art of modifying the ſounds of the larynx by the aſſiſtance of the cavity of the mouth, the tongue, teeth, and lips." (Manch. Mem. vol. v. pt. ii. p. 645.) But much more frequently it is uſed as a pure ſynonym with *diſtinctneſs*. (Mr. Sheridan, in his lectures, confounds it not only with diſtinctneſs but with enunciation generally, and even with idiomatic pronunciation, Lect. ii. p. 21. 8vo. edit.) But, not to inſiſt particularly upon the important axiom, that the very admiſſion of ſynonyms is inconſiſtent with the progreſs and communication of ſcientific truth, if ſuch were the uſe to which the term articulation were to be applied, why did the Engliſh grammarian go to the Greek language and to the ſcience of anatomy to borrow a name for an idea which he had already a good and familiar Engliſh word fully and completely to convey? How came he to apply that word ſo ſuperfluouſly borrowed in a ſenſe diametrically oppoſite to that which it bears in the ſcience from which it is taken? For articulation in anatomy ſignifies the *juncture of bones*, or that flexible combination of joints or elementary portions into a limb, or of limbs into a body, by which the unity of the whole is conſtituted, without injury to the individuality of the parts. And laſtly, how came he to look out for a ſupernumerary name to one idea, while another idea equally indiſpenſible to his ſcience (for the combination of elements is as neceſſary to ſpeech as their formation) without any ſeparate or ſpecific deſignation? Without going further, therefore, into critical diſquiſition, we may venture to lay down, as one of the canons of elocution and grammatical nomenclature, the following definition.—Articulation (as one of the eſſential properties of human enunciation, is the jointing or linking together of the reſpective elements, and ſyllables, and words (the portions, limbs, and members of ſentences) as the bones themſelves, (the portions, limbs, and members of the anatomical frame) are linked or jointed together, by an analogous articulation in animal economy. Implication will then remain to be conſidered merely as that part of articulation which relates ſeparately to the articulation of ſeparate graphic words in the act of oral delivery, and conſequently as indicating rather a grammatical diſtinction, than a diſtinct ſpecies or modification of organic action: for in well delivered ſpeech (it is contended, by the authority ſo frequently referred to in the different articles relative to elocution) the ear, unaſſiſted by the memory of the eye, knows of no ſuch thing as a diviſion or diſtribution of ſpeech into ſuch ſeparable portions as in graphic compoſition are denominated words. The proceſs of enunciation and implication conſiſts in a delicate preciſion of the motion of the organs, without ceſſation of ſound, from one elementary poſition to another, by which the termination of the perfect ſound is glided more or leſs intimately into the ſucceeding element or commencement of the enſuing ſyllable. Thus literal ſounds, intimately glided into each other, are articulated into ſyllables; as, *a* and long *l* into *all*. Syllabic ſounds, intimately glided into each other, are articulated into words; as, *all* and *ways* into *always*. The terminations of words (as they are called in conformity with graphic diſtinctions) glided into the initial ſounds of ſucceeding words, are implicated into clauſes, or parts of clauſes; as

the man, a ſhip, an apple,

Harry to Harry might, and horſe to horſe, &c.

A good enunciation, then, conſiſts in that clear and accurate delivery of verbal language, by which the requiſite qualities of diſtinctneſs and articulation are combined and modified; and the due proportions and alterations of ſound and interruptions, conſtituting the ſpecific relations of letters, ſyllables, members, clauſes, and ſentences, are preſerved in diſcourſe or reading.

ENUNCIATIVE Organs, thoſe portions and members of the human mouth, by the motions, poſitions, and contact of which, ſpecific character is ſuperadded to the original impulſes of voice, ſo as to render them communicable ſigns of diſtinct ideas. See Organs *of Speech*.

ENVOICE. See Invoice.

ENVOY, a public miniſter ſent by one ſovereign prince or independent ſtate to another to negociate ſome affair, or to watch over the intereſts of that ſtate or prince in general, and furniſhed with the credentials of an envoy. Like embaſſadors, envoys may be either *ordinary*, who reſide permanently at the court of a foreign prince, or *extraordinary*, who are diſpatched for one particular purpoſe, and retire when their miſſion is accompliſhed. Envoys hold the ſecond rank among public miniſters ſent to foreign courts: but they are alike under the ſpecial protection of the law of nations, and enjoy all the privileges and immunities of embaſſadors, except thoſe relating to the ceremony of their reception, public entry, and ſolemnity of their audiences. See Embassador.

The quality of envoy extraordinary, Wicquefort obſerves, is very modern; more modern than that of reſident: the miniſters inveſted therewith, at firſt, took on them moſt of the airs of embaſſadors; but they have ſince been taught otherwiſe.

In the year 1639, the court of France made a declaration, that the ceremonies of conducting envoys extraordinary to their audience in the king and queen's coaches, with divers others, ſhould no longer be practiſed to envoys.

S. Juſtiniani, the firſt envoy extraordinary from Venice, after that regulation, offered to cover in ſpeaking to the king, but it was refuſed him; and the king of France himſelf declared, that he did not expect his envoy extraordinary at the court of Vienna ſhould be regarded any otherwiſe than as an ordinary reſident. Since this time, thoſe two kinds of miniſters have been treated alike. Wicquefort.

ENURE, in *Law*, ſignifies to take place, or be available, and is as much as to have effect. Thus for inſtance, a releaſe made to tenant for life ſhall enure, and be of force and effect to him in the reverſion.

ENURESIS, in *Medicine*, from ἐν and οὔρησις, *mingendi actus*, the noſological term for incontinence of the urine. See Urine, *incontinence of*.

ENVY, in *Ethics*, is defined by Mr. Locke to be an uneaſineſs of mind, occaſioned by the conſideration of a good we diſcover in poſſeſſion of another perſon, whom we deem leſs worthy of it than ourſelves. It is a compoſition of ſorrow and hatred, and ſtands in direct oppoſition to congratulation. Otherwiſe, envy entertains a degree of ſorrow that the good contemplated ſhould eſcape ourſelves, and of anger that it ſhould fall to the ſhare of another. Or, it is that ſpecies of malevolence which is inſpired by the conjoined influence of pride, ſorrow, and anger. It differs from *emulation* (which ſee), or a diſquiet, occaſioned by the felicity of another, not becauſe he enjoys it, but becauſe we deſire the like for ourſelves; as it occaſions an uneaſineſs not merely from the want of the felicity poſſeſſed by another, but becauſe he enjoys it. Envy, in its nature and effects, is the baſeſt, moſt miſchievous, and moſt tormenting of all paſſions. Ariſtotle (De Rhetor. l. ii. c. 12.) obſerves, that this paſſion moſt uſually affects perſons who were once upon a level with thoſe they envy. The method preſcribed by Cicero (De Orat. l. ii. c. 52.) for leſſening or removing the influence of this paſſion is to ſhew that the things which occaſioned it, have not happened to the envied perſon undeſervedly; but are the juſt rewards of his induſtry or virtue; that he does not ſo much convert them to his own profit or pleaſure, as to the benefit of others; and that the ſame pains and difficulties are neceſſary to preſerve them, with which they were at firſt acquired.

Envy, in *Mythology*, is repreſented by the Greek and Roman poets as an infernal divinity, with ſquinting eyes, lean body, pale countenance, diſturbed air, head encompaſſed with ſerpents, &c.

ENURNY, is the *herald's* term for the bordure of a coat of arms being charged with any kind of beaſts.

ENXYLON, of εν and ξυλον, *wood*, a name uſed by the Greek authors for a ſpecies of worm or maggot, hatched from the egg of a beetle, and having its habitation in wood: which, in this ſtate, it erodes and burrows into, in various directions. The old Greeks called it alſo *dex* and *thrips*, and uſed the pieces of wood eroded by it in remarkable figures, as ſeals. See Thrips.

ENY, Saint, in *Geography*, a ſmall town of France, in the department of La Manche; 9 miles S. W. of Carentan.

ENYDRA, in *Botany*, (ενυδρος, *living in the water*,) a Syngeneſious genus of Loureiro's Fl. Cochinch. 510, which appears to belong to the 4th ſection of Juſſieu's *Corymbiferæ*, and to the order *Polygamia-ſegregata* of Linnæus. The character is, Common Calyx of four leaves; partial of one leaf, rolled up into a tube, ſingle-flowered. Corollets all tubular; thoſe of the radius three-cleft. Receptacle naked. Down none. The ſpecies is E. *fluctuans*, a native of the marſhes of Cochinchina, with oppoſite, ſerrated, rather haſtate leaves, and a white terminal flower. We know not whether it be reducible to any previouſly-deſcribed genus.

ENYSTRON, of εν and ὕστερος, *poſterior*, a word uſed by Ariſtotle for the ſecond ventricle in ruminating quadrupeds, in which the food is elaborated and concocted.

ENZ, in *Geography*, a river of Germany, which riſes about 10 miles W. of Altenſtadt, in the circle of Swabia, paſſes by Wildbad, Neuenburg, Pfortzheim, &c., and joins the Neckar at Beſſigheim, in the duchy of Wurtemberg.

ENZELLI. See Einzellee.

ENZIG, a lake of Germany, in the circle of Upper Saxony, and new mark of Brandenburg; 12 miles W.S.W. of Dramberg.

ENZINAS, Francis, in *Biography*, was born at Burgos, in Spain, about the year 1515. In Moreri and other works he is known by the name of Dryander, which is a Greek tranſlation of his family name. He was educated in Germany, and became a zealous diſciple of Melancthon, who thought very highly of his talents, and wrote a letter in his favour to archbiſhop Cranmer in the year 1548. He publiſhed a Spaniſh tranſlation of the New Teſtament, which he dedicated to the emperor Charles V.; and which drew down upon him the vengeance of the higher powers, and he ſuffered an impriſonment of 15 months duration. He eſcaped in the year 1545, and went to Calvin, who reſided at Geneva. He publiſhed "A hiſtory of the State of the Low Countries, and of the Religion of Spain," which is very rare, and forms a part of the "Proteſtant Martyrology," printed in Germany.

Enzinas, John, brother of the former, reſided a conſiderable time at Rome, and became a convert to the proteſtant religion, and was ſetting out for Germany to join his brother John, when ſome expreſſions which he dropped, relative to the corruptions and diſorders of the church, occaſioned his being accuſed of hereſy, and thrown into priſon. The terrors of a dungeon, and the proſpect of a cruel death, did not daunt his noble ſoul, but when brought before the pope and cardinals to be examined, he refuſed to retract what he had ſaid, and boldly avowed and juſtified his opinions, for which he was condemned to be burnt alive; a ſentence which was put into execution at Rome in the year 1545. Moreri, under the word Dryander.

ENZOWAN, in *Geography*, a town of Bohemia, in the circle of Leitmeritz; four miles E. of Leitmeritz.

EO, Eu, or *Miranda*, a river of Spain, which riſes in the mountains of Aſturias, ſeparates the province of Aſturias from Galicia, and runs into the Atlantic, a little to the north of Rivadeo.

EOA, in *Ancient Geography*, a town of Africa Propria, according to Ptolemy; called Oea by Mela.

EOBANUS, Helius, in *Biography*, an eminent Latin poet, was born, in 1488, on the confines of Heſſe; hence he obtained the name of Heſſus. His parents were ſo poor, that it has been ſaid he was born in the open air under the ſhade of a wide ſpreading tree; but his education was not neglected. He was taught Latin at a ſmall ſchool, and purſued his more advanced ſtudies at the univerſity of Erfurt, where he afterwards taught the belles lettres till the year 1526, when Philip Melancthon procured him an invitation from the city of Nuremberg. Here he taught for ſeven years and then returned to Erfurt, where his reputation was ſo high and ſo firmly eſtabliſhed, that he is ſaid to have had 1500 ſcholars at a time. His fame produced him but very trifling emoluments, and he was often labouring under the greateſt poverty. He at length obtained through the intereſt of Philip, landgrave of Heſſe, a good ſituation at the univerſity of Marpurg, where he died on the 5th of October 1540. Camerarius, who wrote his life, praiſes his good qualities, his application to labour, and his talent at poetry. He was a man of great good nature, ſincere in his attachments, and averſe from contention. He took credit to himſelf for being a hard drinker, and would challenge any man as to the quantity of liquor which he would drink, and in a conteſt of this kind his antagoniſt fell dead on the floor. He wrote many books, a liſt of which is given by Moreri: his poems and epiſtles have been frequently publiſhed. Moreri.

EODANDA, in *Ancient Geography*, a deſert iſland, ſituated E. of Arabia Felix.

EOLIAN, in *Ancient Muſic*. The Eolian tone or mode was one of the mean or principal modes of the Greek muſic, and its fundamental ſound was immediately above the Phrygian.

The Eolian mode was grave, according to Laſus. "I ſing (ſays he) Ceres and her daughter Melibæa, the ſpouſe of Pluto, upon the Eolian mode, full of gravity."

The name of Eolian, given to this mode, is not derived from the Eolian iſles, but from Eolia, a country of Aſia Minor, where it was firſt uſed.

EOLIC, or rather *Æolic*. See Æolic.

EOLIPILE. See Æolipile.

EOLUS, and Eolus's *harp*. See Æolus.

EON, or Æon. See Æon.

Eon, a word uſed by ſome anatomical writers to expreſs the whole ambit or compaſs of the eye.

Eon, de l'Etoile, in *Biography*, a French fanatic, who, from the reſemblance of his name to the word *eum*, applied to himſelf this paſſage, "per Eum qui venturus eſt judicare vivos et mortuos," and was ſatisfied that he was the perſon alluded to, *viz.* the ſon of God. This doctrine he taught with much fervour, and ſucceeded, like other enthuſiaſts, in making many converts, who gave him the homage due to one on whom their future deſtiny depended. At Rheims he drew down the notice of the clergy, who cauſed him to be apprehended, and after an examination he was committed to priſon, where he languiſhed a few days, and miſerably died. Many of his adherents perſiſting in the ſame follies which had characterized their maſter, were apprehended, and, refuſing to abjure their errors, were delivered over to the ſecular power, and were burnt alive in the neighbourhood of Rheims. Such was the perſecuting ſpirit of the prieſts who never fail to abuſe the power entruſted to them, and who would, in this inſtance, have been better employed in inſtructing their own flocks than in murdering theſe deluded fanatics. Moreri.

EOOA. See Ea-oo-wee.

EORDÆA, in *Ancient Geography*, a country of Macedonia, in Mygdonia.

EORIA, in *Mythology*, a feaſt celebrated by the Athenians in honour of Erigonus, who, by way of puniſhment, for their not avenging the death of his father Icarus, engaged the gods to inflict the curſe on their daughters, that they ſhould love men who never returned their paſſion. The feaſt was inſtituted by the order of Apollo.

EOSTRE, a Saxon goddeſs, to whom they ſacrificed in the month of April, called the month of Eoſtra; and thence the name Eaſter, which the Saxons retained after their converſion to Chriſtianity, applying it to the feſtival celebrated in commemoration of our Saviour's reſurrection. Bed. de Rat. Temp. cap. 13.

EPACRIA, in *Ancient Geography*, a town of Greece, in Attica.

EPACRIS, in *Botany*, from επι, *upon*, and ακρις, *the ſummit of a mountain*, alluding to the native ſituation of ſeveral of the ſpecies. Mountain-bloſſom. Forſt. Gen. t. 10. Linn. Suppl. 19. Schreb. 113. Willd. Sp. Pl. v. 1. 834. Mart. Mill. Dict. v. 2. Gærtn. t. 94. Claſs and order, *Pentandria Monogynia*. Nat. Ord. *Ericæ*, Juſſ.

Gen. Ch. *Cal.* Perianth of ſeveral imbricated, ovate, acute leaves; the five innermoſt longeſt and equal. *Cor.*

of one petal, funnel-ſhaped; tube dilated upwards; limb in five equal, ovate, ſpreading ſegments. Nectary of five obovate blunt ſcales, cloſely ſurrounding the baſe of the germen. *Stam.* Filaments five, equal, very ſhort, inſerted into the ſummit of the tube of the corolla; anthers incumbent, roundiſh oblong, of two cells and two lobes, burſting longitudinally, deſtitute of any appendage. *Piſt.* Germen ſuperior, roundiſh, with five furrows; ſtyle cylindrical, rather ſhorter than the tube; ſtigma capitate. *Peric.* Capſule roundiſh, ſomewhat depreſſed, with five furrows, of five valves and five cells, the partitions from the centres of the valves. *Seeds* numerous, minute, angular, affixed to the central column.

Eſſ. Ch. Calyx imbricated. Corolla tubular. Stamens inſerted into its orifice. Scales five, at the baſe of the germen. Capſule ſuperior, of five cells and five valves, with partitions from their middle. Seeds numerous, chaffy.

The numerous ſpecies of this elegant genus, but few of which have, as yet, found their way into botanical books, are all natives of New Holland or New Zealand. They bear a general reſemblance to the vaſt Cape genus *Erica*, with which botaniſts have aſſociated them in natural order, not without ſome uncertainty. Willdenow enumerates but four ſpecies, of which the fineſt is E. *grandiflora*, Sm. Exot. Bot. v. 1. 75. t. 39. Curt. Mag. t. 982. (E. longiflora; Cavan. Ic. v. 4. 25. t. 344.) "Leaves heart-ſhaped, pungent, recurved, on footſtalks. Flowers pendulous." Native of dry ſandy places in New South Wales, flowering in October. Its chief beauty conſiſts in its copious long pendulous flowers, with a crimſon tube and white border.

To theſe are now added, E. *obtuſifolia*, Sm. Exot. Bot. v. 1. 77. t. 40. "Leaves elliptic-lanceolate, very obtuſe, and pointleſs, on ſhort footſtalks. Flowers drooping toward one ſide." Grows in a ſandy ſoil near Port Jackſon, New South Wales, bloſſoming in October. The flowers are cream-coloured, with a browniſh calyx.

E. *pulchella*, Cavan. Ic. t. 345. Curt Mag. t. 1170. Branches clothed with ruſty down. Leaves heart-ſhaped, recurved, pungent. Flowers axillary, crowded. Native of Port Jackſon. Flowers white, ſweet-ſcented.

E. *pungens*, Cavan. Ic. t. 346. Branches ſmooth. Leaves ovate, pungent. Flowers axillary, crowded. Tube cylindrical. Common about Port Jackſon. The flowers are copious, large, ſnow-white, and very fragrant, reſembling thoſe of a *Phlox* in ſize and figure. Cavanilles' plate, a truly miſerable repreſentation of this magnificent ſpecies, miſled Dr. Sims in Curt. Mag. to confound it with the laſt. We apprehend this laſt writer has committed a further error in taking the red-flowered ſpecies, repreſented in his t. 1199, for a variety of the *pungens*. They ſeem to us very diſtinct.

Forſter and Cavanilles confounded with the genus of *Epacris* that of *Styphelia*, whoſe fruit is a drupa, with five ſeeds.

EPACTHES, Επαχθης, in *Antiquity*, a feſtival celebrated in honour of Ceres, named Αχθεια, from αχθος, *i. e.* *grief*, in memory of her ſorrow, when ſhe had loſt her daughter Proſerpine.

EPACTS, in *Chronology*, the exceſſes of the ſolar month above the lunar ſynodical month; and of the ſolar year above the lunar year of twelve ſynodical months; or of ſeveral ſolar months above as many ſynodical months; and ſeveral ſolar years above as many dozen of ſynodical months.

The epacts, then, are either *annual* or *menſtrual*.

Epacts, *Menſtrual*, are the exceſſes of the civil or calendar month above the lunar month.

Suppoſe, *e. gr* it were new moon on the firſt day of January; ſince the lunar month is 29 days, $12^h\ 44'\ 3''$; and the month of January contains 31 days; the menſtrual epact is 1 day $11^h\ 15'\ 57''$.

Epacts, *Annual*, are the exceſſes of the ſolar year above the lunar.

Hence, as the Julian year is 365 days 6', and the Julian lunar year 354 days 8 48' 36', the annual epact will be 10 days $21^h\ 11'\ 22''$; that is, nearly 11 days. Conſequently, the epact of two years is 22 days; of three years, 33 days; or rather three, ſince 30 days make an emboliſmic, or intercalary month.

Thus the epact of four years is 14 days, and ſo of the reſt; and thus, every 19th year the epact becomes 0; conſequently, the 20th year the epact is 11 again; and ſo the cycle of epacts expires with the golden number or lunar cycle of 19 years, and begins with the ſame, as in the following table; which is formed by the conſtant additions of 11, caſting off 30; ſuppoſing the lunar month to conſiſt of 29 and 30 days, and the civil year of 365 days, with a biſſextile every fourth year. This natural order of the epacts is ſuch as was eſtabliſhed by the council of Nice, A.D. 325.

Gold. Numb.	Epacts.	Gold. Numb.	Epacts.	Gold. Numb.	Epacts.
1	XI	7	XVII	13	XXIII
2	XXII	8	XXVIII	14	IV
3	III	9	IX	15	XV
4	XIV	10	XX	16	XXVI
5	XXV	11	I	17	VII
6	VI	12	XII	18	XVIII
				19	XXIX

Again, as the new moons are the ſame, that is, as they fall on the ſame day every 19 years, ſo the difference between the lunar and ſolar years is the ſame every 19 years. And becauſe the ſaid difference is always to be added to the lunar year, in order to adjuſt or make it equal to the ſolar year; hence the ſaid difference reſpectively belonging to each year of the moon's cycle is called the "epact of the ſaid year," that is, the number to be added to the ſaid year, to make it equal to the ſolar year, the word being formed from the Greek επαγω, *induco, intercalo.*

Upon this mutual reſpect between the cycle of the moon and the cycle of the epacts, is founded this rule for finding the Julian epact, belonging to any of the moon's cycle. Multiply the year given of the moon's cycle into 11; and if the product be leſs than 30, it is the epact ſought; if the product be greater than 30, divide it by 30, and the remainder of the dividend is the epact. For inſtance, we would know the epact for the year 1712, which is the third year of the moon's cycle. Wherefore 3 is the epact for 1712, for 11 × 3 = 33, and 33 being divided by 30, there is left three of the dividend for the epact. But the difference of the Julian and Gregorian years being equal to the exceſs of the ſolar above the lunar year, or 11 days, it happens that the Gregorian epact for one year is the ſame with the Julian epact for the preceding year.

By the help of the epact may be found what day of any month in any year the new moon falls on, thus: to the number of the month, from March incluſively, add the epact of the year given; if the ſum be leſs than 30, ſubtract it out of 30; if greater, ſubtract it out of 60; and the remainder will be the day whereon the new moon will fall.

If the new moon be ſought for in the month of January or March, then nothing is to be added to the epact; if for February or April, then only one is to be added.

Thebes was taken by the Lacedæmonians, and Pelopidas with others attached to liberty and independence were expelled, but Epaminondas was ſuffered to remain, as one whoſe poverty and philoſophy would prevent him from taking any part in political concerns. When the exiles, about four years afterwards, regained the city, they were joined by Epaminondas, and the Thebans regained their liberty. Theſe two friends concurred in improving the military diſcipline of their fellow-citizens; and Epaminondas in particular took pains by his counſel and example, in promoting among them that frugality and contempt of pleaſure which lie at the foundation of all manly exertions. By ſuch conduct he gained the confidence of the Thebans, and being raiſed to a high rank in the army, he was deputed as a delegate to Sparta for the purpoſe of negociating a peace. On this occaſion, when the other deputies were overawed by Ageſilaus, who guided the operations of the Lacedæmonians, Epaminondas aſſerted the dignity of his character as the repreſentative of an independent ſtate, and inſiſted that the Thebans ſhould retain the ſame authority in Bœotia with that of the Spartans in Laconia. The Spartan king was incenſed, and war was immediately declared againſt the Thebans. The Lacedæmonians gave orders to their king Cleombrotus, to march into Bœotia at the head of an army conſiſting of 10,000 foot ſoldiers and 1000 horſe. The army of the Thebans was made up of only 6000 infantry and a ſmall body of cavalry; but Epaminondas commanded it, and under him was Pelopidas. The two armies met at Leuctra, a ſmall town of Bœotia, and on the 8th of July, B.C. 371, a battle was fought, which by the wiſdom and valour of Epaminondas terminated in the defeat of the Lacedæmonians, and the death of Cleombrotus. It afforded ſingular ſatisfaction to the victorious general that his father and mother had lived to witneſs the glory he now acquired. Two years after (B.C. 369) Epaminondas and Pelopidas were nominated Bæotarchs, or chiefs of the Bœotian league. The concurrence of circumſtances, mutual eſteem, friendſhip, and an uniformity of ſentiments and views, formed an indiſſoluble union between theſe two great men. With Pelopidas, the companion of his labours and his glory, Epaminondas entered Peloponneſus, ſpreading terror and deſolation through the ſtates in alliance with Lacedæmon, haſtening the defection of others, and breaking the yoke under which the Meſſenians had groaned for centuries. Seventy thouſand men of different nations marched under his orders with an equal confidence, and he led them on to Lacedæmon. Ageſilaus, appriſed of his approach, was anxious and alarmed; but ſuch was his reſiſtance, and the delay occaſioned by it, that Epaminondas thought it moſt prudent to retreat. After quitting the Spartan territories, he rebuilt the ancient city of Meſſene, and recalled its diſperſed inhabitants from the ſurrounding countries, in which they had long lived as aliens. It was the eſtabliſhed rule of the Bœotian league, that the chiefs ſhould hold their office only for a year, and then reſign to their ſucceſſors. Epaminondas and Pelopidas, however, retained their authority four months longer than the term preſcribed by law. For this they were accuſed, and judicially proſecuted. Pelopidas puſillanimouſly ſunk under the charge; but Epaminondas appeared before his judges with the ſame tranquillity as at the head of his army, and thus addreſſed them: "The law condemns me, I merit death, I only demand that this inſcription be engraven on my tomb: the Thebans have put Epaminondas to death, becauſe at Leuctra he forced them to attack and vanquiſh thoſe Lacedæmonians, whom they did not before dare to look in the face; becauſe his victory ſaved his country, and reſtored liberty to Greece; becauſe under his command the Thebans beſieged Lacedæmon, which deemed herſelf too fortunate to eſcape from ruin: and becauſe he rebuilt Meſſene, and ſurrounded it with ſtrong walls." The people preſent applauded this ſpeech, and the judges did not dare to condemn Epaminondas. In the next year Epaminondas marched again into Peloponneſus to aid the Arcadians againſt the Spartans; and having taken ſome towns and laid waſte the country, he marched to Corinth, which was ſucceſsfully defended againſt him. Upon his return, ſo uncertain is popular favour, he was deprived of his command, and reduced to the condition of a private citizen. After ſome time, an army being ſent to reſcue Pelopidas, who had been ſeized and impriſoned by the tyrant Alexander the Pheræan, Epaminondas ſerved in it as a private ſoldier, and in that humble rank preſerved the army from being utterly deſtroyed. His fellow-citizens reinſtated him in his command, and ſent him with freſh forces to recover his friend, whoſe life was ſuppoſed to be in imminent danger. Alexander was ſo intimidated that he acquieſced in a ceſſation of arms, on condition of releaſing Pelopidas and another deputy. Thebes had now arrived at ſuch a degree of importance among the Grecian ſtates, as to be preferred to Sparta and Athens by the Perſians, who, therefore, wiſhed to enter into a treaty with the Thebans. Pelopidas concluded the treaty, though the Theban allies demurred againſt it. Epaminondas was therefore deputed with an army to force the Achæans to continue the alliance; and in this buſineſs he ſucceeded, and a general peace ſoon followed. Epaminondas wiſhed to render his country as powerful by ſea as it was by land; and with this view he was deputed to negociate with the Rhodians, Chians, and other maritime people. The Thebans were ſtill purſuing their ambitious deſigns; and Epaminondas marched a powerful army into Peloponneſus: but, as a confederacy was formed againſt the Thebans, the troops of which aſſembled at Mantinea, Epaminondas, apprehending that Sparta would be left defenceleſs, made a ſudden march in order to ſurpriſe it. But Ageſilaus was ready to receive him. Informed by a deſerter of Epaminondas's march, he returned home with extraordinary celerity, and placed his ſoldiers in the moſt important ſtations. The Theban general ordered ſeveral attacks. He had penetrated to the forum, and made himſelf maſter of one part of the city, when Ageſilaus, then near 80 years of age, liſtening only to the dictates of deſpair, ruſhed into the midſt of danger, and ſeconded by the brave Archidamus his ſon, repulſed the enemy and compelled them to retire. Epaminondas was not moleſted in his retreat; but a victory was become neceſſary, that the failure of his enterpriſe might be forgotten. He therefore marched ſuddenly to Mantinea, expecting to find it unguarded; but here he was diſappointed. He determined, however, to riſk a battle for the purpoſe of retrieving his honour. The army of the Lacedæmonians and their allies conſiſted of more than 20,000 foot and near 2000 horſe; the army of the Theban league of 30,000 infantry and about 3000 cavalry. Never did Epaminondas diſplay greater abilities than on the preſent occaſion; ſo that the enemy, diſmayed at his appearance, betook themſelves to flight. But whilſt he was purſuing them with great ardour, they ſuddenly rallied, and poured upon him a ſhower of darts. At length one of them pierced his breaſt with a javelin, the point of which was left in his body. When he was carried off the ground to his tent, and had recovered his ſpeech, his firſt queſtion was, what was become of his ſhield? when it was brought him, he kiſſed it as the inſtrument of his labours and his glory. He then inquired concerning the event of the battle; and being informed

formed that the Thebans were victorious, he ſaid, "It is well; I have lived long enough;" or, as others report his declaration, "I die unconquered. Adviſe the Thebans to conclude a peace." The javelin being then extracted, he expired, B. C. 363. Epaminondas was never married; and he ſeems to have regarded celibacy as moſt favourable to his philoſophical purſuits in private life, and to his active ſervices in a public ſtation. On the plain where he fell, two monuments were raiſed to him, *viz.* a trophy and a tomb. Epaminondas is repreſented by Cicero as one of the greateſt men that any age or nation ever produced: and why, it is ſaid, ſhould we not grant this honourable diſtinction to the general who perfected the art of war, who eclipſed the glory of the moſt renowned commanders, and who was never vanquiſhed but by fortune; to the ſtateſman, who gave to Thebes a ſuperiority ſhe had never poſſeſſed, and which ſhe loſt immediately upon his death; to the negociator who, in the general aſſemblies and congreſſes of Greece, always maintained a ſuperiority over the other Grecian deputies, and found means to retain in the alliance of Thebes, his country, even the ſtates who were jealous of the growth of this new power; to the man who equalled in eloquence the greater part of the Athenian orators, was no leſs devoted to his country than Leonidas, and perhaps more juſt even than Ariſtides? Travels of Anacharſis, vol. ii. Corn. Nep. Vit. Epam. Plutarch Vit. Pelop. & Ageſil. Univ. Hiſt. vol. v. and vi.

EPANALEPSIS, Επαναληψις, called alſo *Epanadiploſis*, in *Rhetoric*, the repetition of the ſame word in the beginning of one ſentence, and at the end of another. Thus Virgil,

> "Ambo florentes ætatibus, Arcades ambo."

Such alſo is the expreſſion of Plautus (Amph. Act ii. Sc. 2. v. 21.): "Virtue contains all things: he wants no good thing who has virtue." The figure is the ſame, though the principle is leſs honeſt, which occaſions the advice given by the writer in Horace, (Epiſt. i. 1. 65.) "Get money, if you can, honeſtly; but, however, get money." This figure adds force to an expreſſion, when the principal thing deſigned to be conveyed is thus repeated, ſo as to leave its impreſſion laſt upon the mind. And the beauty is heightened, when the ſentence has an agreeable turn ariſing from two oppoſite parts; as in Cicero's compliment to Cæſar, (Pro Marcell. c. 6.): "We have ſeen your victory terminated by the war: your drawn ſword in the city we have not ſeen." Hermogenes (Sturm. de Univerſ. Eloc. p. 410.) calls this a *circle*, becauſe the ſentence returns again to the ſame word. See Anadiplosis.

EPANAPHORA, Επαναφορα, the ſame with anaphora.

EPANA'STASIS, (from επι, and ανιστημι, *to excite*,) in *Surgery*, a tumour, or tubercle.

EPANASTROPHE, Επαναστροφη, in *Rhetoric*, the ſame with what is otherwiſe called anadiploſis.

EPANCYLO'TUS, (from επι, and αγκυλος, *crooked*), in *Surgery*, a bandage deſcribed by Oribaſius.

EPANODOS, Επανοδος, in *Rhetoric*, an inverſion of a ſentence, or a repetition of the ſame words in an inverted order; thus:

"Nox brevis nimis, ah! nimis brevis nox." Voſſ. Rhet. lib. v. p. 298.

This figure comprehends both *anadiploſis* and *epanalepſis*; for it both begins and ends with the ſame word, and the ſame word is likewiſe repeated in the middle. This turn of expreſſion has a beauty in it, and ſhews a readineſs of thought. Minutius Felix has given an example of it, when he is expoſing the folly of the Egyptian ſuperſtition. "Iſis," ſays he, "with Cynocephalus, and her prieſts, laments, bemoans, and ſeeks her loſt ſon; her attendants beat their breaſts, and imitate the grief of the unhappy mother: in a little time the ſon is found, upon which they all rejoice. Nor do they ceaſe every year to loſe what they find, or to find what they loſe. And is it not ridiculous to lament what you worſhip, or to worſhip what you lament?" This figure ſerves likewiſe to illuſtrate and enforce the ſenſe by ſetting it in two oppoſite views. Such is the expreſſion of the prophet (Iſ. v. 10.) "Wo unto them, who call good evil, and evil good: who put darkneſs for light, and light for darkneſs."

EPANORTHOSIS, or Correction, in *Rhetoric*, a figure by which the orator revokes and corrects ſomething before alleged, as too weak, and adds ſomething ſtronger and more conformable to the paſſion by which he is agitated.

The word is formed of ορθος, *right*, *ſtraight*; whence ορθοω, *I ſtraighten*; ανορθοω, επανορθοω, *I redreſs*, *ſtraighten*, *correct*, and επανορθωσις, *correction*. Accordingly the Latins call it *correctio* and *emendatio*.

This figure is uſed in different ways. Sometimes one or more words are recalled by the ſpeaker, and others ſubſtituted in their room. At other times, without recalling what has been ſaid, ſomething elſe is introduced as more ſuitable, inſtances of both kinds follow.

Such, *e. gr.* is that of Cicero for Cœlius: "O ſtultitia! ſtultitiamne dicam, an impudentiam ſingularem? Oh folly! folly did I call it, or rather intolerable impudence?" And in the firſt Catilinarian: "Quanquam quid loquor? Te ut ulla res frangat? Tu ut unquam te corrigas? Tu ut ullam fugam meditare? Tu ut ullum exilium cogites? Utinam tibi iſtam mentem dii immortales donarent." Thus alſo Terence, in the Heautontimo-rumenos, introduces his old man Menedemus, ſaying,

> "Filium unicum adoleſcentulum
> Habeo. Ah! quid dixi habere me? imo habui, Chreme.
> Nunc habeam necne, incertum eſt." "I have an only ſon, Chremes. Alas! did I ſay, that I have? I had indeed; but it is now uncertain, whether I have or not."

Cicero, in his defence of Milo, ſpeaking to the judges concerning Clodius ſays; "Are you only ignorant, what laws, if they may be called laws, and not rather torches and plagues of the ſtate, he was about to impoſe and force upon us?" Again, in his defence of Plancius he ſays: "What greater blow could thoſe judges, if they are to be called judges, and not parricides of their country, have given to the ſtate, than when they baniſhed him, who, when prætor, freed the republic from a neighbouring war, and when conſul from a civil one?" Here he is ſpeaking of Opimius: but in commending the moderation of Lucius Mummius who did not enrich himſelf, but his country, by demoliſhing the wealthy city of Corinth, he thus recalls his whole expreſſion, and by giving it a new turn, heightens the compliment he deſigned him. "He choſe rather," ſays he, "to adorn Italy, than his own houſe, though by adorning Italy his houſe ſeems to have received the greateſt ornament." De Off. l. ii. c. 22. Sometimes the correction is made by ſubſtituting ſomething contrary to what had been ſaid before: as in the following paſſage of Cicero (Philipp. iii. c. 2.): "Cæſar" (meaning Auguſtus), "though but a youth, by an incredible and ſurpriſing reſolution and courage, when Antony was moſt enraged, and we dreaded his cruel and pernicious return from Brundiſium, at a time when we neither aſked, nor expected, nor deſired it (becauſe it was thought impoſſible) raiſed a very powerful army of invincible veterans, to effect which he threw away his whole eſtate. Although I have uſed an improper word; for he did not throw it away, but employed it for the ſafety of the government." At other times, as we have before obſerved, the correction is made by adding a more ſuitable word, without any repetition of the former. Thus Cicero, after he has inveighed againſt the crimes of Verres (lib. ii. c. 29.) breaks out into this pathetic exclamation: "O the clemency, or rather wonderful and ſingular patience of the Roman people?" The word *clemency* not being, in his apprehenſion, ſtrong enough, he adds *patience*, as better anſwering his purpoſe. The ſudden and unexpected turn of this figure gives a ſurpriſe to the mind, and by that means renders it the more pathetic.

EPANTHE'SMA, or Epanthísma, (from επι, and ανθος, *a flower*), in *Surgery*, an effloreſcence; exanthema.

EPAPHÆ'RESIS, (from επι, importing *a repetition*, and αφαιρησις, *a removal*). In Galen it is employed in the ſenſe of a repeated evacuation by bleeding.

EPARCHA, in the *Muſic of the Ancients.* Pollux, (Onomaſt. lib. iv. cap. 9.) tells us, that the eparcha was one of the ſtrains of the Citharian mode, according to the diviſion of Terpander. It was probably the prelude, for that is the ſignification of the word eparcha.

EPARCHUS, Επαρχος, an officer under the Greek emperors of Conſtantinople, who had the command of the guards, or government of a province.

EPARER, in the *Manege*, is uſed to ſignify the flinging of a horſe, or his yerking or ſtriking out with his hind legs. In caprioles, a horſe muſt yerk out behind with all his force; but in ballottades he ſtrikes but half out; and in croupades he does not ſtrike out his hind legs at all. All horſes that yerk are reckoned rude. See Yerking.

EPA'RGEMOS, (from επι, and αργεμον, ſignifying a white ulceration, or opacity of the eye), in *Surgery*, an epithet applied to a perſon affected with the diſorder called argemon.

EPARITA, in the *Materia Medica*, a name given by Paracelſus to a ſort of fine earth, of a liver colour, ſeemingly the ſame with the Tokay bole.

EPA'RMA, or Epa'rsis, (from επι, and αιρω, *to elevate*,) in *Surgery*, a tumour of any ſort. The term, however, is uſually confined to a ſwelling of the parotid gland.

EPARRES, in *Geography*, a ſmall town of France, in the department of the Iſére, near Vienne.

EPAULE, or Espaule, in *Fortification*, the ſhoulder of the baſtion, or the angle made by the face and flank, otherwiſe called the angle of the epaule. See Bastion and Angle.

The word is pure French, and literally ſignifies *ſhoulder*.

Epaule *en dedans*, in the *Manege*, a leſſon of late invention, which, rendered into Engliſh, denotes that attitude in which, as the horſe goes forward, he is ſo bent through his whole frame, that if he goes to the right hand, he muſt croſs the right fore-leg over the left, and ſo *vice verſâ*; or, in the language of the Manege, his inner ſhoulder, or leg, over the outward. The old maſters worked their horſes upon circles, when they intended to ſupple the ſhoulders and haunches; but to this mode of working upon circles, it has lately been objected that it conſtrains the fore-part too much, and throws the horſe upon his ſhoulders. To remedy this evil, M. de la Guerriniere, an accompliſhed horſeman at Paris, invented the leſſon called "epaule en dedans," and eſtabliſhed it in his Manege. This new method, however, differs very little from the old practice, to which it owes its origin, and from which it is extracted and formed. The only objection againſt the circle is, that the horſe, when worked circularly, has his haunches too much at liberty, by which means the weight of his body is thrown upon his ſhoulders, which are thereby impeded in their motion; and the animal compelled to work in a manner directly oppoſite to what he ſhould do. The blame, however, inſtead of being laid on the circle, ſhould have been aſcribed ſolely to the falſe and ſenſeleſs manner in which horſes were formerly worked in it; when heavy large bitts and caveſons were uſed, with which the heads of horſes were loaded, and brought down to a level with their knees, ſo that they carried them, like rams, when they fight, and batter one another with their foreheads. Had theſe old practitioners known the advantage, and, indeed, the neceſſity of raiſing the head, in order to preſs and bend the haunches, and of doing this by means of a ſnaffle with double reins, one being tied over the withers, on the oppoſite ſide to which the horſe is to turn, the head would at once have been raiſed, the outward ſhoulder brought in, and the horſe bent from noſe to tail; but this diſcovery was reſerved for ſir Sidney Medows, who has made many important improvements in the art of horſemanſhip. Berenger's Hiſt. &c. of Horſemanſhip. vol. ii.

EPAULEMENT. In treating of the enfilade, we had occaſion to notice this part of the defences of batteries expoſed to a flanking-fire. The deſignation is derived from the French word *epaule*, meaning "a ſhoulder," to which the epaulement bears a ſtrong reſemblance. Wherever a work, whether on the defences, or in the approaches of the beſiegers, is ſubject to be enfiladed, and eſpecially where that enfilade is *direct*, it becomes indiſpenſibly neceſſary to raiſe an epaulement, for the purpoſe of warding off the ſhot. The thickneſs of ſuch a buttreſs muſt always be proportioned to its height, which again muſt be carried up ſo far as may render the fartheſt gun, upon the battery to be ſecured, ſufficiently ſafe from the ordinary *lobs* of ſhot fired en ricoçhet, as well as ſuch as may enfilade by deſcent. A general rule may be eaſily formed; namely, that the epaulement ſhould be full as thick as the parapet, be about ten feet, if practicable, beyond the prolonged line of the inner revetement of the terre-pleine, and be raiſed high enough to make an angle of ten degrees from the horizontal; the farther end of the battery being the angular point formed by the meeting of the terre-pleine, with a line drawn from the creſt of the epaulement. If this proportion be properly attended to, it will be almoſt impoſſible to enfilade the defences with effect; becauſe few ricoçhet ſhots, fired at an angle of ten degrees, will riſe more than eight at their ſecond flight. This mode gives a kind of ſtandard, which proportions the height of the buttreſs to the length of the battery it is to protect.

Where there is ſpace for ſuch a work, it is often found highly advantageous to raiſe cavaliers at the extremities of the baſtions, &c. which by their height ſerve as epaulements; but, as ſuch defences, when they fall into the hands of the beſiegers, not only afford a lodgment, but command the adjacent works, it is abſolutely neceſſary they ſhould be ruined; ſo that they may be completely annihilated whenever they are wreſted from the defenders. It being a general rule, that the creſt of the parapet ſhould be full ſeven feet in height, very little elevation thereof will make a competent epaulement for a battery of ſmall force, and eſpecially where the cannon are placed as cloſe up to the flank as circumſtances may admit. This cannot be done ſo eaſily in ſaliant angles which are acute, that is, under 90°; but, in the flanked angles of baſtions, &c. is generally very practicable. In the batteries and places of arms conſtructed by the beſiegers, the epaulements may be made within ten feet of the outer cannon, and may be run up to any height, provided they do not obſtruct the operations of other batteries; which, indeed, can be the caſe only in very peculiar ſituations. The beſt engineers recommend, that the epaulement ſhould be merely temporary, except at the orillons on the extremities of the flanks of baſtions, where they are always requiſite to prevent ſuch ſhots as may paſs over the proximate baſtion, when its angle or face may be battered, from enfilading the battery or the face of that baſtion next to ſuch orillon. When made on emergency, ſand bags are found to anſwer admirably in the conſtruction of epaulements; but when intended to be permanent, the buttreſſes ſhould be made of the firmeſt ſoil, well compacted, and properly gazoned (*i. e.* turfed.) As we have remarked, while ſpeaking of enfilades, no maſonry ſhould be expoſed in the conſtruction of epaulements any more than in traverſes and parapets; on account of the incalculable miſchief done by the numerous ſplinters which are knocked off by ſuch ſhots as ſtrike thereon.

EPAULETTE, is a diſtinguiſhing ornament, worn upon the ſhoulders of commiſſioned and of non-commiſſioned officers of ſome deſcriptions. The epaulette is always made to correſpond in colour with the bindings and lace of the uniform: therefore where yellow binding is in uſe, gold embroidery, &c. are employed, and where white binding is adopted, ſilver embroidery only is ſuitable. The military ſervice is by no means uniform in this ornament, ſome being epaulettes of one, ſome of another pattern; according to the fancies of the commandants reſpectively. The general rule is, that all general and field officers, as well as all ſuperior ſtaff officers, wear two epaulettes, the reſt of the officers in a corps wearing but one. Though, as above ſtated, variety obtains, yet the generality conſiſt of a rich ſtrap, of gold or ſilver lace, cuſhioned below, to give it a ſquare appearance upon the ſhoulder, and ornamented at its lower extremity with rich bullion, and fringe of a correſponding deſcription; the upper end ordinarily faſtens under, or on the cape, to a button; ſome being moveable, for the purpoſe of admitting a belt to paſs underneath. The flank companies, *i. e.* the grenadiers and light infantry, generally wear wings, not altogether unlike creſcents as they fit on the ſhoulder; of theſe the edges are ornamented with ſhorter bullions and fringe than are uſed in epaulettes. Some wings have ſhoulder-ſtraps, others have none; and ſome are ribbed, or ſtriped with narrow lace; but the generality are plain. In the navy, only large gold epaulettes are worn; all captains having two, and all under that rank but one. Formerly ſhoulder-knots, preciſely reſembling thoſe in uſe among ſervants, were worn by many corps, eſpecially the artillery. Theſe originated in the uſe of chains, ſuſpended from the collar down the arms, for the purpoſe of warding off the cuts of ſabres; but they ultimately became merely decorative, and were from that period made of ſilver cords, plaited, looped, and tagged, which hung down generally in front of the ſhoulder. For the ſame purpoſe of defence, the cavalry have in ſome inſtances adopted a laminated epaulette, conſiſting of metal plates of various patterns, but commonly circular or oval, overlapping each other a little, ſo as to allow due play to the limb, yet forming no ſlight reſiſtance againſt a ſabre. It cannot be expected, that the ſhoulder ſhould altogether eſcape injury, even though the edge of the weapon ſhould be averted; ſince the ordinary force of an attempt to cut down the ſhoulder muſt prove extremely painful, and generally benumb the part for a while; or eventually cauſe a bruiſe of ſome conſequence.

It is evident, from what we have detailed, that the epaulette may be conſidered as the type of a certain portion of armour, in uſe not many years ago; but which has become leſs neceſſary ſince diſcipline has empowered infantry to reſiſt cavalry; and as the former laid aſide their broad-ſwords in deference to the adoption, and to the ſuperiority of the muſquet and bayonet.

Though, in ſome parts of the Britiſh ſervice, the corporals ſtill wear ſhort ſhoulder-knots, and the ſerjeants retain their epaulettes, both being of cotton, worſted, or ſilk, the generality of them now wear the diſtinguiſhing marks of their reſpective ranks, in the form of fleches, or angular lacings on their ſleeves. Some variation exiſts in this particular, according to the nature of their employ; but, in general, one, two, and three fleches are the ordinary indications of rank. Thus, where an order of merit is eſtabliſhed among the privates, ſuch as appertain thereto wear one fleche, the corporals having two, and the ſerjeants three. This mode does not, however, ſeem to carry ſo much notoriety with it as the epaulette, which can be ſeen both from before and from behind the individual wearing it; whereas the fleche can be diſtinguiſhed but in one particular point of view.

EPEE, in *Geography*, a port of Africa, in the country of Benin.

EPEMBOLE, Επεμϐολη, in *Rhetoric*, the ſame with parembole.

EPENCRANIS, a name by which ſome of the old authors, particularly Eraſiſtratus, have called the cerebellum.

EPENDYTES, Επενδυτες, among the Greeks, a garment worn under the pallium, and above the interula or inner coat, called, in Greek, ὑποδυτης.

EPENTHESIS, formed of επι, εν, and τιθημι, *q. d.* επεντιθημι, *inſero*, *immitto*, in *Grammar*, the addition, or inſertion of a letter or ſyllable, in the middle of a word; as *relligio* for *religio*, *Mavors* for *Mars*, *alituum* for *alitum*. Virg. Æn. lib. vii. ver. 27.

In the Hebrew language, there are ſome letters which are called *epenthetic*, and they occur without any apparent neceſſity in the middle of words; ſuch are אוין. Maſclef's Heb. Gram. v. i. p. 191.

EPERIES, in *Geography*, a town of Hungary, celebrated for its mines of ſalt; 20 miles N. of Caſchau.

EPERLANUS, in *Ichthyology*, a name ſometimes given, on account of its pearl colour, to the ſmelt. See Salmo *Eperlanus*.

EPERLEQUE, in *Geography*, a town of France, in the department of the Straits of Calais; 2 leagues N.W. of St. Omer.

EPERNAY, or Espernay, an ancient and handſome town of France, in the department of the Marne, chief place of the diſtrict of the ſame name, with a population of 4430 individuals. It is pleaſantly ſituated on the river Marne, 21 miles N.W. of Châlons ſur Marne, 18 miles S. of Rheims, and 88 miles E. by N. of Paris. N. lat. 49° 2'. The canton has a territorial extent of 110 kiliometres, 11 communes, and 13,958 inhabitants.

As chief place of a diſtrict, Epernay has a ſub-prefect, a ranger, a court of juſtice, and a regiſter office. There are ſeveral manufactures of woollen ſtuffs, hoſiery, cutlery, leather, and writing-paper; but the moſt remarkable is that of a ſort of glazed earthen-ware, which ſtands the hotteſt fire.

The diſtrict of Epernay has 10 cantons, 215 communes, and 87,413 inhabitants, on a territorial extent of 2592½ kiliometres. Its ſoil is uncommonly fertile, and produces corn, but eſpecially that excellent red and white champaign of the very firſt quality, which is ſo much ſought for all over the world. Epernay is the centre of the beſt champaign wines; its own vineyards and thoſe of Ay produce the beſt; and the town has a great trade not only with theſe, but alſo with the famous wines of the hills of Hautvilliers, Pierry, and Cumieres, which are not far diſtant.

EPERNON, a town of France, in the department of the Eure and Loire; 4 leagues N.E. of Chartres.

EPERON, in *Natural Hiſtory*, the ſpur-ſhell, ſo called from its reſembling, in ſome degree, the rowel of a ſpur. It is a ſpecies of ſnail, of the round-mouthed kind, or claſs of the cochleæ lunares; all its volutæ are ſurrounded with double rows of prickles. See Lunaris *Cochlea*.

EPERONNIER, in *Ornithology*. See Pavo *Bicalcaratus*.

EPERUA, in *Botany*. See Dimorpha.

EPERVIER. See Falco.

EPERVIERS, in *Natural Hiſtory*, a name given by the French authors to a claſs of butterflies, which make the ſixth in Reaumur's method. They have a way of poizing themſelves on the wing in the manner of kites, and other birds of prey; and always live upon the wing, never ſettling themſelves upon the flowers they feed upon, but keep flying with a humming noiſe like a humble bee, while they thruſt in their trunk and ſuck the juices of the flower.

EPETIUM, in *Ancient Geography*, a town of Illyria, on the coaſt of Dalmatia, between Salone and Pegentium, near the mouth of a river, now called Xarnouvriza. The town which has ſucceeded to Epetium is named *Strobez*.

EPHA, a dry meaſure in uſe among the Hebrews.

The epha was the moſt common meaſure they uſed, and that whereby the reſt were regulated. It is commonly ſuppoſed that the epha, reduced to the Roman modius, contained four modii and a half. Now the Roman modius of grain or flour contained twenty libræ or pounds, conſequently the epha weighed ninety pounds. Dr. Arbuthnot reduces the epha to three pecks three pints, Engliſh meaſure. See Measure.

EPHALGIA, in *Ancient Geography*, now *Elpiſura*, a town of Aſia, in Meſopotamia, upon the banks of the Euphrates, W.N.W. of Circeſium.

EPHEBÆUM, Εφηβειον, in *Antiquity*, the place where the ephebi or youth exerciſed; or, as ſome ſay, where thoſe who deſigned to exerciſe met, and agreed what kind of exerciſe they ſhould contend in, and what ſhould be the victor's reward.

EPHEBI, Εφηβοι, among the Athenians, a deſignation given to their young men when they arrived at eighteen years of age, at which time they had their names entered in a public regiſter. Pott. Archæol. Grec. lib. 1. cap. 9. tom. i. p. 48.

EPHEDRA, in *Botany*, (εφεδρα is an ancient name for a climbing or paraſitical plant, and expreſſes a ſitting upon any thing; hence it ſeems to allude to the ſquat or decumbent and crowded habit of this ſhrub.) Sea ſide Grape. Linn. Gen. 532. Schreb. 707. Willd. Sp. Pl. v. 4. 858. Mart. Mill. Dict. v. 2. Juſſ. 411. Claſs and order, *Dioecia Monadelphia*. Nat. Ord. *Coniferæ*.

Gen. Ch. Male, *Cal.* the ſcales of a catkin, few, ſingle-flowered, roundiſh, concave, each the length of the perianth, which is of one leaf, cloven half way down, roundiſh, inflated, compreſſed, ſmall and blunt. *Cor.* none. *Stam.* Filaments ſeven, united into an awl-ſhaped column, cloven at the top, and longer than the calyx; anthers roundiſh, turned outwards, four of them below the reſt. Female, *Cal.* Perianth five-fold, one placed upon another ſo that their ſegments are alternate, forming an ovate figure; each is nearly ovate, of one leaf, cloven, the outer or lower ones ſmalleſt. *Cor.* none. *Piſt.* Germens two, ovate, the ſize of the innermoſt perianth on which they ſtand; ſtyles two, ſimple, thread-ſhaped, ſhort; ſtigmas ſimple. *Peric.* none; except the perianths, all become ſucculent and thickened, conſtituting a divided berry. *Seeds* two, ovate, acute, convex on one ſide and flat on the other, compreſſed by the perianth which incloſes them on every ſide.

Eſſ. Ch. Male, Calyx the ſcale of a catkin, in two ſegments. Corolla none. Stamens ſeven. Anthers four inferior; three ſuperior. Female, Calyx cloven, five-fold. Corolla none. Piſtils two. Seeds two, incloſed in the pulpy calyx.

The ſpecies known are but two.

1. E. *diſtachya*. Linn. Sp. Pl. 1472. Duhamel Arb. t. 92. (Uva marina; Ger. emac. 1116. f. 1, and 1117. f. 2.) "Flower-ſtalks oppoſite. Catkins in pairs." Native of various parts of the ſouth of Europe, in a ſandy ſoil about the ſhores of the ſea or of lakes, flowering in June and July. It bears our climate, eſpecially if led upright againſt a wall. A fine buſh of this kind may be ſeen in the Oxford garden, ten or twelve feet high. It is a buſhy, ſmooth, leafleſs ſhrub, always green, with the habit of an *Equiſetum*. The *catkins* are yellowiſh. *Berries* ſcarlet, ſweetiſh, viſcid, eatable but not agreeable.

2. E. *monoſtachya*. Linn. Sp. Pl. 1472. (E. polygonoides; Pall. Roſſ. v. 1. t. 83.) "Flower-ſtalks ſeveral. Catkins ſolitary." Native of Siberia. Linnæus ſuſpected this to be only a variety of the laſt, and Pallas confirms his opinion.

EPHELÆUM, in *Anatomy*, is the place from the hypogaſtrum, or lower part of the abdomen, to the ſecret parts.

EPHE'LCIS, from επι, and ἑλκος, *an ulcer*, in *Surgery*, a ſcab, or cruſt, upon a ſore.—Alſo, a ſmall portion of blood, voided by coughing.

EPHELIS, from επι and ἡλιος, *ſun*, a name uſed by the ancient writers on *Medicine*, for a diſorder of the face, brought on by the ſun and drying winds, and of the nature of what we call ſun-burning. It was a certain roughneſs, hardneſs, and bad colour of the ſkin.

The ephelis, or ſun-burning, is removed by an application of reſin, to which a third part of foſſile ſalt, and a little honey are added; but all theſe diſorders, as alſo the unnatural colour of cicatrices, are remedied by the following preparation, aſcribed to Trypho the Elder:

Take equal quantities of myrobolans, crocomagna, cimolian earth of a blueiſh colour, bitter almonds, the meals of barley and bitter vetch, dyer's weed (ſtruthium album); all theſe are to be triturated together, and made up with the moſt ſharp honey. With this preparation the parts affected are to be anointed at night; and the medicine carefully to be waſhed off the next morning. James Med. Dict. See Freckles.

EPHEMERA, from ἐπὶ and ἡμερα, *a day*, in *Medicine*, the name given by the Greek writers to the mildeſt form of fever, which runs through its courſe within the period of one day. By the Romans the ſame fever was termed *diaria*, from *dies*, a day.

A fever which terminates in the courſe of twelve, eighteen, or twenty-four hours, is not a common occurrence in this climate; unleſs the ſlight diſturbance of the ſyſtem, which fatigue, repletion, a ſleepleſs night, &c. induce, is to be called an ephemeral fever: and ſuch, indeed, appears to be the diſorder to which the term ephemera has been applied by writers in general, and which conſtitutes the ephemera ſimplex, or legitima, in their nomenclature. When the febrile condition is more ſevere, and therefore of longer duration, extending to the third or fourth day, by a ſoleciſm in language, it has been denominated ephemera extenſa, or ephemera plurium dierum. Any ſlight fever, of three or four days duration, is occaſionally called an ephemera at preſent; the ſlight derangement of the habit, from the operation of the cauſes juſt mentioned, being ſcarcely deemed a diſeaſe worthy of a diſtinct appellation.

The ephemera ſimplex is a ſlight febrile paroxyſm, marked by languor, loſs of appetite, thirſt, headache, and ſlight pains in the limbs, with ſome heat of ſkin terminating in a gentle perſpiration, and with dryneſs of the tongue and fauces. Theſe ſymptoms, from their mildneſs, imply a very ſlight derangement of any of the functions of the body: they originate from ſome evident cauſe of diſorder in what have been abſurdly termed the non-naturals, and ceaſe ſpontaneouſly when the influence of theſe cauſes no longer operates. The mildneſs of the ſymptoms, and the nature of the evident cauſes, are mentioned as the principal means of diſcriminating the ephemera from the various forms of continued fever at their commencement. Among the cauſes of the ephemera are enumerated the various paſſions of the mind, when ſtrongly excited, as grief, anger, joy, or care and anxiety, likewiſe loſs of ſleep, exceſſive heat of the weather, fatigue from labour or exerciſe, a fit of intoxication or of repletion, ſudden expoſure to cold, faſting, too great evacuations, &c. It is admitted, indeed, that many of theſe cauſes occaſionally give riſe to continued fevers of long duration; but, in theſe caſes, the attack is preceded by cold chills and ſhiverings, by languor and laſſitude, loathing of food, &c. and is accompanied by more ſevere diſorders of the functions, as by violent headache, pains in the back and limbs, nauſea or vomiting, with great anxiety and reſtleſſneſs. The preſence or abſence of theſe ſymptoms, in the commencement, will enable us to anticipate the future progreſs of the diſeaſe, whether it will be a mere ephemera or a more ſerious continued fever.

Beſides the ſimple ephemera, ariſing from the cauſes already enumerated, which Sauvages has included under the four heads of ephemera plethorica, ephemera nauſeativa, ephemera à frigore, and ephemera à calore, thoſe ſlight febrile derangements, connected with bruiſes, diſlocations, parturition, congeſtion of milk in the breaſts, dyſmenorrhœa, &c. have been alſo deſignated by the term ephemera; which, in this caſe, is a ſecondary or ſymptomatic ephemera. Avicenna, among the ancients, and Foreſtus, among the modern phyſicians, have made a ſtill more extenſive diviſion of ephemera; namely, into as many ſpecies as there are evident cauſes which induce it. Hence they uſeleſsly diſtinguiſh ephemera from grief, from joy, from hope, from fear, from thirſt, from faſting, &c.

The original ſignification of the term implied a completion of all the ſtages of a fever, *viz.* the beginning, increaſe, acmè, and decline, (in the language of the ancients,) within the compaſs of a natural day. By this definition, Van Swieten obſerves, the moſt acute fevers, which often kill a patient in twenty-four hours, are excluded from the term; ſince they do not arrive at their declenſion in that ſpace of time, although they end in death. Yet Caius has deſcribed that fatal epidemic, the *ſweating ſickneſs*, or *ſudor Anglicus*, under the term of ephemera; becauſe, on the one hand, it often terminated in the ſpace of twenty-four hours, by deſtroying the patient; and, on the other, by a ſweating, continued for the ſame ſpace of time, the patients were often cured. But in this caſe, though immediate danger was removed, yet great debility and other injuries to the functions ſtill remained, for ſome time afterwards; ſo that the diſeaſe belonged to the claſs of continued malignant fevers. This diſeaſe, under the appellation of ephemera ſudatoria, conſtitutes the ſeventh ſpecies of Sauvages. It has been alſo denominated ephemera Britannica, ephemera maligna, ephemera Anglica peſtilens, &c. See SWEATING *Sickneſs*.

With reſpect to the *cure* of the ephemeral fever, little remains to be ſaid. The term implies that its natural termination will occur within the period of a day, if left to itſelf: we here ſpeak of the ſimple ephemera, ariſing from a ſlight temporary cauſe. Abſtinence alone, or the moſt light and ſlender diet, with diluent drinks, is all that is required. The bowels may be opened by gentle aperients, as neutral ſalts, infuſion of ſenna, &c.: and this ought not to be omitted, where the diſeaſe has ariſen from over-repletion, or intoxication; in which caſe, it will contribute directly to remove the exciting cauſe of the diſorder. Thin drinks, ſuch as ſpring-water, or barley-water, acidulated or not with the juice of lemons, tea, or the infuſions of other grateful herbs, may be uſed, and animal food abſtained from.

The ſame treatment will be uſeful in the ſecondary or ſymptomatic forms of ephemera; in which caſes, however, the cure or alleviation of the original diſorder muſt be the firſt ſtep towards removing the ephemera. See Galen Method. Medend. lib. viii. De Febribus, lib. i. &c. Van Swieten, Comment. App. 728. Burſerius Inſtit. Med. tom. i. ſect. 198. Sauvages Noſ. Meth. claſs ii. genus 1.

EPHEMERA, in *Entomology*, a genus of the neuroptera order. This genus has the mouth deſtitute of mandibles; feelers four, very ſhort, and filiform; jaws ſhort, membranaceous, cylindrical, and connected to the lip; antennæ ſhort and ſubulate; ſtemmata too large above the eyes; wings erect; the lower ſmaller; tail terminating in briſtles.

The ephemeræ are proverbially a race of beings deſtined to enjoy the functions of life for a much ſhorter period than any other animals. This is a popular opinion, and, in a partial view of their hiſtory, not altogether incorrect; but it muſt be underſtood only of the laſt or winged ſtate, after attaining which they exiſt but for a few hours. The duration of this period varies in different ſpecies. It is devoted ſolely to the pleaſures of fulfilling the ordinary purpoſe of nature, the propagation of their kind; in the accompliſhment of which the ephemeræ may be obſerved in myriads, during the ſummer ſeaſon, ſporting on the wing, juſt above the ſurface of the water. In the larva and pupa ſtates the ephemeræ live one or two years; and ſome ſpecies, it is believed, live even three years from the time of hatching from the egg ſtate, before they arrive at the perfect form. The larvæ are found in the water, wherein they conſtantly reſide, and are the favourite food of fiſhes. They are active, furniſhed with ſix legs, a tail, ſix lateral fins or gills, and prey on ſmaller inſects. The pupæ, like the larvæ, are carnivorous, and reſemble the former ſtate, except in having the rudiments of the wings apparent. The ephemeræ are ſo abundant in ſome countries, that they are uſed for the purpoſe of manure, the ſpecies vulgata eſpecially. This is the common practice with the huſbandmen in Carniola. They are alſo very numerous on ſome parts of the Rhine, the Maes, and Iſel. The ſeaſon of their appearance in ſuch multitudes continues, however, only for about three days annually. The ephemeræ are arranged in two ſections, according to the number of briſtles at the extremity of the tail.

Species.

* *Tail with three hairs or briſtles.*

VULGATA. Wings reticulated, and ſpotted with brown; body yellowiſh, ſpotted with black. Scop. Donov. Brit. Inſ., &c.

Inhabits watery places throughout Europe.

Lutea. Wings tranſparent, reticulated; body yellow. Fabr.

Native of Europe, and is found in Britain.

Marginata. Wings white; exterior margin fuſcous; body black. Fabr.

Similar to E. vulgata, but ſmaller.

Vespertina. Wings black; poſterior ones white. Linn.

Native of Sweden, and other parts of Europe.

Halterata. Wings two, white; abdomen whitiſh, with fuſcous tail. Fabr. *Phryganea cauda triſeta*, &c. Degeer.

Inhabits ſtagnant waters in the north of Europe.

Inanis. Wings hyaline; body black; ſegments of the abdomen from the fourth to the ſeventh pellucid. Linn.

Native of Europe.

Maroccana. Wings white, immaculate; body yellowiſh. Fabr.

Found in Morocco.

Brevicauda. Wings two, cinereous, with a black rib; abdomen pale; tail brown. Fabr.

A ſmall ſpecies, found in the vicinity of Paris.

*** Tail with two hairs or briſtles.*

Bioculata. Wings white reticulated; head with two yellow tubercles; tail yellow. Fabr. Geoff., &c.

Native of European waters.

Renosa. Wings white reticulated; body brown. Fabr.

Inhabits Denmark.

Nigra. Body black; wings blackiſh; poſterior pair very ſmall. Linn.

Deſcribed by Linnæus as a native of Sweden; alſo inhabits other parts of Europe.

Culiciformis. Wings white; body brown. Linn.

Found in Greece by Pada; alſo in Sweden by Linnæus, and in France by Geoffroy.

Horaria. Wings white; thicker-margin blackiſh. Linn. *Ephemera minima*, Swammerdam.

Very abundant in Europe.

Striata. Wings hyaline, ſtriated; thorax fuſcous; abdomen white. Fabr. *Ephemera mutica*, Linn. Fn. Suec.

An European ſpecies.

Diptera. Wings two; coſtal margin brown, with cinereous ſpots. Linn.

The abdomen in this inſect is marked with red lines. The ſpecies inhabits Sweden.

Fuscata. Wings hyaline; abdomen brown, with the baſe whitiſh; legs pale. Fabr.

Albipennis. Wings white, immaculate; abdomen pale at the baſe; tail blackiſh. Fabr.

This and the preceding inhabit France, and other parts of Europe.

Notata. Yellow; wings white; abdominal ſegments with a fuſcous ſpot each ſide. Linn.

Ephemera notata and the three following are inhabitants of watery places in Europe.

Testacea. Wings browniſh; body brown teſtaceous; ſoles of the feet fuſcous. Linn.

Ferruginea. Wings yellowiſh; body ferruginous. Linn.

Stigma. Wings browniſh; body pale yellow; thighs with a black dot in the middle.

Ephemera, is alſo applied among *Botaniſts*, to a kind of flowers which open and expand themſelves at ſunriſing, and wither or cloſe up again at his ſetting. Such are the dent-de-lion, vulgarly dandelion, and divers others.

EPHEMERIDES, in *Aſtronomy*, tables calculated by aſtronomers, ſhewing the preſent ſtate of the heavens for every day at noon; that is, the places wherein all the planets are found at that time.

It is from theſe tables that the eclipſes, conjunctions, and aſpects of the planets are determined; horoſcopes, or celeſtial ſchemes, conſtructed, &c.

We have ephemerides of Regiomontanus from 1475 to 1506, of Engel from 1494 to 1500, of Staeffler from 1499 to 1531, of Origan from 1595 to 1654, of Kepler from 1617 to 1628, of Argoli from 1620 to 1700, of Heckerus from 1666 to 1680, of Wing from 1652 to 1671, of De la Hire from 1701 to 1703, of Manfredi from 1715 to 1750, of Parker, &c. S. Caſſini has calculated ephemerides of the ſidera medicæa, or ſatellites of Jupiter, which are of good uſe in determining the longitude.

In England the Nautical Almanac or Aſtronomical Ephemeris, publiſhed annually by anticipation, under the direction of the Commiſſioners of Longitude, is the moſt conſiderable. See Almanac.

In France they have preſerved in the national library ephemerides of 1442; and celeſtial ephemerides have been publiſhed by M. Deſplaces every ten years, from 1715 to 1745: they were afterwards continued by the abbé Caille, with many additions, from 1731 to 1774, of which an account may be ſeen in the Hiſtory of the Academy of Sciences for 1743, &c.; they were further continued by Lalande from 1775 to 1810. The Academy of Sciences have likewiſe publiſhed annually, from the year 1678, a kind of ephemeris, under the title of Connoiſſance des Tems. This has been continued ſince the revolution under the direction of the "Bureau des Longitudes." The two volumes for the years 8 and 9, edited under the inſpection of M. Lalande, contain, beſides other important articles, new catalogues of the ſtars; tables of the moon's horary motion by Delambre; obſervations of Mercury by Videl, &c. They have alſo ephemerides at Bologna; thoſe for 23 years from 1787 to 1810, being computed by C. Mateucci, aſſiſted by Iſolani, Guglielmini, Sacchetti, Zanotti, and Canterzani. The ephemerides of Milan contain the reſult of an important labour of C. Oriani, on the method of correcting the elements of the tables of Mercury by obſervation, and many intereſting obſervations of C. Reggio and De Ceſaris, &c. &c. The ephemerides of Berlin are now conducted by M. Bode, and contain many aſtronomical obſervations and memoirs by German, French, and Engliſh aſtronomers. The aſtronomers of Vienna commenced a ſimilar work in 1757. The geographical ephemerides, undertaken by M. Von Zach, of Gotha, at the commencement of the year 1798, contain many curious obſervations; information reſpecting new books and charts, new voyages and geographical maps, portraits of eminent philoſophers, and, in a word, every thing that can be intereſting to aſtronomers, geographers, and navigators. The meteorological obſervations of the electoral Academy of Sciences at Manheim, from 1781 to 1792, are comprehended in 12 volumes 4to. under the title of "Ephemerides Societatis Meteorologicæ Palatinæ."

EPHEMERUM, in *Botany*, from εφημερος, laſting but a day, in alluſion to its tranſient bloſſoms; ſee Lysimachia. The name has alſo been given in ancient times to the hemlock, on account of the celerity of its deſtructive action upon animal life.

EPHESIA, in *Mythology*, a feaſt inſtituted at Epheſus, in honour of Diana.

EPHESIANS, Epistle *to*. See Epistle.

EPHESIORUM Portus, in *Ancient Geography*, a port of Aſia Minor, upon the Boſphorus of Thrace; the modern name of which is *Aphoſiati*.

EPHESIUM, the name of a plaſter, which is deſcribed by Celſus.

EPHESIUS, in *Biblical Hiſtory*, a manuſcript of the goſpels written in 1166, and formerly in poſſeſſion of a biſhop of Epheſus, whence it has taken its name. It is noted 71 in the firſt part of Wetſtein's N. T. It is at preſent in the archbiſhop's library at Lambeth, to which it was preſented by Trahern, together with the extracts which he had made from it. Theſe were inſerted by Mill, in his collections of readings.

EPHESTIA, in *Mythology*, a feaſt celebrated in honour of Vulcan, in which three young lads ran for a prize.

EPHESTRIA, were feaſts celebrated at Thebes, in honour of Tyreſias.

EPHESUS, in *Ancient Geography*, a city of Aſia Minor, in Ionia, formerly reputed the metropolis of Aſia. Stephanus ſtyles it "Epiphaneſtata," or moſt illuſtrious. Pliny repreſents it as the ornament of Aſia; and Strabo deſcribes it as the largeſt and moſt frequented emporium of that continent. The ancient city, which was originally a ſmall village, ſtood about 50 miles S. of Smyrna, near the mouth of the river Cayſter, and the ſhore of the Icarian ſea, which is a bay of the Ægean; but its preciſe ſituation cannot be aſcertained, as it was often deſtroyed and rebuilt. Some modern travellers maintain that the ancient city ſtood more to the ſouth than the preſent town, or rather village, which they infer from the ruins that ſtill remain. It was known in ancient times by the names of Alopes, Ortygia, Morges, Smyrna, Trachæa, Samornion, and Ptela. Its name Epheſus is derived, according to Heraclides, from the Greek word *epheſus*, ſignifying permiſſion; becauſe Hercules, as he ſays, permitted the Amazons to live and build a city in that place. Others allege, that Epheſus was the name of the Amazon that founded the city: for Pliny, Juſtin, and Oroſius unanimouſly affirm, that it was built by an Amazon; while others aſcribe the honour to Androclus, the ſon of Codrus, king of Athens, who was the chief of the Ionians that ſettled in Aſia. However this be, it is acknowledged, that the city, which in the Roman times was the metropolis of Aſia, was founded by Lyſimachus; who, having cauſed the ancient city to be demoliſhed, rebuilt a new one, at a vaſt expence, in a place more convenient, and nearer the temple. We learn from Strabo, that when the inhabitants manifeſted a reluctance to quit their ancient habitations, this prince cauſed all the drains, that conveyed the water into the neighbouring fens and the Cayſter, to be privately ſtopped up: ſo that the city on the firſt violent rains that fell was in great part laid under water, and many of the inhabitants were drowned: and he thus conſtrained thoſe who remained to retire into the new city. This new Epheſus was greatly damaged by an earthquake in the reign of Tiberius, but that emperor repaired and adorned it with ſeveral ſtately buildings, of which there are now ſome few ruins that teſtify its exiſtence. The aqueduct, of which a part ſtill ſubſiſts, is generally believed to have been the work of the Greek emperors; the pillars, that ſupport the arches, are of fine marble, and they are higher or lower as the level of the water required. This aqueduct ſerved to convey water into the city from the ſpring of Halitee, mentioned by Pauſanias. The gate, now called for ſome unknown reaſon the gate of perſecution, is remarkable for three bas-reliefs on the mould, of exquiſite taſte. The port, of which many medals have been ſtruck. is at preſent merely an open road, and not much frequented. The Cayſter was formerly navigable, and afforded a ſafe place for ſhips to ride in, but it is now almoſt choaked with ſand. Epheſus is now venerable for nothing but the ruins of palaces, temples, and amphitheatres. It is called by the Turks *Ajaſaluk* (which ſee), or the temple of the moon, from the magnificent ſtructure formerly dedicated to Diana. The church of St. Paul, ſaid to have been founded by the apoſtle, is wholly deſtroyed; the little which remains of that of St. Mark is ſinking to ruin. The only church remaining is that dedicated to St. John, who reſided here, and this is now converted into a Turkiſh moſque. The town is merely a miſerable village, the habitation of herdſmen and farmers, living in low and mean huts, ſheltered from the extremities of weather by mighty maſſes of ruinous walls; the pride and oſtentation of former days, and the emblem in theſe of the tranſient vanity of human glory. All the inhabitants of this once famous city amount not to above 40 or 50 families of Turks, without one Chriſtian family among them; ſo ſtrikingly hath the ſcripture denunciation been fulfilled, that "their candleſtick ſhould be removed out of its place."

The ancient city, whether it was firſt built by Androclus, who conducted the Ionians hither and drove out the Carians and Leleges, by whom this ſituation was occupied before his arrival, or by one Crœſus or Epheſus, long before the Ionic migration, as others maintain, became ſoon the metropolis of Ionia. It was at firſt governed by Androclus and his deſcendants, who aſſumed the royal title, and exerciſed regal authority over the new colony; whence, even in Strabo's time, the poſterity of Androclus were ſtyled kings, and allowed to wear a ſcarlet robe, with a ſceptre, and all the enſigns of royal dignity. In proceſs of time, a ſenate was eſtabliſhed and a new form of government introduced, which continued to the time of Pythagoras, who lived before Cyrus the Great, and was one of the moſt ſavage tyrants whoſe name and character hiſtory records; for having expelled the ſenate and engroſſed the whole power, he filled the city with blood and rapine, not ſparing even thoſe who fled for ſhelter to Diana's temple. His ſucceſſor Pindarus governed the city with a milder ſway; and in his time Epheſus was beſieged by Crœſus, king of Lydia, who adviſed the inhabitants to devote their city to Diana, and in conſequence of their following his counſel, treated them with kindneſs, and reſtored them to their former liberty. The other tyrants of Epheſus, mentioned in hiſtory, are Athenagoras, Comes, Ariſtarchus, and Hegeſias; the laſt of whom was expelled by Alexander, who, having defeated the Perſians on the banks of the Granicus, beſtowed upon Diana all the tributes which the Epheſians had paid to the Perſians, and eſtabliſhed a democracy in the city. After his death, this city became the prey of his ſucceſſors. Lyſimachus took it, and afterwards Antigonus had poſſeſſion of it and plundered it. Epheſus for a little while was reſtored to its ancient ſplendour; but it was always ſubject to the kings of Syria. In the war between Mithridates and the Romans, the Epheſians took part with the former, and by his order maſſacred all the Romans that reſided in the city; for which barbarity they were ſeverely fined, and reduced almoſt to beggary by Sylla, but afterwards treated kindly and ſuffered to live according to their own laws. It was under the reign of the emperor Alexius, father of Anne de Comnena, that the Mahometans made themſelves maſters of Epheſus. The Greeks retook it in 1206, but they loſt it again 1283. At the commencement of the 14th century it became a part of the Turkiſh dominions; and both the place itſelf and its vicinity exhibit melancholy traces of indolence and inactivity. The Epheſians were much addicted to ſuperſtition, ſorcery, and curious arts, as the Scripture ſtyles them (Acts, xix. 19.); whence came the proverb "Epheſian letters," ſignifying all ſorts of ſpells or charms. By theſe Epheſian letters were meant certain obſcure words and incoherent ſentences, which ſuperſtitious bigots uſed to write on their girdles, and even imprint on their feet, and other parts of their bodies. They were alſo noted for their luxury and laſciviouſneſs. See Epheſ. v. 5.

Epheſus, in its relation to eccleſiaſtical hiſtory, may be conſidered, firſt of all, as the abode of many Jews, who obtained the privilege of citizens (Joſeph. Cont. Appian. l. 2.), and afterwards, as the place where St. Paul took up his reſidence for three years (Acts, xx. 31.), where he wrought miracles (Acts, xix. 11. 1 Cor. xvi. 9.), and was reſiſted by the Jews, (Acts, xx. 19.); and where Timothy was biſhop; and where John reſided; and, moreover, as containing one of the ſeven churches, whoſe character and doom are recorded in the book of Revelations, ch. ii.

Ephesus, *Temple of*. See Diana.

EPHETÆ, of εφιημι, *I ſend forth*, in *Antiquity*, a ſort of magiſtrates among the Athenians, inſtituted by king Demophoon, to take cognizance of murder, manſlaughter, and chance-medley.

Their number was one hundred, whereof fifty were Athenians, and fifty Argians: they were not admitted to the poſt till upwards of fifty years of age. Demophoon ſubmitted to be tried by this court, for having unfortunately killed one of his ſubjects by the turn of his horſe, as he was coming from Troy. It ſubſiſted for a conſiderable time in the ſame form; but at length Draco new-modelled it, excluded the Argians, and made it to conſiſt of fifty-one Athenians, each above fifty years of age: Ubbo Emmius de Rep. Athen. ſays, he transferred to them part of the juriſdiction of the Areopagites. See Areopagus.

The occaſion of erecting this court and of admitting the Argives to ſit as judges, is ſaid to have been as follows. Agamemnon, or, as others ſay, Diomedes, returning with his forces from Troy, were driven one night into an Athenian port called Phalerus, and thinking themſelves in an enemy's country, began their uſual practice of ravaging and plundering; upon which the Athenians fell upon and killed a conſiderable number of them. Next morning they found the palladium, or ſtatue of Minerva, which was brought from Troy, lying upon the ground among the ſlain; by which circumſtance they knew that they were their friends the Argives. The oracle having been conſulted, ordered them to give the ſlain an honourable burial in the place where they fell, to build a temple there, dedicated to Minerva, and to ſet up the palladium in it. Immediately after this tranſaction, it was ordered that this court ſhould be erected to try all caſes of perſonal injury and property. It conſiſted of 50 members, who were to be above 50 years of age, men of ſenſe and known probity, and who had power of life and death. Upon its firſt inſtitution Agamemnon inſiſting that there ſhould be an equal number of Athenians and Argives, the Athenians readily agreed to the propoſal.

EPHIALTES, ἐφιάλτης, in *Medicine*, from επι, *upon*, and αλλομαι, *I leap*, is ſynonymous with the Latin *incubus*, and the Engliſh *night-mare*, which ſee.

EPHIALTEUM, in *Ancient Geography*, the moſt northern promontory of the iſle of Rhodes.

EPHIDROSIS, in *Medicine*, from επι, and ιδρως, *ſweat*, a term uſed by the ancient writers to denote the appearance of a ſweat, whether critical or not, and whether general, or on the upper parts of the body only. The modern noſologiſts have conſtituted a *genus* of diſeaſe under this appellation; under which Sauvages compriſes every variety of morbid perſpiration that occurs as a ſymptom of different maladies. He enumerates ſeventeen ſpecies of ephidroſis. See his Noſol. Method, Claſs IX. Gen. 20. Cullen, Gen. 118.

EPHIELIS, in *Botany*, from εφιελις, *a little cup*, or ſomething like it, in a crown or garland, which alludes, happily enough, to the nectary forming a ſort of cup, or crown, within the circle of the corolla. Schreb. 253. Willd. Sp. Pl. v. 2. 328. (Mataiba; Aubl. Guian. v. 1. t. 128. Juſſ. 249.) Claſs and order, *Octandria Monogynia*. Nat. Ord. Near the *Sapindi*, Juſſ.

Gen. Ch. *Cal.* Perianth of one leaf, in five deep, ſpreading, roundiſh, acute ſegments. *Cor.* Petals five, roundiſh, ſpreading, notched, with a ſmall point, and having claws as long as the calyx. Nectary of ten roundiſh hairy ſcales, ſmaller than the petals, two of them affixed to the baſe of each petal. *Stam.* Filaments eight, briſtle-ſhaped, longer than the corolla, inſerted into a gland; anthers roundiſh, with four angles. *Piſt.* Germen ovate, encompaſſed with the gland which bears the ſtamens; ſtyle none; ſtigma obtuſe. *Peric.* Capſule oblong, compreſſed, with a furrow on each ſide, of one cell and two valves. *Seeds* two, kidney-ſhaped, one attached to the middle of each valve, one above the other.

Eſſ. Ch. Calyx in five deep ſegments. Petals five, with claws. Nectary of ten ſcales, two to each petal. Capſule compreſſed, of one cell and two valves. Seeds two, attached to the valves.

The only known ſpecies is E. *fraxinea*, Willd. a tree 50 or 60 feet high, with copious *branches*, of which the central ones are erect, the reſt widely ſpreading. *Leaves* alternate, pinnate, ſmooth; leaflets four or ſix, oppoſite, oval, pointed, entire, bright green, ſometimes eight inches long. *Flowers* on long axillary branching ſtalks, very ſmall, white. It grows in the foreſts of Guiana, flowering in October. Juſſieu ſuſpects this genus may be more akin to the *Leguminoſæ* than to his *Sapindi*, but he obſerves that the fruit requires further inveſtigation.

EPHIPPIA, of επι and ιππος, *horſe*, denoted certain cloths or houſings, which were faſtened on a horſe by a girth or ſurcingle, in ancient Greece, before the uſe of ſaddles were known. They were compoſed of different materials, as leather, cloth, and the ſkins of wild beaſts, and ſometimes adorned with gold, ſilver, and precious ſtones. When theſe coverings were common, it was reckoned more manly to ride without them. Varro boaſts of having rode, when a young man, without a covering to his horſe; and Xenophon reproaches the Perſians becauſe they placed more clothes on the backs of their horſes than on their beds, and gave themſelves more trouble to ſit eaſily than to ride ſkilfully. Theſe coverings were, therefore, for a long time not uſed in war; and the old Germans, who conſidered them as diſgraceful, deſpiſed the Roman cavalry who employed them. (Cæſ. de Bell. Gall. l. iv. 2.) Dion Caſſius (l. lxiii. 14.) ſays, that they were firſt allowed to the Roman cavalry by Nero. But it has been ſuggeſted that this author alludes merely to reviews, at which the cavalry were probably obliged before this time to appear always without them. In the time of Alexander Severus, the horſes of the whole Roman cavalry had beautiful coverings. (Lamprid. Vit. Alex. Severi. c. 50.) Saddles were firſt denominated ephippia, which originally ſignified nothing more than a covering for a horſe. Beckmann Hiſt. Inv. vol. ii. Berenger's Art of Horſemanſhip, vol. i. p. 41. See Saddle.

EPHIPPITES. See Hippurites.

EPHIPPIUM, in *Anatomy*, the excavation in the upper ſurface of the ſphenoid bone, called alſo ſella turcica. See Cranium.

EPHOD, אפד, derived from אפד, *aphad, to clothe*, a ſacerdotal garment, in uſe among the ancient Jews, ſuppoſed to have been a kind of linen alb, or ſurplice, wore by perſons of diſtinction, of various characters; the ſame with what the Latins call ſuper-humerale. 2 Sam. vi. 4. 1 Sam. xxii. 18. 1 Sam. ii. 18.

It is very hard to ſay preciſely what the ephod was; and there is room enough for the interpreters to be divided about it. The only point they are agreed upon is, that it was an upper garment worn over all the reſt, immediately under the pectoral or breaſt-plate. Some hold it had ſleeves, others deny it. The generality agree, that it was very ſhort, though ſome maintain that it hung down to the feet behind.

There were two kinds of ephods; the one, common to all who aſſiſted in the temple, being only made of common linen, mentioned in the firſt book of Samuel, ii. 18; the other, peculiar to the high-prieſt, mentioned Exod. xxviii. 6. 15. to be made of gold, of blue, and of purple, of ſcarlet, and fine twined linen, with cunning work; having two ſhoulder-pieces, with a curious girdle of the ſame matter, and two onyxes, with the names of the children of Iſrael engraved thereon, ſix upon each ſtone. Theſe onyxes were ſet in gold, and ſerved as buttons upon each ſhoulder. As for the ſhape of the ephod, the LXX call it επωμις, which ſignifies that it was worn on the ſhoulders.

Joſephus ſays (Antiq. l. iii. § 5), that it was a cubit long. It conſiſted, as ſome ſuppoſe, of two parts, the one an oblong rectangular piece, hanging down behind from the ſhoulders to the feet; the other a ſhort rectangular piece, which hung down before, the length of a cubit. Theſe two pieces were joined together upon the ſhoulders, with ſome proper faſtening, as loops, buttons, or the like.

It is alſo expreſſed in the ſecond book of Samuel, vi. 14. that upon the removal of the ark of the covenant from the houſe of Obed-Edom, David danced for joy, girt with a linen ephod; whence ſome authors have concluded, that the ephod was alſo a regal garment, worn on ſolemn occaſions. It is probable that the peculiarity of the ephod of the high prieſt did not conſiſt in its being of a different ſhape from that which was worn by other perſons; but in the richneſs of the materials of which it was made, and the fine embroidery and jewels with which it was adorned.

EPHORI, Εφοροι, magiſtrates eſtabliſhed in ancient Sparta, to balance and check the power and authority of the kings; as at Rome, there were tribunes created to controul the power of the conſuls.

The word is formed of the Greek, εφοραω, *intueor*, formed of the prepoſition επι, and the verb οραω, *to ſee*; whence εφορος, *q. d. inſpector, overſeer.*

Lycurgus, being ſenſible that a perfect underſtanding between the prince and the people was the baſis and foundation of both their happineſs, to maintain that good underſtanding, eſtabliſhed ephori, or inſpectors, as a kind of mediators, who ſhould have an eye to the meaſures and conduct on both ſides, and preſerve ſo equal a balance between them, that the regal power ſhould never decline into ſeverity and tyranny, or the liberty of the people run into licentiouſneſs and rebellion.

This is the account of their inſtitution given by Herodotus and Xenophon. (Her. lib. i. Xen. de Rep. Lacedæm.) The authority of the ephori was very great; they preſided in popular aſſemblies, collected their ſuffrages, declared war, made peace, treated with foreign princes, determined the number of forces that ſhould be raiſed, appointed the funds to maintain them, and diſtributed rewards and puniſhments in the name of the ſtate: they likewiſe held a court of juſtice, enquired into the behaviour of all magiſtrates, inſpected the education and conduct of youth, had a particular juriſdiction over the helotes, and by degrees drew the whole adminiſtration into their own hands. On certain occaſions, they expelled, and even put to death the kings; and aboliſhed or ſuſpended the power of the other magiſtrates, calling them to account at pleaſure. Ageſilaus, in the height of all his conqueſts, which even ſtruck terror on the great king of Perſia, ſtopped, and turned back, out of deference to the ephori, when they recalled him.

Some authors deny that the ephori were eſtabliſhed by Lycurgus, dating their origin 130 years after the time of that legiſlator.

Thus Plutarch, in his life of Cleomenes, aſcribes their inſtitution to Theopompus, king of Sparta, which is alſo confirmed by the authority of Ariſtotle. (Polit. lib. v.) The ephori were five in number, and annually choſen by the people out of their own body: though ſome have imagined, that they were at firſt appointed by the kings at their pleaſure, but that afterwards the people obtained the power of electing them. The year was denominated from the firſt election of theſe magiſtrates; and the Lacædemonian armies took their names from the principal ephori, as thoſe of Athens did from their firſt archon. The ephori did not riſe up at the entrance of the kings, as all the other magiſtrates did; and if even the kings offended againſt the laws, the ephori took cognizance of their conduct, and puniſhed them.

EPHORUS, in *Biography*, a Greek orator and hiſtorian, was a native of Cuma or Cyme in Æolia, and flouriſhed about the year 352 B. C. He was a diſciple of Socrates, at whoſe inſtigation he wrote hiſtory; which he commenced after the fabulous periods, with the return of the Heraclidæ into Peloponneſus, and brought down to the 20th year of Philip of Macedon. This work, which was divided into 30 books, was held in eſtimation by the ancients, and is frequently cited by Strabo and other writers; though the hiſtorian is charged with errors and miſrepreſentations, and plagiariſms. Beſides the hiſtory, the loſs of which is regretted, Ephorus wrote ſeveral other books on moral, geographical, and rhetorical ſubjects, none of which are extant, Bayle. Voſſ. Hiſt. Græc. Gen. Biog.

EPHRA, in *Ancient Geography*, a city of Judea, in the half-tribe of Manaſſeh, on this ſide of Jordan. It was ſituated on the frontiers of the tribe of Ephraim; ſuppoſed to have been the ſame with Ophrah. Judg. vi. 11.

EPHRAIM, *Tribe of*, ſo denominated from Ephraim, the grandſon of Joſeph by Aſeneth, the daughter of Potiphar, who was born in Egypt about A. M. 2294, occupied the ſouth ſide of Samaria, and extended, like that of Manaſſeh, from the Mediterranean on the weſt, and the river Jordan on the eaſt; bounded on the ſouth by the territory of Benjamin and part of Dan, and on the north by the half-tribe of Manaſſeh. The extent of this tribe from north to ſouth was about 7 leagues; and though ſome parts were mountainous and rocky, they were covered with trees and good paſture, and the low lands were rich and fertile, and even luxuriant. The cities and towns were numerous, large, and well-peopled. Joſhua was of this tribe; and the ark and tabernacle remained in it at Shiloh for a conſiderable time. After the ſeparation of the 10 tribes, the ſeat of the kingdom of Iſrael being in Ephraim, Ephraim is frequently uſed to ſignify the whole kingdom. The diſtrict belonging to this tribe is called Ephratah. Pſ. cxxxii. 6. (See alſo Judg. xii. 5. 1 Sam. i. 1.) Ephraim was led captive beyond the Euphrates, with all Iſrael, by Salmaneſer, king of Aſſyria, A. M. 3283. B. C. 721.

Ephraim, or *Ephrem*, a city of Ephraim, towards Jordan, whither Jeſus is ſuppoſed to have retired before his paſſion. John, xi. 54.—Alſo, a city of Benjamin, 8 miles from Jeruſalem, according to Euſebius, near the wilderneſs of Judea, in the way from Jeruſalem to Jericho, not far from Bethel.—Alſo, a conſiderable mountain in the tribe of Ephraim, and extending to that of Benjamin, on which ſeveral towns were built.—Alſo, an extenſive foreſt ſituated on the other ſide of Jordan, not far from Mahanaim, where David abode while the battle was fought, in which Abſolom received the due reward of his unnatural rebellion.

EPHRATA, or Dunkard-*Town*, in *Geography*, a village of America, in Lancaſter county, Pennſylvania, on the N.W. ſide of Calico creek, which, joining the Coneſtoga, falls into the Suſquehanna; 12 miles N. of the town of Lancaſter, and more than 40 W. of Philadelphia. It is ſituated in a romantic and ſequeſtered vale, and inhabited by a community of religious people, called "Tunkers," who are moſtly of German deſcent and believers in the doctrine of general redemption. They are very plain in their dreſs and language; and will neither ſwear, nor fight, nor go to law, nor take intereſt for the money they lend. They have many peculiarities; but their inoffenſive manners have occaſioned their being called the harmleſs Tunkers. This ſettlement is called "Tunkers' town," and conſiſts of about 40 buildings, of which three are places of worſhip. They ſubſiſt by cultivating their lands, by attending a printing office, a griſt-mill, a paper-mill, an oil-mill, &c. and the ſiſters by ſpinning, weaving, ſewing, &c. Beſide this congregation at Ephrata, there were, about 30 years ago, ſome few others of this ſect in various parts of Pennſylvania, and in Maryland. The whole community, excluſively of thoſe in Maryland, comprehended upwards of 2000 perſons.

EPHRATAH. See *Tribe of* Ephraim and Bethlehem.

EPHREM, or Ephraim, denominated the *Syrian*, and honoured with the appellation of *Saint*, in *Biography*, was a native of Niſibis in Meſopotamia, and born during the reign of Conſtantine the Great. Devoting himſelf at an early period to the monaſtic life, he ſedulouſly applied to his ſtudies, and to the compoſition of various theological and moral works. Towards the cloſe of his life he reſided at Edeſſa, where he began to diſtinguiſh himſelf by his writings about the year 370, and was ordained deacon, determining not to accept of any higher eccleſiaſtical order. His works were all written in the Syriac language, and ſeveral of them were tranſlated into Greek, with which he does not ſeem to have been acquainted, during his life. He was held in high eſtimation, on account both of his virtues and his writings. From Dr. Aſſemann we learn, that the Syrians gave him the titles of Doctor or Maſter of the whole world, and of their Prophet; and St. Jerome informs us, that his works were ſo much eſteemed as to be publicly read in ſome churches after the Scriptures. Sozomen highly commends them both for ſtyle and ſublimity of ſentiment; which excellencies are ſaid by this father, and alſo St. Jerome, to have been transfuſed into the Greek verſion of them. The ſubjects of theſe works were commentaries upon the Old and New Teſtaments; homilies, or ſermons; exhortations to the monks; controverſial pieces againſt Sabellius, Arius, Apollinaris, the Anomians, and the Novatians; treatiſes of morality; hymns to be ſung in the churches; panegyrics, &c. of which we have an account by Cave, Du Pin, and Lardner. The moſt complete edition of the works of this writer was publiſhed at Rome, by Dr. Joſ. Aſſemann, aſſiſted by father Benedatti, a Jeſuit, and Evodius Aſſemann, biſhop of Apamea; which was begun in 1732, and finiſhed in 1747, in 6 vols. folio, of which three are Syriac and Latin, and the other three Greek and Latin. St. Ephrem died about the year 378, under the reign of the emperor Valens; ordering his funeral to be conducted in a plain manner, and forbidding any eulogium to be delivered on the occaſion, or any monument to be erected to his memory. With the acknowledged and applauded learning of Ephrem, a conſiderable degree of enthuſiaſm and fanaticiſm was blended; but his charitable diſpoſition, which he manifeſted on a variety of occaſions, endeared his name to ſurvivors, and entitles him to honourable remembrance. Cave. Du Pin. Lardner. Jortin. Gen. Biog.

EPHREMI Codex, in *Biblical Hiſtory*, a manuſcript of the New Teſtament, written on vellum, and ſuppoſed to be of very high antiquity. It is "Codex Regius 1905," noted in the catalogue of MSS. in the royal library in Paris IX., and in all the four parts of Wetſtien's Greek Teſtament by the letter C. It is particularly deſcribed by Grieſbach in his "Symbolæ," p. iii.—liv. The firſt part of it contains ſeveral Greek works of Ephrem the Syrian, written over ſome more ancient writings, which had been eraſed, though the traces are ſtill viſible, and in moſt places legible. Theſe more ancient writings were the whole Greek Bible. The New Teſtament has many chaſms, which are ſpecified by Wetſtein. Beſides theſe chaſms, it is in many places illegible. Wetſtein contends that this MS. was written before the year 542, though his arguments are not wholly deciſive. Its readings, like thoſe of all other very ancient MSS., are in favour of the Latin; but no proof can be given that this has been corrupted from the Latin verſion. It has been altered by a critical collector, who, according to Grieſbach, muſt have lived many years after the time in which the MS. was written, and has probably eraſed many of the ancient readings. Kuſter was the firſt who procured extracts from it, and he inſerted them in his edition of Mill's Greek Teſtament. Wetſtein has repeatedly collated it with very great accuracy; and the numerous readings, which he has quoted from it, greatly enhance the value of his edition. A fac-ſimile of the characters of this MS., which is written without accents, is given by Montfaucon in his "Palæographia Græca." It has many marginal notes, written in uncial letters without accents. In this MS. the diſputed, or rather ſpurious verſe, John, v. 4, is written, not in the text, but as a marginal ſcholion. Wetſtein ſuppoſed, that this was one of the MSS. which were collated at Alexandria in 616 with the new Syriac verſion; but though this does not appear to have been the caſe, it is certainly as ancient as the ſeventh century. Wetſtein argues, from a marginal note to Heb. viii. 7, that it was written before the inſtitution of the feaſt of the purification of the virgin Mary, that is, before the year 542. March's Michaelis, vols. ii. and iii.

EPHREMOF, or Yephremof, in *Geography*, a town and diſtrict of Ruſſia, in the government of Tula, ſituated on the river Metcha, falling into the Don.

EPHRON, in *Ancient Geography*, a place of Paleſtine, in the tribe of Judah, about 15 miles from Jeruſalem, according to Euſebius and Jerome.—Alſo, a mountain of Paleſtine, on the confines of the tribes of Judah and Benjamin, according to the book of Joſhua.—Alſo, a large and ſtrong town of Judea, in the half-tribe of Manaſſeh, on the other ſide of Jordan, over-againſt Scythopolis. It was ſituated near the torrent of Jabok. This town was taken and ſacked by Judas Maccabæus, and razed to its foundations.

EPHYDOR, Εφυδωρ, in *Antiquity*, an officer in the Athenian courts of juſtice, who was to provide the plaintiff and defendant with equal water hour-glaſſes. When the glaſs was run out, they were not permitted to ſpeak any farther; and therefore we find them very careful not to loſe or miſpend one drop of their water. Whilſt the laws quoted by them were reciting, or if any other buſineſs happened to intervene, they gave order that the glaſs ſhould be ſtopped. Pott. Archæol. Græc. lib. i. cap. 21. lib. i. p. 118.

EPHYRA, in *Ancient Geography*, a town of Greece, in Theſprotia, a province of Epirus; mentioned by Velleius Paterculus and Strabo; the latter of whom ſays, that it was afterwards called *Cichyrus*.—Alſo, a town of Greece, in the Pelaſgiotide, a country of Theſſaly. This town was alſo called *Cranon*. Steph. Byz.—Alſo, a town of the Peloponneſus, in Arcadia. Steph. Byz.—Alſo, a town of the Peloponneſus, in the territory of Elis, ſituated on the river Selleis. This place was famous for the deadly poiſons which it produced.

EPI, *Gr.* in *Muſic*, a prepoſition, which, like *hyper*, ſignifies *ſupra*, above. We find one of theſe words frequently added to the Greek names of ſome of the intervals of muſic; as

Epi, or hyper, { Diapaſon,
Diapente,
Diateſſaron,
Ditonum, &c.

When we meet with them thus in conjunction, they imply that the voice, in canons, is to follow the dux, or guide an octave, a fifth, a fourth, &c. below it. The third part is to obſerve the ſame rule with reſpect to the ſecond, and the fourth to the third, and ſo on, whatever the number of parts may be.

EPIACUM, in *Ancient Geography*, a town of Albion, in the country of the Brigantes, according to Ptolemy. Camden places it at Elcheſter, on the river Derwent; Horſley at Hexham, in Northumberland; and Baxter ſuppoſes it was originally written Pepiacum, and places it at Papcaſtle, in Cumberland.

EPIALOS, from ηπιος, *gentle*, and ἁλς, *ſea*, in the *Medical Writings of the Ancients*, the name of a fever, in which the patient labours under a preternatural internal heat, while he at the ſame time ſhivers with cold. It has by ſome been called the ſhivering-fever, and the Romans named it quercera. Galen ſays, it proceeds from a putrified acrid phlegm. The word is, by ſome, alſo applied to any gentle fever, or feveriſh complaint; and by others, to the cold or ſhivering fit preceding a fever. Hippocrates calls by this name that peculiar fever which attends young women, whoſe menſes are ſtopped by taking cold, or other accidents.

EPIAULIA, a name which the Greeks gave to the Miller's Song. It is conſtantly confirmed, in inquiries after Greek muſic, that every profeſſion, trade, and occupation, had its peculiar *nome*, tune, or ſong. Rouſſeau, ſo often ſatirical and ſarcaſtic, but who ſeldom aims at pleaſantry, has condeſcended to be jocular upon the Greek name for the miller's tune, by aſking whether the burleſque word *piauler*, (whimpering, whining,) was not derived from the Greek; as the whimpering, whining, and ſquauling of women and brats, who cry and complain a long time in the ſame tone, ſufficiently reſemble the ſong or noiſe of a mill, and, by a metaphor, the miller?

EPIBATÆ, Επιβαται, among the Greeks, marines or ſoldiers who ſerved on board the ſhips of war. They were armed in the ſame manner as the land-forces, only that more of them wore full or heavy armour. Pott. Archæol. Grec. tom. ii. p. 140.

EPIBATERION, a poetical compoſition, in uſe among the ancient Greeks. When any perſon of condition and quality returned home after a long abſence or journey, into another country, he called together his friends and fellow-citizens, and made them a ſpeech, or rehearſed them a copy of verſes, wherein he returned ſolemn thanks to the immortal gods for his happy return; and ended with an addreſs by way of compliment to his fellow-citizens.

Theſe verſes made what the Greeks call επιβατηριον, *epibaterium*, of επιβαινω, *I go abroad*. At going away they had another, called *apobaterium*.

EPIBATERIUM, in *Botany*, from the Greek adjective επιβατηριος, *climbing*. Forſt. Gen. 54. Schreb. 640. Willd. Sp. Pl. v. 4. 397. Juſſ. 285. Claſs and order, *Monoecia Hexandria*. Nat. Ord. *Meniſperma*, Juſſ.

Gen. Ch. Male, *Cal.* Perianth double, deciduous; outer minute, flat, of ſix leaves; inner thrice as large, of three ovate ſpreading leaves. *Cor.* Petals ſix, ſmaller than the inner calyx, roundiſh; three of them external, placed between the calyx-leaves; three internal. *Stam.* Filaments ſix, capillary, incurved, the length of the petals; anthers roundiſh. Female, (on the ſame plant,) *Cal.* and *Cor.* as in the male. *Piſt.* Germens three, ſuperior, nearly globoſe; ſtyles three, minute, incurved; ſtigmas ſpreading, compreſſed. *Peric.* Drupas three, roundiſh, pointed with the permanent ſtyles. *Nut* kidney-ſhaped, compreſſed, ſlightly furrowed.

Eſſ. Ch. Male, Calyx double; the outermoſt of ſix, the inner of three leaves. Petals ſix, in two ſeries. Stamens ſix. Female, Calyx and Corolla as in the male. Styles three. Drupas three, globular, pointed. Nuts ſolitary, kidney-ſhaped.

E. *pendulum* is the only ſpecies deſcribed, a native of the iſland of St. Jago. The *ſtem* is ſhrubby, climbing, with long pendulous branches. *Leaves* alternate, pointing one way, on ſhort foot-ſtalks, oblong, entire, obtuſe with a point, ſmooth and without ribs, about an inch long. *Flowers* minute, pale, on ſolitary, axillary, ſimple ſtalks.

EPIBOMEUM, the name of a canticle in the Greek muſic, which was ſung before the altar.

EPIC POEM, an heroic poem, or a poem reciting ſome great and ſignal tranſactions of a hero; called alſo *epopœia*. This kind of poem is univerſally allowed to be, of all poetical productions, the moſt dignified, and, at the ſame time, the moſt difficult in execution. To contrive a ſtory which ſhall pleaſe and intereſt all readers, by being at once entertaining, important, and inſtructive; to fill it with ſuitable incidents; to enliven it with a variety of characters, and of deſcriptions; and to maintain, in the courſe of a long work, that propriety of ſentiment, and that elevation of ſtyle, which the epic character requires, is unqueſtionably the higheſt effort of poetical genius. Hence it is that ſo few have ſucceeded in the attempt, and that ſtrict critics will hardly allow any other poem to bear the name of epic, except the Iliad and the Æneid.

An epic poem, according to Boſſu, is a diſcourſe invented with art, to form the manners, by inſtructions diſguiſed under the allegory of an important action related in verſe, in a probable, entertaining, and ſurpriſing manner.

This definition, it has been obſerved, would ſuit Æſop's fables, if they were extended, and put into verſe. Accordingly the critic draws a parallel between the conſtruction of one of Æſop's fables and the plan of Homer's Iliad. The firſt thing, he ſays, which a writer of fables, or of heroic poems, does, is to chooſe ſome maxim or point of morality, deſigned to be inculcated in the work. He next invents a general ſtory, or a ſeries of facts, without any names, ſuch as he conceives moſt proper for the illuſtration of his intended moral. Laſtly, he particularizes his ſtory; that is, if he be a fabuliſt, he introduces his dog, his ſheep, and his wolf; and if he be an epic poet, he draws from ancient hiſtory ſome proper names of heroes to be applied to his actors; and thus his plan is completed. This, ſays Dr. Blair, is one of the moſt frigid and abſurd ideas that ever entered into the mind of a critic; nor can any perſon of juſt reflection and taſte ever imagine, that Homer could have proceeded in this manner. No one, indeed, can entertain a doubt that the firſt objects which ſtrike an epic poet are, the hero whom he is to celebrate, and the action, or ſtory, which is to be the ground-work of his poem. "He does not ſit down, like a philoſopher, to form the plan of a treatiſe of morality. His genius is fired by ſome great enterpriſe, which to him appears noble and intereſting; and which, therefore, he pitches upon as worthy of being celebrated in the higheſt ſtrain of poetry. There is no ſubject of this kind, but will always afford ſome general moral inſtruction, ariſing from it naturally. The inſtruction, which Boſſu points out, is certainly ſuggeſted by the Iliad; and there is another which ariſes as naturally, and may juſt as well be aſſigned for the moral of that poem; namely, that Providence avenges thoſe who have ſuffered injuſtice; but that when they allow their reſentment to carry them too far, it brings misfortunes on themſelves. The ſubject of the poem is the wrath of Achilles, cauſed by the injuſtice of Agamemnon. Jupiter avenges Achilles, by giving ſucceſs to the Trojans againſt Agamemnon; but by continuing obſtinate in his reſentment, Achilles loſes his beloved friend Patroclus."

An epic poem is in its nature the recital of ſome illuſtrious enterpriſe in a poetical form. This definition is ſufficiently exact; and hence it appears to comprehend ſeveral other poems beſides the Iliad of Homer, the Æneid of Virgil, and the Jeruſalem of Taſſo; which are, perhaps, the three moſt regular and complete epic works that were ever compoſed. But to exclude all poems from the epic claſs, which are not formed exactly upon the ſame model as theſe, is, ſays Dr. Blair, the pedantry of criticiſm. This writer, therefore, does not ſcruple to claſs ſuch poems, as Milton's Paradiſe Loſt, Lucan's Pharſalia, Statius's Thebaid, Oſſian's Fingal and Temora, Camoen's Luſiad, Voltaire's Henriade, Cambray's Telemachus, Glover's Leonidas, Wilkie's Epigoniad, under the ſame ſpecies of compoſition with the Iliad and Æneid. They are all, undoubtedly, epic; that is, poetical recitals of great adventures, and conſequently belonging to this denomination of poetry.

The epic poem is diſtinguiſhed from comedy, in that the action of the latter is not important, nor is related by the poet, but acted by the perſons introduced for that purpoſe; which circumſtance, likewiſe, diſtinguiſhes it from tragedy. It differs alſo from tragedy in the event, or concluſion; which, in the latter, is generally unfortunate, but ſeldom or ever ſo in the former. See Action.

Nor is it a philoſophical poem, as that of Lucretius, or the Creation of ſir R. Blackmore; nor a treatiſe of agriculture, or the like, as the Georgics of Virgil; thoſe poems not being intended to form the manners: beſide, that the inſtructions they contain are naked, ſimple, and direct, without any diſguiſe or allegory. Which ſecond circumſtance likewiſe diſtinguiſhes it from a treatiſe of morality, written in verſe; or a ſimple hiſtory in verſe: add, that its being confined to one important action, diſtinguiſhes it from a poem which relates all the actions of a perſon's life.

M. de la Motte, indeed, in his controverſy with madam Dacier, on the ſubject of Homer, maintains, that the whole life of a hero may juſtly be made the ſubject of an epic poem: and even that the Lutrin of M. Boileau might paſs for an epic poem; but he ſeemed afterwards to return to the common ſentiment. In effect, the queſtion is not as to the ſenſe which may be annexed to the words epic poem, but the ſenſe which cuſtom has actually annexed to them.

If we had only regard to the etymology of the word epic, of ἔπος, *verſe, poetry*, from εἴπω, *dico, I ſpeak (relate)*, all poems wherein the poet ſpeaks or rehearſes things himſelf, without making the perſons of his poems ſpeak, except at ſecond-hand, as he relates what they ſpoke on this or that occaſion, would be properly epic poems; and ſo there is not an epigram, ſonnet, or madrigal, but would come under that denomination: but this were wild.

In effect, the term epic poem is only attributed to a compoſition whoſe ſubject is great, inſtructive, and ſerious; that only comprehends one ſingle principal event, to which all the reſt refer; which principal action is to be terminated in a certain ſpace of time, ordinarily about a year. It is true, all this is arbitrary; but the ſenſe of all words is ſo too; and in matters of language we muſt be guided by cuſtom.

If M. de la Motte had only pretended, that one might make a fine inſtructive poem on the whole life of a hero, or an agreeable and diverting poem on ſome humorous adventure, all the world would have been on his ſide. But it is enough that cuſtom has not thought good to apply the term epic either to ſubjects of too much extent, and that are crowded with too many incidents no-way connected together; or to burleſque poems, as the Batrachomyomachia of Homer, the Secchia Rapita of Taſſoni, the Défaite de Dulot, the Lutrin of Boileau, the Hudibras of Butler, the Rape of the Lock of Mr. Pope, or the Diſpenſary of Dr. Garth.

Dr. Blair cannot allow with Boſſu and others, that it is the eſſence of an epic poem to be wholly an allegory, or a fable contrived to illuſtrate ſome moral truth; nevertheleſs, he admits, that no poetry is of a more moral nature than this. The effect, however, in promoting virtue is not to be eſtimated by any one maxim or inſtruction, which reſults from the whole ſtory, like the moral of one of Æſop's fables; but from the impreſſion which the parts of the poem ſeparately, as well as the whole taken together, make upon the mind of the reader; from the great examples which it ſets before us, and the high ſentiments with which it warms our hearts. Its propoſed end is to extend our ideas of human perfection, and thus to excite admiration; an end, which can be accompliſhed only by proper repreſentations of heroic deeds and virtuous characters. Epic poems muſt, according to this ſtatement of their object, be favourable to virtue. Moreover, the general ſtrain and ſpirit of epic compoſition ſufficiently mark its diſtinction from the other kinds of poetry. In paſtoral writing, the reigning ideas are innocence and tranquillity; compaſſion is the great object of tragedy; and ridicule the province of comedy. But the predominant character of the epic is admiration excited by heroic actions. It is ſufficiently diſtinguiſhed from hiſtory, both by its poetical form, and the liberty of fiction which it aſſumes. It is a more calm compoſition than tragedy. It admits, nay, requires the pathetic and the violent on particular occaſions; but the pathetic is not its general character. It requires more than any other ſpecies of poetry, a grave, equal, and ſupported dignity. It takes in a greater compaſs of time and action than dramatic writing admits; and thereby allows a more full diſplay of characters. Dramatic writing diſplays characters chiefly by means of ſentiments and paſſions; epic poetry chiefly by means of actions. The emotions which it excites are, therefore, not ſo violent, but they are more prolonged. Theſe, ſays Dr. Blair, are the general characteriſtics of this ſpecies of compoſition.

The epic poem may be conſidered under three heads; firſt, with reſpect to the ſubject, or action; ſecondly, with reſpect to the actors, or characters; and laſtly, with reſpect to the narration of the poet.

The action muſt poſſeſs the following properties; it muſt be one, and entire, great, and intereſting. (See Action and Episode. See alſo Æneid, Iliad, Paradise Lost, &c.) The actors or perſonages introduced in an epic poem muſt be diſcriminated by appropriate and well-ſupported characters; which is denominated by Ariſtotle giving manners to the poem. See Character, in *Poetry*.

If we examine the characters of Milton, we ſhall find that he has introduced all the variety which his fable was capable of receiving. The whole ſpecies of mankind was reſtricted to two perſons at the time to which the ſubject of his poem relates. We have, however, four diſtinct characters in theſe two perſons. We ſee man and woman in the higheſt innocence and perfection, and in the moſt abject ſtate of guilt and infirmity; the two laſt characters are, indeed, very common and obvious, but the two firſt are not only more magnificent, but more novel than any characters either in Virgil or Homer, or indeed in the whole circle of nature. Milton was ſo ſenſible that the ſubject of his poem afforded him but few characters, as to be led to introduce two actors of a fictitious nature, in the perſons of "Sin" and "Death," by which means he has wrought into the body of his fable a very beautiful and well invented allegory. However, it has been thought, that perſons of ſuch a chimerical exiſtence are not proper actors in an epic poem; becauſe there is not that meaſure of probability annexed to them, which is requiſite in writings of this kind.

There is one circumſtance, relating to the principal actors of the Iliad and Æneid, that merits particular notice, becauſe it gives a peculiar beauty to theſe two poems, and was, therefore, contrived with very great judgment. This is the choice for their heroes of perſons nearly related to the people for whom they wrote. Achilles was a Greek, and Æneas the remote founder of Rome. Their countrymen were thus rendered particularly attentive to all the parts of their ſtory, and ſympathized with their heroes in all their adventures. Milton's poem is alſo admirable in this reſpect; ſince it is impoſſible for any of its readers, to whatever nation, country, or people he may belong, not to be related to the perſons who are the principal actors in it; but what is ſtill infinitely more to its advantage, the principal actors in this poem are not only our progenitors, but our repreſentatives. We have an actual intereſt in every thing they do, and no leſs than our utmoſt happineſs is concerned, and lies, as it were, at ſtake in their whole behaviour.

Beſides human actors, there are perſonages of another kind, that uſually occupy no ſmall place in epic poetry; ſuch are the gods, or ſupernatural beings. This conſtitutes what is called the machinery of the epic poem; and it is the moſt nice and difficult part of the ſubject. About the neceſſity and uſe of machinery in an epic compoſition, critics have been divided. The French critics conſider it as eſſential to the conſtitution of an epic poem; and they allege that a poem, though it ſhould poſſeſs every other requiſite, has no pretenſion to be ranked in the epic claſs, unleſs the main action be carried on by the intervention of the gods. This deciſion ſeems to be principally, if not ſolely, founded on a ſuperſtitious reverence for the practice of Homer and Virgil. But, although theſe poets very properly embelliſhed their reſpective ſtory by the traditionary tales and popular legends of their own country, according to which, all the great tranſactions of the heroic times were intermixed with the fables of their deities; does it hence follow, that in other countries, and in other ages, which do not poſſeſs a ſimilar advantage of current ſuperſtition, and popular credulity, epic poetry muſt be confined to antiquated fictions, and fairy tales? Lucan has compoſed a very ſpirited poem, certainly of the epic kind, where neither gods nor ſupernatural beings are at all employed. The author of Leonidas has alſo ſucceeded in an attempt of the ſame kind; and, without doubt, wherever a poet gives us a regular heroic ſtory, well connected in its parts, adorned with characters, and ſupported with proper dignity and elevation, though his agents be every one of them human, he has fulfilled the chief requiſites of this kind of compoſition, and has a juſt title to be claſſed with epic writers. Dr. Blair, whilſt he cannot admit that machinery is indiſpenſibly neceſſary or eſſential to the epic plan, differs from thoſe critics of conſiderable name, who are for wholly excluding it, as inconſiſtent with that probability and impreſſion of reality, which, as they conceive, ſhould prevail in this kind of writing. (See Elem. of Criticiſm, ch. 22.) In epic poetry, where admiration and lofty ideas are ſuppoſed to reign, the marvellous and ſupernatural find, if any where, their proper place. They both enable the poet to aggrandize his ſubject, by means of thoſe auguſt and ſolemn objects which religion introduces into it; and they allow him to enlarge and diverſify his plan, by comprehending within it heaven, and earth, and hell, men and inviſible beings, and the whole circle of the univerſe.

In the uſe, however, of this ſupernatural machinery, a poet ſhould be prudent and temperate. The ſyſtem of the marvellous, which he introduces, ſhould have ſome foundation in the popular belief, ſo that events, which are moſt contrary to the common courſe of nature, may derive from it an air of probability; and he ſhould guard againſt exceſs in the uſe of it. As to allegorical perſonages, fame, diſcord, love, and the like, they form, ſays Dr. Blair, the worſt machinery of any; and though they may ſerve for embelliſhment, they ſhould not be permitted to bear any ſhare in the action of the poem.

With regard to the narration in an epic poem, it is not of any great moment, whether the poet relate the whole ſtory in his own character, or introduce ſome of his perſonages to relate any part of the action that had paſſed before the poem opens. Homer follows one method in his Iliad, and the other in his Odyſſey. Virgil has, in this reſpect, imitated the conduct of the Odyſſey; Taſſo that of the Iliad. Where the ſubject is of great extent, and comprehends the tranſactions of ſeveral years, as in the Odyſſey and the Æneid, the latter method ſeems preferable. When the ſubject is of ſmaller compaſs, and ſhorter duration, as in the Iliad and the Jeruſalem, the poet may, without diſadvantage, relate the whole in his own perſon. It is of very conſiderable importance in the courſe of the narration, that it be perſpicuous, animated, and enriched with all the beauties of poetry. No ſort of compoſition requires more ſtrength, dignity, and fire, than the epic poem. "It is the region," ſays Dr. Blair (Lectures on Rhetoric, &c. vol. iii.) "within which we look for every thing that is ſublime in deſcription, tender in ſentiment, and bold and lively in expreſſion;" and, therefore, though an author's plan ſhould be faultleſs, and his ſtory ever ſo well conducted, yet, if he be feeble, or flat in ſtyle, deſtitute of affecting ſcenes, and deficient in poetical colouring, he can have no ſucceſs. The ornaments which epic poetry admits muſt all be of the grave and chaſte kind. Nothing that is looſe, ludicrous, or affected, finds any place there. All the objects which it preſents ought to be either great, or tender, or pleaſing. Deſcriptions of diſguſting or ſhocking objects ſhould as much as poſſible be avoided; and, therefore, the fable of the Harpies, in the third book of the Æneid, and the allegory of Sin and Death, in the ſecond book of Paradiſe Loſt, had been better omitted in theſe celebrated poems. Mr. Addiſon, in his critique on the Paradiſe Loſt (Spectator, vol. iv.), has introduced ſeveral pertinent remarks on this ſubject. The ſentiments, which in an epic poem are the thoughts and behaviour aſcribed by the author to the perſons whom he introduces, ſhould be conformable to the reſpective characters of theſe perſons, and when this is the caſe they are ſaid to be *juſt*. The ſentiments have likewiſe a relation to *things* as well as to *perſons*, and they are then perfect, when they are adapted to the ſubject. If in either of theſe caſes the poet endeavours to argue or explain, to magnify or diminiſh, to raiſe love or hatred, pity or terror, or any other paſſion, we ought to conſider whether the ſentiments he makes uſe of are proper to thoſe ends. Homer is cenſured by the critics for his defect as to this particular in ſeveral parts of the Iliad and Odyſſey; but candour aſcribes this defect to the times in which he lived. Virgil has excelled all others in the propriety of his ſentiments. Milton is likewiſe commended in this reſpect; and he claims peculiar praiſe from the conſideration, that moſt of his characters lie out of nature, and were to be formed purely by his own invention. The loves of Dido and Æneas are merely copies of what has paſſed between other perſons. Whereas Adam and Eve, before the fall, are a different ſpecies from that of mankind, who are deſcended from them; and no one but a poet of the moſt unbounded invention, and the moſt exquiſite judgment, could have introduced into their converſation and behaviour ſo many apt circumſtances during their ſtate of innocence. An epic poem ſhould abound not only with ſuch thoughts as are natural, but alſo with ſuch as are ſublime. In this reſpect Virgil is inferior to Homer. Indeed, Virgil ſeldom riſes into ſentiments that are aſtoniſhing, where he is not fired by the Iliad. He every where charms and pleaſes us by the force of his own genius; but ſeldom elevates and tranſports us where he does not deduce his hints from Homer. Milton's chief talent, and diſtinguiſhing excellence, lie in the ſublimity of his thoughts. In the greatneſs of his ſentiments he triumphs over all the poets both ancient and modern, Homer only excepted. As ſentiments that are natural and ſublime are always to be purſued in an heroic poem, there are two kinds of thoughts, which ſhould be carefully avoided; the firſt are ſuch as are affected and unnatural, and the ſecond ſuch as are mean and vulgar. In Virgil we meet with little or nothing that reſembles the firſt kind of thought: none of thoſe trifling points and puerilities that often occur in Ovid, none of the epigrammatic turns of Lucan, none of the ſwelling ſentiments that are ſo frequent in Statius and Claudian, and none of the mixed embelliſhments of Taſſo. Every thing is juſt and natural. Milton has ſometimes erred in this reſpect; and it is urged as his apology, that he was infected by the taſte and practice of the age in which he lived. Mean and vulgar thoughts have rendered Homer obnoxious to cenſure; but his advocates have imputed ſentiments of this kind to the age in which he wrote, and to that which he deſcribed, rather than to any imperfection in that divine poet. No blemiſh of this kind is obſervable in Virgil, and Milton is ſeldom chargeable with it.

We have already obſerved, that the language of an heroic poem ſhould be both perſpicuous and ſublime. In proportion as either of theſe two qualities are wanting, the language is imperfect. See farther of the nature of the epic poem under FABLE. For its matter, ſee ACTION. For its form, ſee NARRATION. For its verſification, ſee HEXAMETER. See alſo MANNERS, CHARACTERS, MACHINE, &c. See alſo ÆNEID, ILIAD, TASSO's *Jeruſalem*, CAMOENS' *Luſiad*, FENELON's *Telemachus*, VOLTAIRE's HENRIADE, and MILTON's PARADISE *Loſt*.

EPICAIROS, in *Ancient Geography*, a town of Paleſtine, E. of Jordan. Ptolemy.

EPICARIA, a town of Illyria, in Dalmatia. Ptol.

EPICAU'MA, (from ἐπι, and καιω, *to burn*). See ENCAUMA.

EPICEDION, Επικηδιον, formed of ἐπι, *upon*, and κηδος, *funeral*, in the *Greek and Latin Poetry*, was a funeral eulogy, or a compoſition in proſe or verſe, delivered over the corpſe of a friend or neighbour, commemorative of the virtues of the deceaſed. In celebrating the obſequies of diſtinguiſhed perſons three kinds of funeral diſcourſes were uſed on the occaſion. One, delivered when the friends were aſſembled to perform the laſt mournful offices for the dead, was termed *epicedium;* another, at the rogus, buſtum, or funeral pile, *nænia;* and that inſcribed on the tomb or cenotaph, *epitaphium*. In the early ages of ſociety, the epicedium was generally an extemporaneous effuſion of ſome near relative or affectionate friend, expreſſive of the ſentiments he felt at the loſs, and calculated to excite the common ſympathy of the ſurrounding attendants. Beautiful ſpecimens are given of this ſpecies of poſtobituary reſpect by Virgil in the Æneid: the one (lib. ix.) on the death of Euryalus, and the other (lib. xi.) on the death of Pallas. But in ſubſequent periods, when wealth and luxury had ſupplanted the ſimplicity of nature, and truth of feeling had been obliged by faſhion to yield to the flattery of pomp; the cuſtom, though preſerved, materially differed in its character and form. What once had been the proper expreſſion of undiſſembled eſteem, was changed into a degrading ſyſtem of pageantry and venality. In moſt public funerals, but more eſpecially in thoſe called *vindictivi*, the corpſe, previous to interment, was carried into the forum, attended by a vaſt train of invited or hired followers, when one of the relatives, or ſome orator of eminence, aſcended the roſtrum, and harangued the audience in praiſe of the departed friend or hero. The origin of this cuſtom is attributed to Valerius Publicola, after the expulſion of the regal title. He having honoured the obſequies of his colleague with a funeral oration, ſo pleaſed the vanity of the Roman people, that it ſoon became faſhionable to celebrate the funerals of great or diſtinguiſhed characters with panegyrics, or encomiaſtic orations. The practice became at length ſo popular, that the younger Pliny, in his epiſtle, lib. ii. ep. 1. conſiders it as the laſt, but not the leaſt addition to the happineſs of a great and good man, to have had the enviable honour of being commended at his funeral by the eloquence of the conſul, Tacitus. Nor was this privilege excluſively confined to men; for Livy relates that the Roman matrons, having been extremely liberal and active in raiſing a collection of gold to enable the government to deliver the city from the hands of the Gauls, were allowed, by an act of the ſenate, to have the privilege of epicedia being pronounced at the celebration of their obſequies, equally with the other ſex. The abuſes to which this cuſtom was liable, and to which it actually became in time ſubſervient, are made the ſubjects of juſt complaint, and pointed animadverſion, both by Cicero and Livy; as tending, by the fulſomeneſs of flattery, to weaken the motives to virtue, and by the greater attention which thoſe poſthumous orators paid to the blandiſhments of eloquence, than to the accurate ſtatement of facts, to falſify the page, and corrupt the ſource of hiſtory. For on ſuch occaſions the orator did not fail to extol the deceaſed in the moſt unqualified terms of praiſe, to emblazon his virtues in the moſt brilliant colours, and to place to his credit noble actions which he had never achieved. Particularly when the orator entered on an inveſtigation of the lineage of the party, he ſeldom failed to ally him to ſome patrician family, or dignify his pedigree, by aſſociating with his name ſome of the moſt renowned characters in the commonwealth to illuſtrate and confirm the deſcent, ſo that gradually, by means of theſe miſrepreſentations being recorded, the epicedia tended to obliterate the juſt diſtinctions of conſanguinity, and throw down the barriers of property. From this heathen cuſtom are derived obituary maſſes, oraiſons funebres, and funeral ſermons.

EPICERASTICS, Επικεραϛικα, formed of επι and κεραννυμι, *I moderate*, in *Medicine*, remedies which, by their temperate moiſture, ſoften the acrimony of a humour, and aſſuage the painful ſenſation of a part irritated or afflicted by it; ſuch are the roots of althæa, mallows, liquorice; leaves of lettuce, mallows, water-lily, purſlain; the ſeeds of flax, poppy, &c. See Emollients.

EPICHARMUS, in *Biography*, a native of the iſland of Cos, who flouriſhed in the 5th century, B. C. His father removed him at an early age to Megara, and afterwards to Syracuſe, where he became a diſciple in the Pythagorean ſchool. Being prevented, by the tyranny of Hiero, from aſſuming the public profeſſion of philoſophy, he chiefly applied himſelf to the ſtudy of dramatic poetry, and offended the Pythagoreans, by introducing the doctrines and precepts of Pythagoras upon the ſtage. His comedies were numerous, of which Suidas aſſigns to him 52; but only ſome few fragments remain. He taught a ſchool at Syracuſe, and is ſaid to have invented the two Greek letters θ and χ. He alſo wrote commentaries upon phyſical and medical ſubjects. We have no accurate account of his philoſophical tenets: but ſome of his apophthegms deſerve to be recorded; ſuch are the following: "To die is an evil; but to be dead is no evil." "Every man's natural diſpoſition is his good or evil dæmon." "He who is naturally inclined to good is noble, though his mother was an Ethiopian." "Be ſober in thought, be ſlow in belief; theſe are the ſinews of wiſdom." "The gods ſet up their favours at a price, and induſtry is the purchaſer." "Live ſo as to be prepared either for a long life or a ſhort one." According to Lucian, the life of Epicharmus was prolonged to the age of 97 years. Laert. l. viii. § 78. Suidas. Fabr. Bib. Græc. v. i. p. 676. Brucker's Phil. by Enfield, vol. i.

EPICHIREMA, Επιχειρεμα, in *Logic*, an argumentation, conſiſting of four or more propoſitions, ſome of which are proofs of others.

Thus, that oration of Cicero for Milo may be reduced to the epichirema: "Thoſe who way-lay a man to kill him, it is lawful for him to kill, as is allowed by the laws of nature and nations, and by the practice of the beſt men; but Clodius way-laid Milo with that view, as appears from his forming an ambuſcade before his country-houſe, and from his proviſion of weapons, ſoldiers, &c." Therefore it was lawful for Milo to kill Clodius.

EPICHIROTONIA, among the Athenians. It was ordained by Solon, that once every year the laws ſhould be carefully reviſed and examined; and if any of them were found unſuitable to the preſent ſtate of affairs, they ſhould be repealed. This was called επιχειροτονια των νομων, from the manner of giving their ſuffrages, by *holding up their hands*. See a farther account of this cuſtom in Pott. Archæol. Græc. lib. i. cap. 26. tom. i. p. 142.

EPICHORDIS, from χορδη, *an inteſtine*, in *Anatomy*, a name given by ſome to the meſentery.

EPICHUS, or Tacape (*Gabs*), in *Ancient Geography*, a town of Africa, on the coaſt of the Mediterranean ſea, S. of Tephrura. See Gabs.

EPICITHARISMA, in the *Ancient Muſic*, an air for the cithara, ſaid to be played at the end of dramatic pieces; which, conſequently, muſt have been to Greek plays what a terminating ballet is now to an opera.

EPICLEROS, Επικληρος, among the Athenians, a daughter that had no brothers, and therefore inherited her father's whole eſtate. See Epidicasia.

EPICŒNE, Επικοινοι, in *Grammar*, a term applied to nouns, which, under the ſame gender and termination, mark, indifferently, two kinds of ſexes. See Gender.

Such in Latin, are *aquila*, *veſpertilio*, &c. which ſignify equally a male or a female eagle, or bat.

Grammarians diſtinguiſh between epicœne and common. A noun is ſaid to be common of two kinds, when it may be joined either with a maſculine or a feminine article; and epicœne, when it is always joined to ſome one of the two articles, and yet ſignifies both genders.

EPICOLIC Region, in *Anatomy*, from επι, *upon*, and κοιλιον, *the colon*, that part of the abdomen which is above the colon.

EPICRANIUS, a thin and broad muſcle, covering the ſuperior arched portion of the cranium, and called alſo fronto-occipitalis, and occipito-frontien; or deſcribed as two muſcles by the names of frontalis and occipitalis.

If we deſcribe this as a ſingle muſcle, which we conſider as the moſt natural and correct method, it will belong to the claſs of digaſtric muſcles, or of ſuch as poſſeſs a middle tendon, with fleſhy fibres connected to its two ends. The aponeuroſis is a very broad but thin plane, made up of tendinous fibres, variouſly interwoven, covering the upper part of the cranium, and hence called by Soemmerring galea cranii aponeurotica. It is ſeparated, along the middle, by a narrow interval from the oppoſite muſcle, and it extends externally as far as the ſemicircular line, to which the temporal faſcia is affixed. Its outer ſurface adheres cloſely to the ſcalp, while the inner is much more looſely connected, by a yielding cellular ſubſtance free from fat, to the pericranium. Its edges are inſenſibly continued into the neighbouring cellular ſubſtance.

The frontal portion is a thin flattened layer of muſcular fibres, commencing by a ſemilunar edge from the front of the aponeuroſis, and deſcending in a ſtraight courſe to the eyebrow. Internally it is continuous with the oppoſite muſcle, and detaches a portion of fibres along the ſide of the noſe, to join the compreſſor narium, and levator labii ſuperioris and alæ naſi. It then terminates by joining the orbicularis palpebrarum, through the whole of its upper convexity, and it is alſo connected with the corrugator ſupercilii. The external ſurface of this muſcle is covered by the integuments of the forehead; and its inner ſurface lies on the frontal bone and os naſi.

The occipital portion is not ſo broad as the preceding. Ariſing from the back edge of the aponeuroſis, it is inſerted into the upper part of the external tranſverſe ridge of the occipital bone. It covers the occipital and a little of the temporal bone, and is covered by the ſcalp.

It is very obvious that the occipito-frontalis cannot affect the bones of the head; but it moves the integuments in different directions, in conſequence of the connection between its tendon and the ſcalp. When the frontal and occipital portions act alternately, they draw the common tendon backwards and forwards, and thereby impart conſiderable motion to the whole hairy ſcalp. If they act together, they will render the aponeuroſis tenſe. When the frontal acts ſeparately, it draws up the eyebrow and ſkin of the forehead, and throws the latter into tranſverſe wrinkles. Hence it is concerned in the expreſſion of the countenance, and acts more eſpecially in the gay and joyful emotions, directly antagoniſing the corrugator ſupercilii, which throws the forehead, and particularly the eyebrows, into longitudinal wrinkles. It contributes alſo, by means of its connection with the upper eyelids, to the opening of the eyelids, when we carry that to as great an extent as poſſible. The ſeparate action of the occipital can only produce a ſlight effect on the integuments of the back of the head. Its contraction, however, fixes the aponeuroſis, and renders it a firm point for the contraction of the frontal in raiſing the eyebrow and eyelid. This muſcle, on the whole, is ſtrongly analogous to the panniculus carnoſus of quadrupeds.

EPICRASIS, in *Medicine*, is a gradual evacuation of ill humours in the blood.

EPICRISIS, Επικρισις, in *Rhetoric*, a clear and brief declaration of the ſpeaker's judgment concerning the ſubject in hand. Thus, "ego ſic ſtatuo, in optimo imperatore quatuor has res ineſſe oportere, &c." Voſſ. Rhet. lib. vi. p. 495.

EPICTETI, in *Ancient Geography*, a people, who, according to Strabo, bounded Bithynia on the eaſt. Hence the weſtern part of Phrygia obtained the appellation of "Phrygia Epictetus." In this territory was the ſource of the river Hermus, and the town of Ancyra was ſituated in it, on the frontiers of Myſia.

EPICTETUS, in *Biography*, an eminent Stoic philoſopher, no leſs diſtinguiſhed for his virtues than his wiſdom, was born in a ſervile condition at Hierapolis in Phrygia, and flouriſhed in the firſt century of the Chriſtian era. At an early age he was ſold as a ſlave to Epaphroditus, a celebrated freedman of Nero, to whom Joſephus inſcribed moſt of his works, and who was afterwards put to death by Domitian. Epictetus was lame; and of this infirmity various cauſes have been aſſigned by different writers. Celſus relates, that when his maſter, in order to torture him, ſqueezed his leg very hard, the philoſopher betrayed no ſymptoms of fear, but ſaid very calmly to his tormentor; "You will break my leg;" and when it was broken, he only ſaid with a ſmile, "Did I not tell you that you would break it." Some ſay, that he was born lame; and others aſcribe his lameneſs to the heavy chains with which his maſter loaded him. Epictetus, having, by ſome means which are not recorded, obtained his freedom, retired to a ſmall hut within the city of Rome, where, in an indigent condition, he devoted himſelf to the ſtudy of philoſophy. Having in his retirement acquired a competent knowledge of the principles of the Stoic ſect, and having alſo received inſtructions in rhetoric from Rufus; he became, notwithſtanding his poverty, a popular preceptor of morals. He was an acute and judicious obſerver of manners; his eloquence was ſimple, majeſtic, nervous, and penetrating: his doctrine inculcated the pureſt morals; and his life was an admirable pattern of ſobriety, magnanimity, and the moſt rigid virtue. His reprehenſions of vice were bold and animated; his inſtructions and precepts impreſſive and conciliating; and they were communicated without that dogmatiſm, vanity, and rudeneſs, which were too generally affected by the philoſophers. He was accuſtomed to obſerve, that the ſum of moral inſtruction may be compriſed in two words, *ανεχȣ και απεχȣ*, *i. e.* endure and abſtain, or bear and forbear. Aulus Gellius repreſents him as the greateſt man the ſect of the Stoics ever produced. The tyranny of Domitian, notwithſtanding his extreme poverty and ſingular merit, included him in the number of thoſe philoſophers who were baniſhed from Italy; and to the arbitrary decree of this monſter, he calmly ſubmitted, conſidering himſelf as a citizen of the world, and fully appriſed, that wherever he went he carried his beſt treaſure along with him. At Nicopolis in Epirus, which he choſe as the place of his reſidence, he purſued his deſign of correcting vice and folly by the precepts of philoſophy. The wiſdom and eloquence of his diſcourſes were held in ſuch high eſtimation, that his hearers were very numerous, and it became a common practice among them to commit his inſtructions to writing. It is not certain whether he returned to Rome after the death of Domitian; but the reſpect which Adrian entertained for him renders it probable, that he ſpent the latter part of his life in that city. Here, however, he obtained no favours, that could induce him to abandon that humble condition of contented and independent poverty, which he had ſelected, and in which he determined to remain. Of the time and manner of his death we have no certain account. Themiſtius and Suidas aſſert that he lived till the time of the Antonines; but from the mention that is made of him by Aulus Gellius and Marcus Aurelius, it is probable that he died towards the cloſe of the reign of Adrian. His name and memory were ſo much reſpected after his deceaſe, that, according to Lucian, the earthen lamp, by which he uſed to ſtudy, was ſold for 3000 drachmas, or more than 90*l.* of our money. The teſtimony of Suidas, who aſſerts that Epictetus wrote many books, is not ſupported by any ancient author; however this be, the only remains of this philoſopher are his beautiful moral manual, entitled "Enchiridion," and his "Diſſertations," ſelected by Arrian, which were drawn up from notes taken by his diſciples from his lips. Arrian's account of his life and death is not now extant, Simplicius has left a commentary upon his doctrine, in the eclectic manner. There are alſo various fragments of his wiſdom preſerved by Antoninus, Gellius, Stobæus, and others. Although the doctrine of Epictetus is leſs extravagant than that of any other Stoic, his writings every where breathe the true ſpirit of Stoiciſm. The tenet of the immortality of the ſoul was adopted and maintained by him with a degree of conſiſtency ſuited to a more rational ſyſtem than that of the Stoics, who inculcated a renovation of being in the circuit of events, according to the inevitable order of fate; and his exhortations to contentment and ſubmiſſion to Providence are enforced on much ſounder principles than thoſe of the Stoics. He alſo ſtrenuouſly oppoſed the opinion held by the Stoics in general, concerning the lawfulneſs of ſuicide; and his whole ſyſtem of practical virtues approaches nearer than that of any other inſtructor, unenlightened by revelation, to the purity of Chriſtian morality. We have various editions of the remains of this philoſopher, publiſhed at Leyden in 1670, in 8vo. cum notis variorum; at Utrecht in 1711, in 4to.; at Oxford, in 1740, in 8vo. by Joſeph Simpſon, together with the Table of Cebes, &c.; at London in 1742 by J. Upton, in two volumes 4to. which is the moſt valuable of all. The Enchiridion was publiſhed by C. G. Heyne, in 1776, in 8vo. and, together with Cebes's table, by Schweighauſer, in 1798, 8vo. Theſe have been tranſlated into various languages; but the moſt eſteemed verſion in our country is that by Mrs. Carter, publiſhed in 1758, with notes. Fabr. Bib. Græc. v. iii. Aul. Gell. l. i. c. 2. Arrian, l. i. iii. Lucian in Pereg.

t. iv. Adv. Indoct. lib. ement. t. ii. Brucker's Hiſt. Phil. by Enfield, vol. ii.

EPICUREANS, a ſort of ancient philoſophers, who adhered to the doctrines and opinions of Epicurus. See Epicurus.

The doctrines of Epicurus, as they are ſtated in a juſt, comprehenſive, and elaborate detail by Brucker in his "Hiſtory of Philoſophy," tranſlated and abridged by Dr. Enfield, are arranged under the diſtinct heads of Philoſophy in general, canons or rules of philoſophiſing, Phyſics, and Ethics. Philoſophy is the exerciſe of reaſon in the purſuit and attainment of a happy life; whence it follows, that thoſe ſtudies which conduce neither to the acquiſition nor the enjoyment of happineſs are to be diſmiſſed as of no value. The end of all ſpeculation ought to be, to enable men to judge with certainty what is to be choſen, and what to be avoided, to preſerve themſelves free from pain, and to ſecure health of body and tranquillity of mind. Accordingly, the young ſhould apply to the ſtudy of it without delay, nor ſhould the old be ever weary in the purſuit of it. As nothing ought to be dearer to a philoſopher than truth, he ſhould proſecute it by the moſt direct means, deviſing no fictions himſelf, nor ſuffering himſelf to be impoſed upon by the fictions of others, neither poets, orators, nor logicians; making no other uſe of the rules of rhetoric or grammar, than to enable him to ſpeak or write with accuracy and perſpicuity, and always preferring a plain and ſimple to an ornamented ſtyle. A wiſe man will embrace ſuch tenets, and only ſuch, as are built upon experience, or upon certain and indiſputable axioms. Philoſophy conſiſts of two parts:—phyſics, which reſpect the contemplation of nature; and ethics, which are employed in the regulation of manners. Of theſe, the latter is the moſt important; the knowledge of nature being only neceſſary as a means of promoting the happineſs of life. Philoſophers have added a third part, dialectics; which ought to be rejected, as only productive of thorny diſputes, idle quibbles, and fruitleſs cavilling. In order to facilitate the purſuit of knowledge, a few plain maxims and rules may be uſeful. Truth is of two kinds; that which reſpects real exiſtence, and that which conſiſts in a perfect agreement between the conception of the mind and the nature of things. In order to judge rightly concerning truth, it is neceſſary to uſe ſome criterion, or inſtrument, of judging. This criterion will vary according to the nature of the object which the mind contemplates. In judging of natural and moral objects, the three inſtruments employed are ſenſe, preconception, and paſſion. The maxims, or canons, pertaining to ſenſe, are four: Firſt, that the ſenſes can never be deceived, and conſequently, that every perception of an image, or appearance, is true; that is, that the perception, or ſimple apprehenſion, and its efficient cauſe, the ſpecies or image flowing from the object, really agree. Secondly, opinion, or judgment, is conſequent upon perception, and admits of truth or falſehood. Perceptions, or ſenſations, are the effect of real external *phenomena*; but when the mind judges concerning theſe appearances, the opinion may be either right or wrong. Thirdly, every opinion is to be admitted as true, which is atteſted, or not contradicted, by the evidence of the ſenſes, after a careful and deliberate examination of every circumſtance which can be ſuppoſed to affect the queſtion. Fourthly, an opinion contradicted, or not atteſted by the evidence of the ſenſes, is falſe. Thus, the opinion of a *Plenum* muſt be falſe, becauſe it contradicts the evidence of the ſenſes, which atteſt, that there is ſuch a thing as motion. Concerning the ſecond inſtrument of judgment, *viz.* πρόληψις, or pre-conception, four canons may be laid down. Firſt, that all pre-conceptions are derived from the ſenſes, either by immediate impreſſion, as of an individual man; by enlargement or diminution, as of a giant or dwarf; by reſemblance, as of an unknown city to one which has been ſeen; or by compoſition, as of a centaur. Secondly, pre-conception is neceſſary to enable us to reaſon, inquire, or judge of any thing. Thirdly, pre-conceptions, or univerſal notions, are the principles of all reaſoning and diſcourſe; and we eaſily refer to theſe in comparing one thing with another. If theſe notions be agreeable to nature, and diſtinctly conceived, artificial reaſoning will be unneceſſary. Fourthly, truths, not ſelf-evident, are to be deduced from manifeſt pre-conceptions; or, where the relation of ideas is obſcure, it is to be made evident by the intermediate uſe of ſome acknowledged principle. The third inſtrument, paſſion, or affection, which comprehends pleaſure and pain, admits of the following four evident maxims. Firſt, all pleaſure, to which no pain is annexed, is for its own ſake to be purſued. Secondly, all pain, to which no pleaſure is annexed, is for its own ſake to be avoided. Thirdly, that pleaſure, which either prevents the enjoyment of a greater pleaſure, or produces a greater pain, is to be ſhunned. Fourthly, that pain, which either removes a greater pain, or procures a greater pleaſure, is to be endured. As to the uſe of words, two canons are ſufficient. Firſt, in ſpeaking, uſe terms in common uſe, and in the ſenſe in which they are commonly underſtood. Secondly, in hearing, or reading, attend carefully to the ſignification which the ſpeaker or writer affixes to his terms. Attention to theſe maxims would prevent much obſcurity and confuſion, and terminate many diſputes. By theſe rules Epicurus undertook to conduct his followers into the ſecrets of nature, and to lay open to them the origin of things.

The phyſical doctrine of Epicurus was as follows: Nothing can ever ſpring from nothing, nor can any thing ever return to nothing. The univerſe always exiſted, and will always remain; for there is nothing into which it can be changed. There is nothing in nature, nor can any thing be conceived, beſides body and ſpace. Body is that which poſſeſſes the properties of bulk, figure, reſiſtance, and gravity: it is this alone which can touch and be touched. Space, or *vacuum*, deſtitute of the properties of body, incapable of action or paſſion, is the region which is or may be occupied by body, and which affords it an opportunity of moving freely. The exiſtence of bodies is atteſted by the ſenſes. Space muſt alſo exiſt, in order to allow bodies place in which to move and exiſt; and of their exiſtence and motion we have the certain proof of perception. Beſides body and ſpace, no third nature can be conceived. But the exiſtence of qualities is not precluded, becauſe theſe have no ſubſiſtence except in the body to which they belong. The univerſe, conſiſting of body and ſpace, is infinite. Bodies are infinite in multitude; ſpace is infinite in magnitude. The univerſe is immoveable, becauſe there is no place beyond it into which it can move. It is alſo eternal and immutable, ſince it is liable to neither increaſe nor decreaſe, to production nor decay. Nevertheleſs, the parts of the univerſe are in motion, and are ſubject to change. All bodies conſiſt of parts, which are either themſelves ſimple principles, or may be reſolved into ſuch. Theſe firſt principles, or ſimple atoms, are diviſible by no force, and therefore muſt be immutable. The exiſtence of ſuch atoms is indiſputable, becauſe it is impoſſible that any thing which exiſts ſhould be reduced to nothing. A finite body cannot conſiſt of parts infinite either in magnitude or number; and therefore diviſibility of bodies *in infinitum* is inconceivable. All atoms are of the ſame nature, without any difference in eſſential qualities; and yet it appears, from their different effects upon the ſenſes, that they differ in magnitude, figure, and weight. Atoms exiſt in every poſſible variety of figure; and yet on account of their ſolidity, they are infrangible, or incapable of actual diviſion. Gravity is an eſſential principle of atoms; for being perpetually in motion, or making an effort to move, they muſt be moved by an internal impulſe, which may be called gravity. By this internal force, atoms are carried forward in a direction, which is nearly rectilinear; and whilſt they paſs through free ſpace, their declination from a right line occaſions a caſual concurrence of corpuſcles of different forms. Thus various kinds of curvilinear motion will be produced. Moreover, when one atom is reflected from another, and again repelled by a third, it will acquire a kind of vibratory or tremulous motion. Hence an univerſal agitation will enſue. The principle of gravity, being eſſential to the primary corpuſcles or atoms, theſe muſt have been inceſſantly, and from eternity, in actual motion; and with a velocity, when no obſtacle intervenes, which will cauſe them to paſs through the greateſt imaginable ſpace in the ſmalleſt imaginable portion of time. All atoms are alſo ſuppoſed, whilſt they paſs without reſiſtance through the ſame empty ſpace, to move with equal velocity; and though, by colliſion, their direction may be changed, their velocity is not diminiſhed. Atoms are the elements from which all things are compounded, and into which they are reſolved; and the energy, or principle of motion, which eſſentially belongs to them, is the ſole agent in the operations of nature. Action originates in atoms, and from theſe proceeds to compound bodies. Al the changes which take place in the figure, and other properties of bodies, conſiſt in local motion. Bodies are more or leſs rare, in proportion to the ſize of the vacuities which intercept the ſolid atoms of which they are compoſed. Tranſparency depends partly upon the ſame cauſe, and partly upon the poſition of the vacuities between the particles: for rays of light will paſs eaſily through a denſe body, as glaſs, if its vacuities be placed in a ſtraight line. Hardneſs and ſoftneſs, flexibility, ductility, and other qualities, may be explained in a ſimilar manner. The weight of a body is the reſult of the weight of all its atoms; and ſince gravity is an eſſential property of all atoms, all bodies muſt be heavy; and the only reaſon why ſome bodies appear to have the contrary principle of levity is, that they are driven upwards by the denſer maſs in which they are placed. Heat is the influx of certain ſmall, round, ſoft corpuſcles, which inſinuate themſelves into the pores of bodies in continual ſucceſſion, till by their perpetual action, the parts are ſeparated, and at length the body diſſolved. The ſenſe of heat is the perception of the ſeparation of parts, which were before contiguous. Cold is the influx of certain irregular atoms, whoſe motion is ſlower than that of thoſe which occaſion heat, and their effect the reverſe of the former. Pleaſure and pain, motion and reſt, and even time, are actions of bodies. Production and diſſolution are nothing more than a change of the poſition of atoms, or an increaſe or diminution of the particles of which bodies are compoſed. The world is finite and terminable, and muſt have ſome figure, though this cannot poſſibly be aſcertained. It is not eternal, but began at a certain time to exiſt; for ſince every thing in the world is liable to viciſſitudes of production and decay, the world itſelf muſt partake of them. This may alſo be inferred from the ſhort date of hiſtory, and the late invention of arts.

The formation of the world may be conceived to have happened in the following manner: a finite number of that infinite multitude of atoms, which, with infinite ſpace, conſtitutes the univerſe, falling fortuitouſly into the region of the world, were in conſequence of their innate motion collected into one rude and indigeſted maſs. In this chaos, the heavieſt and largeſt atoms, or collections of atoms, firſt ſubſided, whilſt the ſmaller, and thoſe which from their form would move moſt freely, were driven upwards. Theſe latter, after many reverberations, roſe into the outer region of the world, and formed the heavens. Thoſe atoms, which by their ſize and figure were ſuited to form fiery bodies, collected themſelves into ſtars: thoſe which were not capable of riſing ſo high in the ſphere of the world, being diſturbed by the fiery particles, formed themſelves into air. At length from thoſe which ſubſided was produced the earth. By the action of air, agitated by heat from the heavenly bodies upon the mixed maſs of the earth, its ſmoother and lighter particles were ſeparated from the reſt, and water was produced, which naturally flowed into the loweſt places. In the firſt combination of atoms, which formed the chaos, various ſeeds aroſe, which, being preſerved and nouriſhed by moiſture and heat, afterwards ſprung forth in organized bodies of different kinds. Of the animal productions of the earth, ſome may be conceived to have been produced imperfect, and therefore incapable of life, but others would come forth more perfect. Theſe, after the earth was exhauſted of its ſeminal virtues, would reſpectively continue their ſpecies. The world, thus formed, would be preſerved by the ſame mechanical cauſes which produced it; but by the inceſſant motion of atoms, which alone are ſolid and incorruptible, it would gradually tend to diſſolution. In proceſs of time nothing will remain but ſeparate atoms and infinite ſpace. As atoms are infinite, the number of worlds may alſo be infinite. The earth occupies the middle part of the world; but no point within it is properly the centre of gravity, for all heavy bodies fall in nearly parallel lines. The doctrine of Antipodes, according to the Epicurean philoſophy, is falſe. The figure of the earth is a circular plane; and it is preſerved from falling towards the lower region by the air, with which it is congenial, and upon which therefore it does not preſs; their mutual action deſtroying the effect of gravity. Earthquakes are cauſed by the agitation of internal winds and water, or by the decay or ſudden fall of columns, that ſupport portions of the earth's ſurface. Or, the internal winds may be converted into fires, which may cauſe ſudden and violent eruptions, as in mount Ætna. Waters paſſing out of the ſea into the crevices of the earth, undergo a filtration, by which the particles of ſalt received by them from the bed of the ſea are ſeparated. Foſſils and plants are produced by the motion of atoms, that cauſe the continual tranſpoſition, accretion or diminution of individual bodies. Having no vital principle, they can only be ſaid analogically to live or die. Animals having been once formed, at the beginning of the world, by the caſual conjunction of ſimilar atoms, the production of animal bodies is ſtill continued in a conſiſtent and determinate order. The parts of animals were not originally framed for the uſes to which they are now applied; but, having been accidentally produced, they were afterwards accidentally employed. The eye, for example, was not made for ſeeing, nor the ear for hearing, but the ſoul, being formed within the body at the ſame time with theſe organs, and connected with them, could not avoid making uſe of them in their reſpective functions. The ſoul is a ſubtle corporeal ſubſtance, compoſed of the fineſt atoms; which, by the extreme tenuity of its particles, is able to penetrate the whole body, and to adhere to all its parts. It is compoſed of four diſtinct parts; fire, which cauſes animal heat; an ethereal principle, which is moiſt vapour; air; and a fourth principle, which is the cauſe of ſenſation. Theſe four parts are ſo perfectly combined as to form one ſubtle ſubſtance, which, whilſt it remains in the body, is the cauſe of all its faculties, motions, and paſſions, and which cannot be ſeparated from it, without producing the entire diſſolution of the animal ſyſtem. Different ſenſations are the caſual effects of the different organs, which the ſoul in its union with the body is capable of employing, and of the different properties and qualities of external objects. Theſe become ſenſible by means of certain ſpecies, or images, which are perpetually paſſing like thin films from bodies, in form ſimilar to the ſurfaces of the bodies themſelves, and ſtriking upon organs fitted to receive them. The mind, or intellect, which is endued with the power of thinking, judging, and determining, is formed of particles moſt ſubtle in their nature, and capable of the moſt rapid motion. This intellect is a portion of the ſoul, forming with it one nature, and yet retaining its diſtinct character, which is the power of thinking; the ſuppoſed ſeat of it is the middle of the breaſt, or the heart, which we perceive to be the region of thoſe affections which are excited by cogitation. Thought is produced by ſubtle images, which find their way through the body, and, when they arrive at the intellect, move it to think. The affections and paſſions of the ſoul may be reduced to two, pleaſure and pain. Voluntary motion is the effect of images conveyed to the mind, by which pleaſurable or painful conceptions are formed, and ſubſequent deſires or averſions are produced, which become the immediate ſprings of action. Sleep is produced, when the parts of the ſoul, which are at other times diffuſed through the body, are expreſſed or ſeparated by the action of the air, or of food. Dreams are the effect of images caſually flying about, which from their extreme tenuity penetrate the body and ſtrike upon the mind, exciting an imaginary perception of thoſe things, of which they are images. Death is the privation of ſenſation, in conſequence of the ſeparation of the ſoul from the body; in which caſe, the ſoul is diſperſed into the corpuſcles or atoms of which it was compoſed, and therefore can no longer be capable of thought or perception. The knowledge of things, which belong to the regions above the earth, whether aërial or celeſtial, is to be purſued only for freeing the mind from imaginary fears, and ſettling it in a ſtate of tranquillity. In the heavens, or ethereal regions, the ſun, moon, and ſtars appear to be fiery bodies; or they may be ſmooth mirrors, from which bright fiery particles flowing through the ethereal regions are reflected to the earth; or they may be deep veſſels, containing fires; or they may be circular plates heated like mortar, or ſtones in a furnace. The apparent motion of the heavenly bodies may ariſe from the revolution of the whole heaven in which they are fixed, like nails in a ſolid body: or by the revolution of the bodies themſelves through the heaven as a fluid and permeable medium. The cauſe of this motion may be, either an internal neceſſity in the natures of the bodies themſelves, or the external preſſure of ſome ethereal fluid.

In the univerſe there are, according to Epicurus, without contradiction, divine natures; becauſe nature itſelf has impreſſed the idea of divinity upon the minds of men. The notion is univerſal, nor is it eſtabliſhed by cuſtom, law, or any human inſtitution; but it is the effect of an innate principle, producing univerſal conſent, and therefore it muſt be true. This univerſal notion has probably ariſen from images of the gods, which have caſually made their way into the minds of men in ſleep, and have afterwards been recollected. But it is inconſiſtent with our natural notions of the gods, as happy and immortal beings, to ſuppoſe that they encumber themſelves with the management of the world, or are ſubject to the cares and paſſions which muſt attend ſo great a charge. Hence it is inferred, that the gods have no intercourſe with mankind, nor any concern with the affairs of the world. Nevertheleſs, on account of their excellent nature, they are objects of reverence and worſhip. In their external ſhape the gods reſemble men; and though the place of their reſidence is unknown to mortals, it is without doubt the manſion of perfect purity, tranquillity, and happineſs.

Upon a review of the preceding ſummary of the Epicurean ſyſtem, furniſhed chiefly by Laertius and Lucretius, it muſt appear to be a feeble and ineffectual effort to explain the phenomena of nature upon mechanical principles. With this view Epicurus adopts a variety of wild and fanciful hypotheſes, which evince his incapacity of ſolving the grand problem concerning the origin and formation of the world. But the greateſt defect of this ſyſtem is the attempt of its author to account for all the appearances of nature, even thoſe which reſpect animated and intelligent beings, upon the ſimple principles of matter and motion, without introducing the agency of a Supreme Intelligence, or admitting any other idea of fate, than that of blind neceſſity inherent in every atom, by which it moves in a certain direction. Hence he leaves unexplained thoſe appearances of deſign, which are ſo manifeſt in every part of nature, and abſurdly ſuppoſes, that the eye was not made for ſeeing, nor the ear for hearing. Beſides the idea which he gives of the nature of the gods, whoſe exiſtence he admits, as ſimilar to man; and of their condition, as wholly ſeparate from the world, and enjoying no other felicity except that which ariſes from inactive tranquillity, falls infinitely ſhort of the true conception of Deity, as the intelligent Creator and Governor of the world.

The doctrine of Epicurus concerning nature differs from that of the Stoics, (ſee STOICS,) chiefly in the following particulars: while the latter held God to be the ſoul of the world, diffuſed through univerſal nature, the former admitted no primary intelligent nature into his ſyſtem, but held atoms and ſpace to be the firſt principles of all things; and whilſt the Stoics conceived the active and paſſive principles of nature to be connected by the chain of fate, Epicurus aſcribed every appearance in nature to a fortuitous colliſion and combination of atoms. See ATOMICAL and CORPUSCULAR *Philoſophy*.

The ethics of Epicurus are much leſs exceptionable than his phyſics; of which we may judge from the following ſummary. The end of living, or the ultimate good, which is to be ſought for its own ſake, according to the univerſal opinion of mankind, is happineſs: which men generally fail of attaining, becauſe they form wrong notions of the nature of happineſs, or do not uſe proper means for attaining it. The happineſs, which belongs to man, is that ſtate in which he enjoys as many of the good things, and ſuffers as few of the evils incident to human nature as poſſible, paſſing his days in a ſmooth courſe of permanent tranquillity. Perfect happineſs cannot poſſibly be poſſeſſed without the pleaſure that attends freedom from pain, and the enjoyment of the good things of life. Pleaſure is in its nature good, and ought to be purſued; and pain is in its nature evil, and ſhould be avoided. Beſides, pleaſure or pain is the meaſure of what is good or evil in every object of deſire or averſion. However, pleaſure ought not in every inſtance to be purſued, nor pain to be avoided; but reaſon is to diſtinguiſh

guiſh and compare the nature and degrees of each, that the reſult may be a wiſe choice of that which ſhall appear to be, upon the whole, good. That pleaſure is the firſt good appears from the inclination which every animal, from its firſt birth, diſcovers to purſue pleaſure and avoid pain; and is confirmed by the univerſal experience of mankind, who are incited to action by no other principle, than the deſire of avoiding pain, or obtaining pleaſure. Of pleaſure there are two kinds; one conſiſting in a ſtate of reſt, in which both body and mind are free from pain: the other ariſing from an agreeable agitation of the ſenſes, producing a correſpondent emotion in the ſoul. Upon the former of theſe, the enjoyment of life chiefly depends. Happineſs may, therefore, be ſaid to conſiſt in bodily eaſe and mental tranquillity. It is the office of reaſon to confine the purſuit of pleaſure within the limits of nature, ſo as to attain this happy ſtate; which neither reſembles a rapid torrent, nor a ſtanding pool, but is like a gentle ſtream, that glides ſmoothly and ſilently along. This happy ſtate can only be attained by a prudent care of the body, and a ſteady government of the mind. The diſeaſes of the body are to be prevented by temperance, or cured by medicine, or endured tolerably by patience. Againſt the diſeaſes of the mind philoſophy provides ſufficient antidotes; the virtues are its inſtruments for this purpoſe; the radical ſpring of which is prudence, or wiſdom, and this inſtructs men to free their underſtandings from the clouds of prejudice; to exerciſe temperance and fortitude in the government of themſelves; and to practiſe juſtice toward all others. In a happy life, pleaſure can never be ſeparated from virtue. A prudent man will conſult his natural diſpoſition in the choice of his plan of life. Temperance is that diſcreet regulation of the deſires and paſſions, by which we are enabled to enjoy pleaſures without ſuffering any conſequent inconvenience. They who maintain ſuch a conſtant ſelf-command, as never to be enticed by the proſpect of preſent indulgence to do that which will be productive of evil, obtain the trueſt pleaſure by declining pleaſure. Sobriety, as oppoſed to inebriety and gluttony, teaches men that nature is ſatisfied with a little, and enables them to be contented with ſimple and frugal fare: thus health is preſerved; the offices of life are performed with alertneſs and activity; and the occaſional varieties of a plentiful board acquire an excellent reliſh, and a perſon is prepared to meet every reverſe of fortune without the fear of want. Continence, which is a branch of temperance, prevents the diſeaſes, infamy, remorſe, and puniſhment to which thoſe are expoſed, who indulge themſelves in unlawful amours. Muſic and poetry, which are often employed as incentives to licentious pleaſure, are to be cautiouſly and ſparingly uſed. Gentleneſs, as oppoſed to an iraſcible temper, greatly contributes to the tranquillity and happineſs of life, by preſerving the mind from perturbation, and arming it againſt the aſſaults of calumny and malice. Moderation in the purſuit of honours or riches, is the only ſecurity againſt diſappointment and vexation. A wiſe man will, therefore, prefer the ſimplicity of ruſtic life to the magnificence of courts. As the events of futurity are uncertain, he neither will be elated with confident expectation, nor depreſſed by doubt and deſpair; the one and the other being equally deſtructive of tranquillity. It will contribute to the enjoyment of life, to conſider death as the perfect termination of a happy life, which it becomes us to cloſe like ſatisfied gueſts, neither regretting the paſt, nor anxious for the future. Fortitude, by enabling us to endure pain and baniſh fear, is of great uſe in producing tranquillity. Philoſophy inſtructs us to pay homage to the gods, not through hope or fear, but from veneration of their ſuperior nature. It enables us alſo to conquer the fear of death, by teaching us, that it is no proper object of terror; ſince, whilſt we are, death is not, and when death arrives, we are not; ſo that it concerns neither the living nor the dead. The only evils to be apprehended are bodily pain and diſtreſs of mind. It becomes a wiſe man to endure the former with patience and firmneſs, becauſe, if it be ſlight it may be eaſily borne; and if it be intenſe, it cannot laſt long. Mental diſtreſs commonly ariſes, not from nature, but from opinion; a wiſe man, will, therefore, arm himſelf againſt this kind of ſuffering, by reflecting that the gifts of fortune, the loſs of which he may be inclined to deplore, were never his own, but depended upon circumſtances which he could not command. If, therefore, they happen to leave him, he will endeavour as ſoon as poſſible to obliterate the remembrance of them, by occupying his mind in pleaſant contemplation, and engaging in agreeable avocations. Juſtice reſpects man as living in ſociety, and is the common bond without which no ſociety can ſubſiſt. This virtue, like the reſt, derives its value from its tendency to promote the happineſs of life. It is the intereſt of every individual in a ſtate of ſociety to conform to the laws of juſtice, for in ſociety, the neceſſity of the exerciſe of mutual juſtice, in order to the common enjoyment of the gifts of nature, is the ground of thoſe laws by which it is preſcribed. Nearly allied to juſtice are the virtues of beneficence, compaſſion, gratitude, piety, and friendſhip. He who confers benefits upon others, procures to himſelf the ſatisfaction of ſeeing the ſtream of plenty ſpreading around him from the fountain of his own beneficence; at the ſame time he enjoys the pleaſure of being eſteemed by others. The exerciſe of gratitude, filial affection, and reverence for the gods, is neceſſary, in order to avoid the hatred and contempt of all men. Friendſhips are contracted for the ſake of mutual benefit; but by degrees they ripen into ſuch diſintereſted attachment, that they are continued without any proſpect of advantage. A true friend will partake of the wants and ſorrows of his friend, as if they were his own; if he be in want, he will relieve him; if he be in priſon, he will viſit him; if he be ſick, he will come to him; nay, ſituations may occur, in which he would not ſcruple to die for him. It cannot then be doubted, that friendſhip is one of the moſt uſeful means of procuring a ſecure, tranquil, and happy life.

From the preceding ſummary of the ethics of Epicurus, we may be enabled to refute the cenſures which many writers have paſſed upon him, as the preceptor of luxurious and licentious pleaſures. Theſe cenſures have originated in a miſconception of the nature of that pleaſure which he recommends and juſtifies, and which, in his ſyſtem, is only another name for happineſs. Whilſt the Stoics taught that virtue itſelf is happineſs, Epicurus maintained, that the motive by which men are induced to practiſe virtue is the deſire of happineſs. Both taught, that it is impoſſible to be happy without virtue, and both ſuppoſed virtue to conſiſt in a conformity to nature. Whatever errors and abſurdities may be juſtly charged on the Epicurean ſyſtem, it muſt be allowed that, when candidly and fairly interpreted, it afforded no encouragement to immoral conduct. However, it cannot be denied by its moſt zealous advocates, that by the erroneous repreſentations of the gods, and the diſbelief of providence and the immortality of the ſoul, which this ſyſtem propagated, it ſerved very much to relax the obligations and enfeeble the ſanctions and motives of virtue. This was actually the caſe both at Athens and at Rome, where thoſe who belonged to the ſchool of Epicurus, partly diſſeminating his genuine doctrine and partly perverting it, diſgraced the ſyſtem to which they adhered by the laxity and diſſoluteneſs of their manners. Some indeed have expreſſed a doubt, whether Epicurus himſelf diſbelieved the immortality of the ſoul. (See the notes upon "Cudworth's Intellectual ſyſtem of the Univerſe," ſubjoined by Dr. Moſheim to his Latin tranſlation of that learned work, vol. i. p. 66. 500. vol. ii. p. 1174.) His followers, however, ſeem to have been more explicit on this ſubject; and Moſheim aſſerts (Eccl. Hiſt. v. i. p. 167.) that towards the cloſe of the ſecond century of the Chriſtian era, of all the philoſophers, the Epicureans enjoyed the greateſt reputation, and had undoubtedly the greateſt number of followers, becauſe their opinions tended to encourage the indolent ſecurity of a voluptuous and effeminate life, and to baniſh the remorſe and terrors that haunt vice, and naturally incommode the wicked in their ſenſual purſuits. Hence it is certain, that in the common uſe of the appellation, Epicurean has been underſtood to ſignify an indolent, effeminate, and voluptuous perſon, who only conſults his particular and private pleaſure, without concerning himſelf with any thing ſerious. Accordingly it has been maintained, that there were always two kinds of Epicureans, the rigid and the remiſs. The rigid Epicureans were thoſe who were ſtrictly attached to the ſentiments of Epicurus, and who placed their whole happineſs in the true pleaſures of the mind, reſulting from the practice of virtue. The looſe or remiſs Epicureans, taking the words of that philoſopher in a more groſs ſenſe, placed all their happineſs in corporeal gratifications and pleaſures, in eating, drinking, &c. Thoſe of the former claſs, who were the genuine Epicureans, called the others the "Sophiſts of their ſect." In the "Nouveau Dictionaire Hiſtorique" the reader may find a ſhort account of modern Epicurean ſchools in France, the members of which were more diſtinguiſhed by their literary refinement, poliſhed manners, and luxurious indulgence, than their culture of the genuine doctrine of the Greek philoſopher.

Before we cloſe this article, we ſhall briefly trace the ſubſiſtence and progreſs of the Epicurean ſchool, after the death of its founder. From Epicurus the charge of it devolved upon his friend Hermachus; and it was continued in ſucceſſion by Polyſtratus, Baſilides, Protarchus, and others. The ſect ſubſiſted, in a depraved and degraded ſtate, till the decline of the Roman empire. It entered Rome, indeed, in conſequence of the oppoſition excited againſt it by the Stoics in Greece, under a heavy load of obloquy. This was much increaſed by the vehemence with which Cicero, (De Fin. l. ii. Tuſc. Qu. l. 1. 3. Fam. Ep. xiii. 1. Orat. in Piſon. c. 22.) inveighed againſt this ſect, and by the eaſy credit which he gave to the calumnies induſtriouſly circulated againſt its founder. It was, however, patronized by ſeveral perſons of diſtinction in Rome, and particularly by Atticus, the boſom friend of Cicero. Nevertheleſs, the true doctrine of Epicurus was not fully ſtated by any Roman writer, till Lucretius, with much accuracy of conception and clearneſs of method, as well as with great ſtrength and elegance of diction, unfolded the Epicurean ſyſtem in his poem, "De Rerum Naturâ," "On the Nature of Things." The Epicurean ſect, though much degenerated from the ſimple manners of its founder, continued to flouriſh through a long courſe of years under the Roman emperors. This was owing in part to the freedom of manners which it permitted, and in part to the boldneſs with which it combated ſuperſtition; but principally to the ſtrict union which ſubſiſted among the members of this ſchool, and the implicit deference which they unanimouſly agreed to pay to the doctrines of their maſter. The ſucceſſion of diſciples in this ſect was, as Laertius atteſts (l. x. § 9.) uninterrupted, even when other ſchools began to fail. In many places the doctrine of Epicurus was publicly taught, and at Athens the Epicurean ſchool was endowed with a fixed ſtipend. Among the learned men of this period there were ſome, whoſe whole concern was to tranſmit the tenets and maxims of Epicurus uncorrupted to poſterity; and others, who held the memory of Epicurus in high eſtimation, and in many particulars adopted his doctrine, and who, therefore, may not improperly be ranked in the claſs of Epicureans. The principal of theſe are Pliny the elder, Celſus, Lucian, and Diogenes Laertius. After the revival of letters at a much later period, there were not wanting ſeveral learned men, who, finding little ſatisfaction in the obſcure and ſubtle ſpeculations of metaphyſics, had recourſe to the doctrine of Epicurus, as the true key to the myſteries of nature. The firſt reſtorer of the Epicurean ſyſtem among the moderns was Daniel Sennert, an eminent phyſician of Wittemburg, who flouriſhed at the beginning of the 17th century. Sennert, however, confounded the corpuſcles of the more ancient philoſophers with the atoms of Democritus and Epicurus, and held that each element has primary particles peculiar to itſelf. The ſame doctrine was taught, with ſome inconſiderable variations, by Chryſoſtom Magnenus, profeſſor of medicine in the univerſity of Pavia, who, in the year 1646, publiſhed "A treatiſe on the Life and Philoſophy of Democritus." His ſyſtem is rendered obſcure by an attempt to unite the incompatible dogmas of Epicurus and Ariſtotle. The ableſt and moſt ſucceſsful attempt towards the revival of the phyſical and moral philoſophy of Epicurus was made by Peter Gaſſendi, who, beſides a variety of other learned treatiſes, wrote a life of Epicurus, in which he undertakes to reſcue that philoſopher from the load of calumny under which his memory had lain for many ages, as well as to give a fair and impartial repreſentation of his doctrine. The moſt celebrated followers of Gaſſendi were Francis Bernier, a phyſician of Montpelier, who wrote an "Abridgement of Gaſſendi's Philoſophy," Par. 1678, and Walter Charlton, an Engliſhman, who wrote a treatiſe, entitled "Phyſiologia Epicuro-Gaſſendo-Charletoniana," Lond. 1654, in which he attempts to eſtabliſh natural ſcience upon atomic principles. Indeed, the doctrine of atoms and a vacuum has been embraced by the moſt eminent philoſophers. Huygens applies it to explain the cauſe of gravitation, and Newton admits it into his theory of natural philoſophy. (See Atomical *Philoſophy*.) Diogenes Laertius. l. x. Lucretius de Rerum Natura. Stanley's Hiſt. Phil. part. xiii. Gaſſendus de Vita et Moribus Epicuri. Bayle. art. *Epicurus*. Brucker's Hiſt. Phil. by Enfield.

EPICURUS, in *Biography*, the founder of the ſyſtem deſcribed in the preceding article, was an Athenian, of the Ægean tribe, the ſon of Neocles and Chæreſtrata, perſons of honourable deſcent but reduced condition, and born at Gargettus in the vicinity of Athens, at the beginning of the third year of the 109th olympiad, B. C. 342. Neocles, being reduced to poverty, was ſent with a colony of 2000 Athenian citizens to the iſland of Samos, where he occupied a ſmall farm, and took up the profeſſion of a ſchool-maſter; and where his wife Chæreſtrata performed the arts of incantation and luſtration, for the purpoſe of curing diſeaſes and driving away ſpectres, in which, it is ſaid, ſhe was aſſiſted by her ſon, Epicurus, who furniſhed her with luſtral ſongs for her ſolemn rites. Epicurus remained at Samos and in the neighbouring iſland of Teos, till he was 18 years of age, and then removed, with a view to farther advantage for improvement, to Athens. Upon the death of Alexander, he left Athens, and went to his father at Colophon. Soon afterwards he removed to Mitylene, and after paſſing one year in that city, he reſided for 4 years at Lampſacus. In the 36th year of his age, he returned to Athens. From his 14th year to this time, he was induſtriouſly employed in the ſtudy of philoſophy. At Samos he was inſtructed in the Platonic philoſophy by Pamphilus, as Cicero informs us (De Nat. Deor. l. i. c. 26.), and, as we learn from Clement of Alexandria (Strom. l. i.); he attended in his early years upon Nauſiphanes a Pythagorean, and Pyrrho the ſceptic. During his abode at Athens he could not fail to derive conſiderable benefit from Xenocrates, who taught in the Academy, and from Theophraſtus, who delivered lectures in the Lyceum. His ſyſtem of philoſophy, however, was the reſult of his own reflections, after comparing the doctrines of other ſects. About the 32d year of his age, he opened a ſchool, firſt at Mitylene, and afterwards at Lampſacus; but not ſatisfied with theſe obſcure retreats, he determined to make his appearence on the more public theatre of Athens; and purchaſed for his own uſe, at the expence of 80 minæ, a pleaſant garden, where he taught his ſyſtem of philoſophy. From this circumſtance the Epicureans were denominated "the philoſophers of the garden." During the ſiege of Athens by Demetrius, when Epicurus was 44 years of age, and while the city was diſtreſſed with famine, he is ſaid to have ſupported himſelf and his friends on a ſmall quantity of beans, which he ſhared equally with them. The period in which he introduced his philoſophy was peculiarly favourable for his purpoſe: for in the room of the Socratic philoſophy nothing remained but the ſubtlety and affectation of Stoiciſm, the unnatural ſeverity of the Cynics; or the doctrine of indulgence taught and practiſed by the followers of Ariſtippus. The younger citizens were, therefore, diſpoſed to liſten to a preceptor who ſmoothed the ſtern and wrinkled brow of philoſophy, and, under the notion of conducting his followers to enjoyment in the bower of tranquility, led them, unawares, into the paths of moderation and virtue. This circumſtance rendered his ſchool popular, ſo that diſciples flocked into the garden, not only from different parts of Greece, but from Egypt and Aſia. Seneca, though a Stoic philoſopher, bears this teſtimony to Epicurus (Ep. 21.): "I the more freely quote the excellent maxims of Epicurus, in order to convince thoſe who became his followers from the hope of ſcreening their vices, that to whatever ſect they attach themſelves, they muſt live virtuouſly. Even at the entrance of the garden they will find this inſcription: "The hoſpitable keeper of this manſion, where you will find pleaſure the higheſt good, will preſent you liberally with barley cakes, and water from the ſpring. Theſe gardens will not provoke your appetite by artificial dainties, but ſatisfy it with natural ſupplies. Will you not then be well entertained?" The diſciples of Epicurus were ſo cordially attached to one another, that each individual cheerfully ſupplied the neceſſities of his brother. The friendſhip ſubſiſting in the Epicurean fraternity is deſcribed by Cicero (De Fin. l. i. c. 20.) as unequalled in the hiſtory of mankind; and Valerius Maximus (l. i. c. 8.) relates a memorable example of indiſſoluble friendſhip between Polycrates and Hippoclides, two philoſophers of the garden. Epicurus, that he might not be interrupted in the proſecution of his ſtudies, lived in a ſtate of celibacy; and he exhibited an example of that temperance and continence, which he inculcated on his diſciples. Towards the cloſe of his life, however, his conſtitution was enfeebled, and he was afflicted with the ſtone. When he perceived his end approaching, he wrote a will, in which he bequeathed his garden and its appurtenances to Hermachus, and in ſucceſſion to the future profeſſors of his philoſophy. On the laſt day of his life, he informs his friend Hermachus, that his pain was extreme: but he adds, "All this is counterbalanced by the ſatisfaction of mind, which I derive from the recollection of my diſcourſes and diſcoveries." He concludes with intreating his friend by the affection which he had always manifeſted to him and to philoſophy to take care of the children of Metrodorus. The emperor Marcus Antoninus confirms this account, and further ſays, that Epicurus, in his ſickneſs, relied more upon the recollection of his excellent life, than upon the aid of phyſicians, and inſtead of complaining of his pain, converſed with his friends upon thoſe principles of philoſophy which he had before maintained. At length, finding nature juſt exhauſted, he ordered himſelf to be put into a warm bath, where, after refreſhing himſelf with wine, and exhorting his friends not to forget his doctrines, he expired. His death happened in the ſecond year of the 127th olympiad, or B. C. 271, and in the 72d year of his age. He is ſaid to have written a greater number of original works than any other Grecian philoſopher; but none of them are extant, except a compendium of his doctrine preſerved by Laertius, and ſome few fragments diſperſed among ancient authors. His memory was held in high eſtimation, not only by his immediate followers, but by eminent writers, who diſapproved his philoſophy, but entertained a reſpect for his perſonal merit. Nevertheleſs his character and his philoſophy have been ſeverely cenſured; and the accuſations againſt the Epicurean ſchool have been more or leſs confirmed by men diſtinguiſhed for their wiſdom and virtue: Zeno, Cicero, Plutarch, Galen, and a long train of Chriſtian fathers. But a candid examination of his doctrine and character will obviate many of thoſe charges that have been alleged againſt them, and prove, that though in ſome reſpects this philoſopher is highly cenſurable, in others he has been unjuſtly and too ſeverely condemned. The charge of impiety admits of no refutation. The doctrine of Epicurus concerning nature not only militated againſt the ſuperſtitions of the Athenians, but againſt the agency of a ſupreme deity in the formation and government of the world, and he diveſted the Deity of ſome of his primary attributes. Whilſt he profeſſed the utmoſt contempt for popular ſuperſtitions, the gods, whoſe exiſtence he allowed, were deſtitute of many eſſential characters of divinity, and his piety was of a kind very different from that which is inſpired by juſt notions of Deity. Beſides, it has been ſuggeſted, that his ſentiments concerning the gods were adopted and profeſſed for the purpoſe of avoiding the odium and diſgrace which would have attended a direct avowal of atheiſm. Epicurus has alſo been charged with inſolence and contempt towards other philoſophers: but this ſeems to be ſcarcely compatible with the general air of gentleneſs and civility, which appears in his character. The charge of intemperance and incontinence is unqueſtionably an atrocious calumny. That he was eminent for the contrary virtues has been amply atteſted by Laertius, and alſo by thoſe who were adverſe to his doctrine, particularly Cicero, Plutarch, and Seneca. Epicurus has been with equal injuſtice repreſented as uninſtructed and an enemy to liberal ſcience. "We ought to be thankful to nature," ſays this philoſopher, cited by Stobæus, "for having made thoſe things which are neceſſary, eaſy to be diſcovered, and thoſe things which are difficult to be known, not neceſſary."

The temper and character of Epicurus were altogether the reverſe of thoſe of Zeno and the Stoics; his mode of inſtruction was very different; and his ſchool was eſtabliſhed in direct oppoſition to that of the Stoics; and, therefore, we need not wonder, that he ſhould become the object of detraction and calumny. Beſides, the deſign of his philoſophy and its general principles were very different, and they endeavoured to ſecure their own declining popularity by miſrepreſenting his principles and character, and holding him up to the public as an advocate for infamous pleaſures. For theſe, and ſimilar reaſons, Epicurus encountered the violent oppoſition of the Stoics; and yet he had many friends and followers during his life, and his memory was venerated after his death. His three brothers, Neocles, Chæredamus, and Ariſtobulus, devoted themſelves to the ſtudy of philoſophy, and were ſupported by his liberality. Of his intimate friends the moſt celebrated were Metrodorus, Polyænus, and Hermachus. After his death his birth-day was celebrated by his followers as a feſtival; and they preſerved his image in their rings or cups, or in pictures, which they either carried about their perſons, or hung up in their chambers. Their reverence for his authority was ſuch, that they committed his maxims, and ſome of them the whole body of his inſtructions, to memory; and for a long period, it was deemed a kind of impiety to innovate upon his doctrine: ſo that the Epicureans formed a philoſophical republic, regulated by one judgment, and animated by one ſoul. Laertius, l. x. Brucker's Hiſt. Phil. by Enfield, vol. i.

EPICYCLE, formed of the Greek επι, *upon*, and κυκλος, *circle*, q. d. *a circle on a circle*, in the *Ancient Syſtem of Aſtronomy*, was a ſubordinate orbit, or circle, which moved on the circumference of a larger one, which latter was called the *deferent*. By means of this epicycle, one motion, apparently irregular, was reſolved into two that were circular and uniform; and when the obſerved motion was ſo irregular and complicated as not to be repreſented by one epicycle, the method was to add others, till a nearer approximation was obtained. This ſyſtem owed its origin to a prejudice that ſeems to have been extremely ancient, in favour of uniform and circular motion; and the problem that chiefly occupied the aſtronomers in thoſe times, was to aſſign the proper proportion of the deferent and epicycle which ſhould approximate neareſt to the actual obſervations.

The repreſentation made by this concentric theory of the ſolar inequalities in longitude, was as follows:

Let C (*Plate* XII. *Aſtronomy*, *fig.* 105.) be the centre both of the earth and of the circle F B D, and let H G K be a ſmaller circle, called an epicycle, whoſe centre B moves uniformly in the circumference F B D from weſt to eaſt, or in conſequentia, while the ſun moves alſo uniformly, and with the ſame velocity, in the circumference of the epicycle, in antecedentia in the upper part, but in conſequentia in the lower. If the point G of the epicycle, called the apogee, as being moſt diſtant from the earth, be ſuppoſed, at the beginning of the anomaliſtical revolution, to be placed in the point A of O F produced; and if when it comes to G the arch G H be taken ſimilar to F B, the point H will be the place of the ſun when the centre of the epicycle has moved from F to B. If then in O F, to which B H is parallel, we take O E = B H, and on E, as a centre, with the diſtance E A = C F, deſcribe the circle A H P, the ſun would be ſeen from E to move in this circle equably; for the angle A E H is equal to the angle F C B; but ſeen from C, the centre of the earth, he will appear to move in it inequably, for the angle A C H in the firſt ſemicircle of anomaly, that is, in the paſſage of the ſun from A to P, is always leſs than A E H or F C B: and his true place H will be leſs advanced in longitude than his mean B. When, again, the centre of the epicycle, or the mean place of the ſun, having deſcribed a ſemicircle of the epicycle, will be found in P, the perigee of the orbit A H P, and his mean and true places B and H, will be ſeen from C to coincide as they did in A, the apogee; but in the ſun's paſſage from P to A, that is, in the ſecond ſemicircle of anomaly, his true place H, as ſeen from C, will be always more advanced in longitude than his mean place B; for in this ſemicircle the angle P C H is always greater than P E H in D C B. The angle E H C, or B C H, which is the difference between the mean and true places of the ſun, is called the equation of the orbit, as being that quantity which, added to the true motion A C H of the planet in its orbit A H P, in the firſt ſemicircle of anomaly, and ſubtracted from it in the oppoſite ſemircircle, will render it equal to the mean motion A E H or F C B; and it is evident that the equation, or difference, will be greateſt in N or M, where the centre B of the epicycle is 90° diſtant from either apſis. Any lines drawn from E, the centre of the orbit A H P, to the true place of the ſun in H, and from C the centre of the earth, and of the deferent F B D, to the mean place of the ſun in B, are equally called the line of the mean motion of the ſun, becauſe theſe lines are always parallel, and mark the ſame point in the zodiac; and any line drawn from C to the true place of the ſun is the line of the ſun's true motion.

It was thus that the ancients originally proceeded in their repreſentation of the ſolar inequalities, and the repreſentation ſeemed to be ſufficiently juſtified by obſervation; at leaſt till the days of Tycho Brahe no obſervations had been made with ſufficient accuracy to ſubject it to ſuſpicion. Their ſucceſs alſo, while no lunar inequality, except the ſimple anomaliſtical one, was diſcovered, was equal in the application of the ſame concentric theory to the motions of the moon; and having in two caſes thus ſucceſsfully, by means of one ſubordinate ſphere, or epicycle, reconciled apparent inequality of motion with real uniformity, it was natural to ſuppoſe that other inequalities, though more various and complicated, might be explained in a ſimilar manner, and required only the addition of other epicycles. The ſame method of procedure, therefore, was continued, and every new inequality which obſervation diſcovered was accounted for by a new ſphere, or epicycle, producing it, till the whole number employed in the ſyſtem amounted to 34. Ariſtotle, on narrower examination, found theſe inſufficient, and added to them 22: but ſtill they were deemed inſufficient, and the number was at laſt increaſed to 72; but though it was not till long after the days of Ariſtotle that the theory was carried to ſuch a degree of extravagance, the multiplication of epicycles rendered it, even in his time, almoſt as intricate and complex as the appearances which it was intended to explain. Some examples of this kind occur on the revival of it by Copernicus and Tycho Brahe; and when Hipparchus and Ptolemy introduced excentric orbits, and by means of them ſomewhat diminiſhed the multiplicity of the ſpheres employed by their predeceſſors, they were thought to do a ſignal ſervice to aſtronomy. See EXCENTRIC *Theory*.

What was principally required in theſe theories was to aſcertain in the one the ratio of the excentricity; in the other, the ratio of the ſemi-diameter of the epicycle to the ſemi-diameter of the deferent. If we make the radius of Jupiter's deferent circle to that of the epicycle as 52 to 10, the epicyclical motion ariſing from this conſtruction will very nearly agree with obſervation: only we may obſerve, that the oppoſitions which ſucceed each other near the conſtellation Virgo, are leſs diſtant from one another than thoſe obſerved in the oppoſite part of the heavens; ſo that the centre of the epicycle ſeems to move ſlower in the firſt caſe than in the laſt. To reconcile this with the perfect uniformity of the motion of that centre in the circumference of the deferent circle, the ancient aſtronomers ſaid that the earth was not exactly in the centre of the deferent, but ſo placed that the equable motion of the centre of the epicycle appeared ſlower, becauſe it is then more remote, and after various trials they ſixed on a degree of excentricity for the deferent, which accorded better than any other with the obſervations, and really differed very little from them. Copernicus ſhews that their hypotheſis for Jupiter never deviates more than half a degree from obſervation, if it be properly employed. They found that the epicycle moved round the deferent in $4332\frac{1}{3}$ days, with an equation gradually increaſing to near ſix degrees; ſo that if the place of the epicycle be calculated for a quarter of a revolution from the apogee, at the mean rate of $5'$ a day, it will be found too far advanced by near ten days' motion. See Dr. Small's account of Kepler's diſcoveries, where this ſubject is treated at great length.

EPICYCLOID, in *Geometry*, denotes a curve generated by the revolution of a point of the periphery of a circle, along the convex or concave part of another circle.

A point of the circumference of a circle, proceeding along a plane in a right line, and at the ſame time revolving on its centre, deſcribes a cycloid. And if the generating circle, in lieu of moving on a right line, moves along the circumference of another circle, whether equal or unequal, the curve deſcribed by any point in its circumference is called an epicycloid. Indeed the common cycloid has been ſometimes repreſented as an epicycloid formed by the revolution of a finite circle on an infinite circle.

If the generating circle proceeds along the convexity of the periphery, it is called an upper, or exterior epicycloid; if along the concavity, a lower, or interior epicycloid.

In an epicycloid, the part of the circle the generating point moves along, is called the baſe of the epicycloid: thus in *Plate* V. *Analyſis*, *fig.* 9. D C is the baſe of the epicycloid; V its vertex; V B its axis; D P V half of the exterior epicycloid, made by the revolution of the ſemicircle V L B (which is called the generant) along the convex ſide of the baſe D B; as D P U is the interior epicycloid, formed by the generant's revolving along the concave ſide of the baſe.

The length of any part of the curve, which any given point in the revolving circle has deſcribed from the time it touched the circle whereon it revolved, is to double the verſed ſine of half the arc which all that time touched the quieſcent circle, as the ſum of the diameters of the circles to the ſemidiameter of the quieſcent circle; provided the revolving circle moves upon the convex ſide of the quieſcent circle; but if upon the concave ſide, as the difference of the diameters to the ſemidiameter. Otherwiſe: the circumference of the epicycloid G E F (*fig.* 10.) is to four times the diameter of the generating circle B E, as the ſum of the diameters of the two circles is to that of the baſe, in the former of the caſes above mentioned; but in the ſecond, *e.g. feg*, in the ſame figure, as the difference, &c. In the firſt caſe, if the generating circle be ſuppoſed to have its diameter equal to half that of the baſe, the epicycloid F H E G is equal to 6 B E. In the ſecond caſe, when F I is a quarter of F G, the curve F*eg* will be found equal to 3 F I. When the generating circle is half the baſe-circle, as in *fig.* 11, the epicycloid degenerates into a right line, or the diameter of the baſe. Hence it appears, that in order to deduce the known property of the common cycloid, or that its circumference is equal to four times the diameter of the generating circle, we need only ſuppoſe the baſe-circle to be infinite; an infinite, augmented or diminiſhed by a finite quantity, being always the ſame.

Dr. Halley gives us a general propoſition for the meaſuring of all cycloids and epicycloids: thus, the area of a cycloid, or epicycloid, either primary, or contracted, or prolate, is to the area of the generating circle; and alſo the areas of the parts, generated in thoſe curves, to the areas of analogous ſegments of the circle; as the ſum of double the velocity of the centre, and velocity of the circular motion, to the velocity of the circular motion. The demonſtration hereof, ſee in Phil. Tranſ. N° 218.

The areas of epicycloids may be determined by the following proportion: as the radius of the circle of the baſe to three times that radius together with twice that of the generating circle, ſo is the circular ſegment *b* H to the epicycloidal ſector *b* H F, or the whole generating circle to the whole area of the epicycloid F E G B. As to the tangents, it is known from the time of Des Cartes, that the line H *b*, drawn from any point H, to that of the baſe which touches the circle, whilſt this point is deſcribed, is perpendicular to the curve, and conſequently to the tangent. Maupertuis in diſcuſſing this ſubject, conceived a polygon to revolve upon another, the ſides of which are reſpectively equal, one of the angles deſcribed a curve, the periphery of which is formed of arcs of circles, and the area is compoſed of circular ſectors and right-lined triangles. He determined the proportion of the area and of the periphery of this figure to thoſe of the generating polygon. He moreover ſuppoſed theſe polygons to become circles, the figure deſcribed to become an epicycloid; and the above-mentioned proportion, modified agreeably to this ſuppoſition, gave him the area and the periphery of the epicycloid. Mem. de l'Acad. 1727.

The invention of epicycloids is aſcribed to M. Roemer, the celebrated Daniſh aſtronomer, during his reſidence at Paris, about the year 1674. Theſe curves appeared to him to be ſuch as beſt ſuited the teeth of wheels, conſtructed ſo as to diminiſh their mutual friction, and to render the action of the power more uniform; hence he was led to conſider them, and to this purpoſe they have been applied. However, M. de la Hire in his "Traité des Epicycloides," printed in 1694, makes no mention of Roemer, and ſeems to claim the merit of this geometrical and mechanical invention. But M. Leibnitz, who reſided at Paris in 1674 and the two following years, ſays, that the invention of epicvloids, and their application to mechanics, were the work of this Daniſh mathematician, and that he was eſteemed the author of it. It does not appear that any writer publiſhed an account of epicycloids before the celebrated Newton, who, in the firſt book of his "Principia" propoſed a general and very ſimple method of rectifying theſe curves. After him J. Bernouilli, during his reſidence at Paris, ſhewed how, by means of the integral and differential calculus, to determine their area, rectification, &c. Many of his "Leçons du calcul integral" are devoted to this object. In 1694, M. de la Hire publiſhed his "Traité des Epicycloides;" and in the "Memoires of the Academy for 1706" he communicated to the public an extenſive and elegant treatiſe on theſe curves.

Spherical epicycloids are formed by a point of the revolving circle, when its plane makes an invariable angle with the plane of the circle on which it revolves. Meſſrs. Bernouilli, Maupertuis, Nicole, and Clairaut, have demonſtrated ſeveral properties of theſe epicycloids, in Hiſt. Acad. Sc. for 1732.

Epicycloids, *Parabolic*, *Elliptic*, &c. If a parabola be made to revolve upon another equal to it, its focus will deſcribe a right line perpendicular to the axis of the quieſcent parabola; the vertex of the revolving parabola will alſo deſcribe the ciſſoid of Diocles; and any other point of it will deſcribe ſome one of Newton's defective hyperbolas, having a double point in the like point of the quieſcent parabola. In like manner, if an ellipſe revolve upon another ellipſe equal and ſimilar to it, its focus will deſcribe a circle, whoſe centre is in the other focus, and conſequently, the radius is equal to the axis of the ellipſe; and any other point in the plane of the ellipſe will deſcribe a line of the 4th order. The ſame may alſo be ſaid of an hyperbola, revolving upon another, equal and ſimilar to it; for one of the foci will deſcribe a circle, having its centre in the other focus, and the radius will be the principal axis of the hyperbola; and any other point of the hyperbola will deſcribe a line of the 4th order. Concerning theſe lines, ſee Newton's Principia, lib. i. De la Hire's Memoires de Mathematique, &c. where he ſhews the nature of the epicycloid and its uſe in mechanics. See alſo Maclaurin's Geometria Organica. For the method of forming the epicycloidal teeth of wheels, ſee Wheel.

EPICYEMA, from κυω, *I conceive*, a word uſed by Hippocrates to ſignify a fœtus, or a falſe conception, or mole coming on after the conception of a former or regular fœtus.

EPIDAMNUS, in *Ancient Geography*, a town of Illyria, upon a ſmall promontory between Nymphæum and Petra, built by the Corcyreans. Its name, which the Romans conſidered as inauſpicious, was afterwards changed into Dyrrhaicum, now *Durazzo*, which ſee.

EPIDAURIA, Επιδαυρια, in *Antiquity*, a feſtival celebrated by the Athenians, in honour of Eſculapius. See Æsculapius.

EPIDAURUS, in *Ancient Geography*, a town of Greece, in the ancient kingdom of Argos, mentioned by Homer in the enumeration of its ſhips, and which he repreſents as fertile in the production of vines. It was ſituated on the eaſtern coaſt of the peninſula of the Argolide, near the Saronic gulf, and oppoſite to the iſland of Ægina. This town was celebrated among the ancients for the temple of Æſculapius, ſituated about a mile from the river, whither the inhabitants of moſt parts of Europe and Aſia reſorted for the cure of all diſtempers. It is pretended that this was the birth-place of Eſculapius. (See Æsculapius.) Antoninus Pius, after having been adopted by Adrian, conſtructed in this place a temple dedicated to the deities called "Epidotes," and another dedicated to the goddeſs of health, to Eſculapius, and to Apollo, ſurnamed the "Egyptian." He moreover built a houſe, for the accommodation of perſons who inhabited the diſtrict conſecrated to Eſculapius, and alſo for lying-in women. He alſo re-eſtabliſhed the portico of Cotys, which had been demoliſhed. The grove of Eſculapius near this town was encloſed by two mountains, one called "Titthion," and the other "Cynortion," upon which was conſtructed a temple dedicated to Apollo Maleates, and upon its ſummit another dedicated to Diana Coryphæa. In a rotundo near this town were preſerved ſome curious pieces of painting, the performances of Pauſias, a famous painter of Sicyone, and contemporary of Apelles. The Epidaurians had a beautiful theatre in the temple of Eſculapius, conſtructed by Polycletus, who alſo built the rotundo at the entrance of the town. Bacchus and Venus had alſo temples in this town. Epidaurus was alſo famous for its temple of Diana the Huntreſs, and a grove conſecrated to her, in which was a ſtatue of Epione, ſuppoſed to be the wife of Eſculapius. In this grove was a ſuperb fountain, ſplendidly ornamented. In the citadel of the town was a very beautiful ſtatue of wood, which repreſented Minerva, denominated by the Epidaurians "Ciſſea." The temple, dedicated to Juno, was on the ſide of the port, on a promontory which commanded a view of the ſea. The Dorians, having been driven from this town by Deiphon and the Argians, united with the Ionians and with them inhabited the iſlands of Samos and Chios. Epidaurus is now a ſmall place, called "Pidavra."

Epidaurus *Limera*, or *Epidaurus Malvaſia Vecchia*, *i. e.* the ancient Malvoiſia, is a port of Laconia, ſeated on the gulf of Argos, now "Golfo di Napoli," S. E. of Zarex. It is pretended that this place was founded by a colony of Epidaurians from the Argolide. Having embarked, as it is ſaid, for the iſland of Cos, they were driven by contrary winds on this coaſt of Laconia. They were cautioned in a dream from ſettling here; but a ſerpent which they brought with them left the ſhip and conducted them to the land. This fable was credited in the country, and the worſhip of Eſculapius was eſtabliſhed along this whole coaſt. The Epidaurians thus contrived to obtain a conſiderable part of the wealth which ſuperſtition had accumulated in the Epidaurus of the Argolide: and hence the new town acquired the appellation annexed to it. It was denominated *Limera*, *i. e.* famiſhed, a name which was not improperly applied to a town, the inhabitants of which contrived to exiſt at the charge of another. It was built upon an eminence, at the bottom of a ſmall gulf; it was well-peopled, and was famous among other things for its excellent wine, called Malveſy or Malmeſy, which grew round the vicinity of it, and with which it ſupplied other parts of Greece. The moſt remarkable objects of this place in the time of Pauſanias were two temples; one of Venus, another of Eſculapius, with a ſtatue of this god. Its port was honoured with the appellation of the "Port of Jupiter Conſervator."

Epidaurus, a town of Illyria, in Dalmatia, according to Ptolemy and Pliny, the latter of whom gives it the title of a colony; in whoſe time it was joined to the continent, though, as he ſays, it had formerly been an iſland. It is now "Raguſi-Vecchio."

EPIDELICUM, a town of Laconia, on the Argolic gulf, S. E. of Epidaurus.

EPIDELOS, a word uſed by Hippocrates for a youth in the time of his growth, from the age of ſeven to that of fourteen. The ſame author alſo uſes it in a very different ſenſe, expreſſing by it the obſervable days in a diſeaſe, ſuch as the fourth, eighth, and eleventh, which indicate what ſort of criſis is to be reaſonably expected on the great critical day.

EPIDEMIA, Επιδημια, in *Antiquity*, feaſts of Apollo, at Delphos, and Miletus; and of Diana, at Argos.

Theſe feaſts bore the name epidemia (from επι, *in*, and δημος, *people*,) becauſe theſe gods were imagined to be preſent on thoſe days among the people. Accordingly, on the laſt day of the epidemia they ſung an hymn called αποπεμπτικος, to bid them adieu, and ſet them forwards on their journey.

As thoſe gods could not be every where, and yet were honoured in many different places, there were times allowed them to paſs from one place to another, to receive the vows of their adorers. See Scaliger, Poet. lib. iii. cap. 114.

Epidemia were alſo private feſtivals, and times of rejoicing, when a friend or relation had returned from a journey. Pott. Archæol. Græc. lib. ii. cap. 20. tom. i. p. 394.

EPIDEMIC Diseases, from ἐπι, and δημος, *the people*, are thoſe diſeaſes which prevail extenſively, at different times and ſeaſons, among the inhabitants of cities, or countries: when they occaſion great mortality among the perſons ſeized; they are termed *peſtilential*.

The diſeaſes, which are liable to occur epidemically, or to attack a great number of individuals about the ſame time, or in rapid ſucceſſion, are principally thoſe of the acute or febrile claſs. Thus the plague, the ſweating ſickneſs, the yellow fever, contagious fever, or typhus, intermittent and remittent fevers, ſcarlet fever, ſmall-pox, meaſles, dyſentery, catarrh, (denominated influenza under ſuch circumſtances,) ophthalmia, hooping cough, &c. are the diſeaſes which have at different times ſpread over extenſive diſtricts epidemically, ſome of them occaſioning the moſt deſtructive mortality. Of theſe the influenza, or epidemic catarrh, appears to be the moſt extenſive in the range which it takes, and the moſt independent of local cauſes: in ſome inſtances, as in the years 1781 and 1782, this diſeaſe appears to have originated in China, and thence to have ſpread through Aſia, to Europe, and in the year following to have viſited America.

The other fatal epidemics, ſuch as the plague, yellow fever, and ſmall-pox have been in general the calamities more particularly, though not excluſively, connected with large towns, camps, or other congregations of men. Some of theſe diſeaſes, as the plague and ſweating ſickneſs, are ſcarcely known except as epidemical; and are altogether unknown, but as diſeaſes of a malignant and fatal tendency: but many of the others, as ſmall-pox, meaſles, ſcarlet fever, and typhus, are common and familiar appearances, which ſeldom ceaſe to exiſt among us; but which, nevertheleſs, only occaſionally aſſume thoſe fearful and fatal characters, which belong to them as epidemics.

No circumſtance, connected with diſeaſes, has been the ſubject of more general inquiry, among the phyſicians of all ages, than this variation in their tendency to ſpread at one time to multitudes of individuals, to put on a malignant character, and to prove generally deſtructive; whilſt at others they exiſt in milder forms, affecting few, and deſtroying ſcarcely any. Yet the moſt comprehenſive views of the concomitant circumſtances, in regard to the obvious conditions of the ſeaſons, and of the moral and political ſtate of the diſtricts, where epidemic diſeaſes ariſe or diſappear, continued with the moſt minute obſervation during a ſucceſſion of ſeaſons, have failed to elucidate ſatisfactorily this intereſting topic. Hippocrates, who has noted with accuracy the peculiarities of various years, together with the prevalent ſpecies of diſeaſe, attributes the variation of the maladies to a divine ſomething, τὸ θεῖον; which ſome of his commentators conſider as ſignifying merely the atmoſphere at large; but others, among whom is Galen, ſuppoſe that he intended to expreſs a latent and inſcrutable cauſe in the air, which produced theſe ſurpriſing effects. (See Hippoc. lib. i. de Prognoſt. Galen in Com,—alſo, Sennert. lib. iv. cap. ii. de Cauſis Peſtilentiæ.) Galen obſerves, in his commentary upon this point, "non quæcunque cauſas habent abditas et obſcuras, *divina* vocamus; ſed ubi admirabilia videntur duntaxat." The modern Hippocrates, Sydenham, ſtates, that he had obſerved with the utmoſt diligence the different peculiarities of different years, as to the obvious changes and conditions of the atmoſphere, with a view to aſcertain the cauſes of the great varieties of epidemic diſorders; but that he had not made the ſmalleſt approximation to ſuch a diſcovery; on the contrary, that he had remarked, that ſeaſons of the moſt decided ſimilarity, in reſpect to the manifeſt qualities of the air, were infeſted by diſeaſes altogether diſſimilar; and *vice verſâ.* "For the *conſtitutions* of different years are various;" he ſays, "yet they do not depend upon the degree of heat or cold, of dryneſs or humidity, which accompanies them; but probably originate from ſome occult and inexplicable changes, wrought in the bowels of the earth itſelf, by which the atmoſphere is contaminated with certain effluvia, which prediſpoſe the bodies of men to one or other form of diſeaſe. This prediſpoſition continues during the prevalence of the ſame conſtitution, which, in an uncertain period of time, is ſuperſeded by another." (Sydenham, ſect. i. cap. 2. De Morbis Epidem. See alſo Van Swieten Comment. ad Aph. 1408.)

From a conſideration of the ſame facts, ſeveral writers have attempted to account for theſe ſuppoſed occult changes in the qualities of the atmoſphere, which induce epidemic diſeaſes, by tracing them to ſome of the obvious phenomena of nature, by which ſuch changes may be ſuppoſed to be effected. Thus a coincidence has been attempted to be traced between the appearance of comets and of meteors, the occurrence of earthquakes, the eruptions of volcanoes, the conjunction of certain planets, &c.; by all of which it is preſumed that ſome important operations are accompliſhed in the condition of our atmoſphere. Of the effects of planetary influence, indeed, in inducing or diminiſhing the morbific qualities of the air, nothing is to be found in the writings of the preſent times: the hypotheſis originated and has gone by with the age of aſtrology. But a very late writer has filled two volumes with evidence, which he believes goes far to prove the exiſtence and operation of ſome general agent, or *peſtilential principle,* throughout the phyſical world. To this agent he aſcribes the origin of earthquakes, and volcanoes, and meteors; and he ſeems to conſider it as the medium by which comets affect the earth, producing tempeſtuous ſeaſons, great heats, and great colds. (See a brief Hiſtory of Epidemical and Peſtilential Diſeaſes, by Noah Webſter, 1800.) This, as a mere hypotheſis, would be ſcarcely leſs viſionary and futile, than the ſuppoſition of planetary influence, juſt noticed. Mr. Webſter, therefore, has collected, with great induſtry, an hiſtorical account of the various epidemic and peſtilential viſitations on record, which have ſucceſſively occurred to different countries, and has connected with it a chronological view of the appearance of comets, the eruptions of volcanoes, the commotions of the earth, and of the various atmoſpheric phenomena, which have been deſcribed by authors in order to prove their coincidence. "It is certain," we are told, "that comets have a very ſenſible effect on the weather;" (loc. cit. vol. ii. p. 122.) and Ariſtotle, Pliny, and Seneca, are quoted to prove that great heat, tides, and winds, are among the general concomitants of comets. "All the comets," Mr. W. affirms, "which have approached this earth, in their paſſage to and from the ſun, eſpecially thoſe which have paſſed very near us, have been preceded, attended and followed by moſt extraordinary effects, as great heat and drought in ſummer, and ſevere cold in winter; deluging rains, violent tempeſts, and unuſual tides. They occur ſo uniformly, with the appearance of theſe bodies, and for ſome months preceding and following, as to leave no room to queſtion the influence from which they proceed." Ibid. Whatever may occaſion extreme variations in the condition of the atmoſpheric temperature, produce inundations, dearth, &c. will thus remotely, no doubt, induce epidemic diſeaſes, as will be ſhewn in the ſequel. A great number of records are quoted by Mr. Webſter, to prove the connection of earthquakes with epidemics (an opinion which many writers have adopted); and aſo to ſhew that ſenſible vapours have iſſued from the earth, contaminating the atmoſphere, about theſe periods, or ſometimes without any earthquakes. From theſe ſenſible exhalations an inference is readily drawn of the exiſtence of vapours incognizable by our ſenſes, according to the conjecture of Sydenham. It appears, however, that great peſtilence, even when occurring within a ſhort period of earthquakes, has generally appeared *before* the earthquakes: nor does it occur in the ſeat of the earthquakes. Thus *after* the plague in London, in 1665, ſhocks are ſaid to have been felt *on the continent*. But Mr. Webſter does not conceive this to be any objection to the hypotheſis. He believes "that peſtilence and earthquakes depend on one common cauſe; which excites into action the internal fires." But he ſuppoſes that "the action or fermentation may precede, for months, and even years, the exploſion in earthquakes and volcanoes; and by means of an inſenſible vapour or heat, or electrical diſcharges, the elements of water and air may be eſſentially affected in ſuch a manner as to impair the principle of animal and vegetable life." P. 137.

This hypotheſis, which was held by the ancients, (as Claudian writes,

> "In cœlo nunquam ſpectatum impune cometam,")

has been adopted by Horſtius, Riverius, and echoed by ſeveral other writers on the ſubject of peſtilence; but, like many other ſuppoſitions upon the ſame ſubject, it is altogether gratuitous, and has been received only in the abſence of all poſitive knowledge of the real ſources of peſtilential diſeaſes. The ſame obſervation applies to the ſuppoſed influence of earthquakes, and diſtant volcanic eruptions; more particularly, as the former are allowed to have often followed the effect aſcribed to them, and the countries immediately in the vicinity of volcanoes are admitted to have been not more liable to epidemic diſeaſes than other regions.

Two other points have been generally ſtated as proving the exiſtence of a *peſtilential principle*, which is diffuſed through the atmoſphere at large: one is, that trees and vegetables are affected with mildew, and other diſeaſes; the other, that the animal creation alſo often ſuffers, when peſtilence is committing ravages among mankind. A *rubigo*, or mildew, *i. e.* "a dew impregnated with highly corroſive powers," (ſee Hird on Peſtilence, p. 91.) was anciently deemed one of the cauſes of epidemic diſeaſes. The Romans, appriſed of the pernicious effects of theſe mildews, inſtituted what they denominated *Feſta rubigalia*, and worſhipped an imaginary god, under the name of Robigus. The appropriated ſacrifice was a ſucking whelp; whence Columella,

> "Hinc mala rubigo, virides ne torreat herbas,
> Sanguine lactentis catuli placatur et extis."

Hoffmann mentions ſuch a dew, "ros valde corroſivus," as having infeſted vegetables in 1693-4, whence the cattle died in multitudes. (Tom. i. de Temp. Ann. Inſalub.) And Ramazzini aſcribes an epidemic to ſimilar dews; at which time the vegetables, corn, and fruit became black, being affected with a "lues rubigalis." (Conſtitut. Epidem.) The ſame year was remarkable for the ſcarcity of honey; and moſt creatures that live upon what they extract from vegetables died, or languiſhed. Probably ſimilar occurrences led many of the ancient writers to mention the ſilence of the graſshopper, and the drooping inactivity of the bee and the ſilk-worm, among the preſages of impending peſtilence. As to the ſpots, which are ſaid to have aſſumed various forms, eſpecially thoſe of *cruciculæ*, or little croſſes, and to have appeared ſuddenly on garments, utenſils, &c. as they are recorded chiefly on the authority of monks, whoſe writings are highly tinged with ſuperſtition, they are ſcarcely worthy of ſerious conſideration.

The exiſtence of epidemic diſeaſe among cattle is neceſſarily much connected with the diſeaſed condition of vegetables; and epidemics among cattle ſeem to have moſt commonly occurred after exceſſive humidity. (Webſter.) The calamity among brutes has ſometimes proved the forerunner of peſtilence among mankind; ſometimes its follower; and at other times, they have raged concomitantly: but, in general, their appearance has been remote and unallied. (Hird, loc. cit.)

It is curious, again, and not eaſily explicable on the principle of a peſtilential effluvium, unfriendly to every form of life, pervading the atmoſphere, that, while vegetables droop and are mildewed, the graſshopper is ſilent, the bee and the ſilk-worm are idle, and cattle die, from its influence, ſwarms of inſects and creatures of other ſpecies are ſaid to be among the precurſors and attendants of peſtilence. It is ſurely an abſurdity to contend for the exiſtence of a poiſonous atmoſphere, deſtructive to the life of both animals and vegetables; and at the ſame time to deſcribe the myriads of noxious inſects, frogs, mice, locuſts, ſnails, ſerpents, and other animals, which appear during an epidemic peſtilence! Is one kind of life poſſeſſed by man and the animals uſeful to him, and another by thoſe which are noxious? This contradiction in the hypotheſis appears to be very general among writers. The author, whom we have already often quoted, obſerves, "one thing is very evident, that what I denominate a *peſtilential principle* does, at certain times, pervade not only the element of air, but the water alſo. The proofs of this are abundantly numerous and convincing. In all the great plagues which have afflicted the human race, other animals, as horſes, cattle, ſheep, ſometimes cats, dogs, and fowls, together with the fiſh in rivers and the ocean, and even vegetables, have borne their ſhare in the calamity. The peſtilential principle has extended to every ſpecies of life. The beaſts of the field periſh with deadly epidemics; the fiſh die on the bottom of rivers and the ſea, or become lean and ſickly; while corn is blaſted on the moſt fertile plains, and the fruits in gardens and orchards wither, or fail to arrive at their uſual ſtate of perfection." (Webſter, Hiſt. of Epidemics, vol. ii. p. 153.) And immediately afterwards (p. 166.) we are called upon to "attend to the effects of a peſtilential" (*i. e.* univerſally deleterious) "ſtate of air, and in the *production* of inſects and ſmall animals. This is one of the moſt remarkable ſymptoms of a *ſickly* ſtate of the elements, &c."

It is only againſt ſuch hypotheſes that we have any objection. The fact, that myriads of inſects have ſometimes been produced, about the time when epidemics prevailed, cannot, we apprehend, be queſtioned; although probably many of the accounts tranſmitted to us on this point are much exaggerated. In ſome inſtances, ſuch a profuſion of inſect life may be a reſult of the ſame cauſe with the epidemic, *viz.* extraordinary heat, or heat and moiſture: in others, it may contribute to produce the epidemic, by deſtroying grain and fruits, the food of man; or graſs and herbs, the food of cattle, fowls, and other animals which conſtitute a part of his ſubſiſtence. It proves nothing in reſpect to any occult quality pervading the atmoſphere.

Beſides, the inſtances of the copious generation of inſects and ſmall animals have not been univerſal, but partial: ſome particular ſpecies have been generated in profuſion; and, therefore, the origin of them muſt be aſcribed to ſome partial, and not to a general cauſe. In the plague of Lauſanne, in 1613, according to Diemerbroeck, flies were produced in an incredible abundance; as well as during or preceding that of Holland, in 1635. The approach of the plague at Dantzick, in 1709, is ſaid to have been announced by an immenſe number of ſpiders in the preceding year. The year 1633, which produced a peſtilential fever among the ſettlers at Plymouth, in America, was remarkable for ſwarms of large flies, which filled the woods with their humming ſounds. (Webſter.) We cannot but conſider, therefore, that the ſtatement above quoted of the univerſal failure of animal and vegetable life, on the one hand, or the general diſpoſition in the air to generate noxious animals, on the other, as equally erroneous, inconſiſtent, and abſurd. How the individual ſpecies of inſect or animal is generated, in ſuch caſes, or what connection the production of them may have with the peſtilence, which ſometimes concurs in point of time, we cannot eaſily aſcertain. But where the means of obſervation fail us, gratuitous hypotheſes add nothing to our knowledge.

There are, however, ſeveral circumſtances which are open to our obſervation, which, if they do not abſolutely produce epidemics of the moſt peſtilential kind, certainly contribute to give them birth, and to aggravate them when produced, and are notoriouſly the ſource of epidemics of a leſs deſtructive ſpecies. Of theſe obvious cauſes of the origin or aggravation of epidemic diſeaſes, ſome contribute directly to excite diſeaſe; others to induce, what is ſcarcely leſs neceſſary to their occurrence, a prediſpoſition to them. In fact, the operation of ſome general agent, inducing a prediſpoſition to be affected by contagion, or other exciting cauſe of diſeaſe, would appear to be the principal ſource of the predominance of ſome epidemics. For if the exciting cauſe never, or ſcarcely ever, ceaſes to exiſt, its occaſional activity in inflicting diſeaſe among multitudes can only be aſcribed to the caſual operation of ſome general prediſpoſing cauſe, which renders them temporarily ſuſceptible of its influence. This is particularly exemplified with reſpect to contagious diſeaſes. The contagion of ſmall-pox, meaſles, and ſcarlet-fever perpetually exiſts among us; yet it is only at particular times that theſe diſeaſes attack ſo many individuals, as to be called epidemic. In crowded towns, like this metropolis, the infection of typhous fever is perpetually generated in the cloſe, dirty, and unwholeſome habitations of the poor: yet there has been no epidemic typhus in London for ſeven years paſt. Nay, even the plague itſelf exiſted year after year in this city, without ſpreading generally. It muſt not be imagined that the diſeaſe was accidentally imported juſt at the periods when it raged ſo extenſively, and with ſo much deſtruction. The principal plague-years of the ſeventeenth century were 1603, 1625, 1636, and 1665; in which the number of deaths from the plague, independent of thoſe from other diſeaſes, are reported in the bills of mortality to have been 36,269, 35,417, 10,400, and 68,596, reſpectively. But ſo far was the diſeaſe from being extinct in the intermediate periods, that from the year 1603, when the regiſter begins, till 1667, the bills of mortality exhibit only three years entirely free from the plague. It is obvious, therefore, that the preſence of infectious matter, or other exciting cauſe, is not alone ſufficient to produce an epidemic diſeaſe. Some concurrent circumſtances are likewiſe neceſſary, to give a prediſpoſition to the human body to be readily acted upon by ſuch cauſe. Now, ſome of theſe circumſtances have been well aſcertained, namely, particular ſeaſons, marſhy and other effluvia, a crowded and filthy population, deficient or depraved aliment, certain paſſions of the mind, exhauſtion of the conſtitution by fatigue, &c. We ſhall illuſtrate the operation of each of theſe prediſpoſing cauſes by a few obſervations.

1. *Seaſons.*—The influence of certain ſeaſons, in favouring the propagation of epidemic diſeaſes, has been obſerved and confirmed by all the medical writers on the ſubject, from the days of Hippocrates downwards, and was noticed by the earlieſt poets, even before the time of that great phyſician; eſpecially the influence of the heats of ſummer and autumn, and of the ſultry ſouth winds, which blow at thoſe ſeaſons. In many paſſages of the Iliad, Homer has alluded to theſe cauſes of peſtilential diſeaſes. Thus, in book v.

> "As vapours blown by Auſter's ſultry breath,
> Pregnant with plagues, and ſhedding ſeeds of death,
> Beneath the rage of burning Syrius riſe." Pope, 1058.

And again in book xxii. 37.

> "Not half ſo dreadful riſes to the ſight,
> Through the thick gloom of ſome tempeſtuous night,
> Orion's dog (the year when autumn ſways),
> And o'er the feebler ſtars exerts his rays:
> Terrific glory! for his burning breath
> Taints the red air with fevers, plagues, and death."

In the firſt book, peſtilence is alſo aſcribed to the anger of Apollo, an allegorical expreſſion for the extreme heat of the ſun. (See Pope's verſion, lines 83, and 87.)

Theſe poetic ſtatements accord moſt accurately with the obſervations of Hippocrates, who frequently mentions epidemic fevers as common in the ſummer and autumn, and as prevailing moſt extenſively when wet ſprings with ſoutherly winds were ſucceeded by hot and cloſe ſummers. A remarkable conſtitution of this kind, which continued for two years, is deſcribed in his treatiſe on Epidemics, (De Morbis Vulgaribus, lib. iii.) at which time ardent remitting and intermitting fevers of a bad kind prevailed, attended with fluxes, parotids, and eruptions of a peſtilential nature. The autumn and ſpring were wet, cloſe, and cloudy, without wind, the breezes from the ſouth; and theſe continued during the hot and ſultry ſummer, when the uſual refreſhing Eteſian winds did not blow.

Exceſſive heat of the ſummer, without moiſture, has occaſionally accompanied an epidemic ſeaſon. Thus in the year of Rome 325, there was a moſt grievous famine, occaſioned by a ſevere drought, in all the Roman territory. "Siccitate eo anno plurimum laboratum eſt; nec cœleſtes modo defuerunt aquæ, ſed terra quoque, ingenito humore egens, vix ad perennes ſubfecit amnes;" the cattle thronged in multitudes round the arid fountains, and periſhed with thirſt, diſeaſes followed among the cattle, from which they were propagated by contagion among men ("vulgatique contactu in homines morbi"), the peaſantry firſt ſuffering, then the lower claſſes, and at length the whole city was infected. (Tit. Liv. lib. iv. 30.) In more modern times, great droughts have been accompanied by epidemic diſeaſes, eſpecially in cities ſituated in low and damp countries. In the autumn of 1652, Bartholine informs us that a malignant fever appeared at Copenhagen, after an unuſually hot and dry ſummer. And a ſimilar fever raged at Leyden in the year 1669, as deſcribed by Silvius de la Boe. The ſpring and beginning of ſummer were cold, but the remainder of ſummer, and the autumn, were unuſually hot, with little or no rain, and with a conſtant calm or ſtagnation of the air. (See Pringle on Diſ. of the Army, p. iii. claſs 4.)

But epidemic diſeaſes are ſtill more fatal in thoſe ſeaſons, in the damp countries of the ſouth, where the heats are longer and more intenſe, and much moiſture is combined. In ſome parts of Italy, and in other tracts of the ſame latitude, epidemic fevers have appeared with ſuch alarming ſymptoms, as not only to have been called peſtilential, but confounded with the plague itſelf. In this ſenſe we are to underſtand Celſus, (De Medicina, lib. i. cap. 10. lib. iii. cap. 8.) in the terms *peſtilentia* and *febris peſtilentialis*, which he deſcribes as peculiar to the "grave anni tempus," and the "graves regiones." His meaning is, that this bad fever is the diſeaſe of the latter part of ſummer, and of autumn, when the air is thickeſt and moſt foggy, and that is moſt frequent in low and marſhy countries. Rome was always liable to theſe fevers. Galen calls the *hemitritæa* the epidemic of that city, and ſpeaks of its moiſt air. (De Temperament. lib. ii.)

In fact the chief malignancy of the worſt epidemic diſeaſes, and of the plague itſelf, has always been felt in the ſummer and autumn; as the hiſtories of that diſeaſe in all the large towns in Europe will teſtify. Diemerbroeck has juſtly obſerved, that when the plague has been excited out of its proper ſeaſon, it has not ſpread: and Dr. Ruſſell tells us, that in the winter time, when infected perſons have come to places about Aleppo, ſome of whom have died in the families where they lodged, the diſtemper by ſuch means was not propagated. In the four great plagues of London, during the ſeventeenth century, the mortality invariably increaſed, as the ſeaſon advanced, reaching its acmè in Auguſt and September, and thenceforth gradually declining. (See the Bills of Mortality.—See alſo Dr. Heberden, jun. on the Increaſe and Decreaſe of Diſeaſes, 1801.). Thus in the laſt plague in London, in the year 1665, the mortality of the reſpective months was as follows; in the ſpring very few perſons had died of the plague, in June 590 perſons died of it, in July, 4,129, in Auguſt, 19,046, in September, 26,230, in October, 14,372, in November, 3,349, and in December a few hundreds. (See PLAGUE.) The progreſs, in the other three inſtances, was exactly ſimilar.

Again, the regular decreaſe of peſtilential diſeaſes, with the declining ſummer, equally demonſtrates the neceſſity of the preſence of the hot ſeaſon for their propagation; which may operate either by rendering the contagion more virulent, by producing certain pernicious effluvia from the earth in moiſt places, or by inducing a prediſpoſition in the human body to receive the influence of thoſe exciting cauſes. At Grand Cairo putrid and peſtilential fevers prevailed annually in March, April, and May, which the ſoutherly winds make the hotteſt months in that country; but they ceaſed at the overflowing of the Nile, when the cold winds ſet in. (Proſper. Alpin. de Med. Egypt, lib. i. cap. 14. Mead on the Plague, p. 30.) And "at Smyrna the annual plague conſtantly ceaſes about the 24th of July, by the *dry and cold weather* they always have at that time." (Mead, p. 56.) Indeed, when this change of ſeaſon takes place, while every place abounds, it muſt be preſumed, with the contagion, yet it ceaſes to be detrimental. Proſper Alpinus remarks, that when this change of ſeaſon comes, in the month of June, even the clothes imbued with the moſt peſtiferous contagion then infect no one. "Sed quod valde mirabile creditur, omnia ſupellectilia peſtifero contagio infecta tunc nullum contagii effectum in eam gentem edunt."—And this inertneſs of the contagion in the moſt infected places, on the approach of winter, was moſt remarkable in the laſt plague of London. "Many who made moſt haſte in retiring," ſays Dr. Hodges, "made the moſt to return, and came into the city without fear: inſomuch, that in December they crowded back as thick as they fled: the houſes, which were before full of the dead, were now again inhabited by the living; the ſhops, which had been moſt part of the year ſhut up, were again opened, and the people again cheerfully went about their wonted affairs of trade and employ: and even what is almoſt beyond belief, thoſe citizens, who before were afraid even of their friends and relations, would, without fear, venture into the houſes and rooms where infected perſons had but a little before breathed their laſt: nay, ſuch comforts did inſpire the languiſhing people, and ſuch confidence, that many went into the beds, where perſons had died, before they were even cold, or cleanſed from the ſtench of the diſeaſed." (Loimologia, or Hiſt. Acc. of the Plague in 1665, p. 27.) In the ſame way we read, that when the plague was in Italy, the Neapolitans uſed no artifice to purify either their goods or houſes; yet the diſeaſe ceaſed among them as entirely as in the beſt regulated towns. (Heberden, loc. cit.)

Theſe facts amply prove the extenſive influence of certain ſeaſons, in favouring and interrupting the progreſs of the moſt peſtilential epidemics; and that not in conſequence of any occult, but of certain ſenſible and obvious conditions of the weather. The ſame circumſtances of the ſeaſons modify the propagation and diminution of the minor epidemics, ſuch as dyſentery, remittent and intermittent fevers, &c. and even the ſmall-pox. Of the former of theſe, we ſhall more properly ſpeak under the ſecond head of cauſes; namely,

2. *Marſhy and other Effluvia.*—Galen aſſigns two cauſes for peſtilential fevers; the firſt of which is great heat of the weather, and the ſecond, which he conſiders as moſt frequent, a corrupted ſtate of the air, ariſing either from a multitude of dead bodies left unburnt, as after a battle, or from the evaporation of corrupted lakes and marſhes. (De Febr. Diff. lib. i. cap. 4.) Other authors of antiquity have noticed the coincidence of epidemic fevers with marſhy ſituations. Thus Diodorus, the hiſtorian, has recorded the occurrence of a peſtilential diſeaſe among the Carthaginians at the ſiege of Syracuſe, which he attributes to the combination of the following circumſtances; the multitude of people confined within a narrow compaſs, the ſituation of the camp in a low and wet ground, and the ſcorching heats in the middle of the day, ſucceeded by cold and damp air from the marſhes in the night. (Bibl. Hiſt. lib. xiv. cap. 70.) In more modern times the origin of epidemic diſeaſes from marſh effluvia had been very generally obſerved. Fracaſtorius aſcribes a malignant epidemic fever, in Italy, in the ſixteenth century, to an extraordinary inundation of the Po, which, happening in the ſpring, left marſhes, and thoſe corrupting infected the air through the ſummer. Foreſtus remarks, that, from the putrefaction of the water only, the city of Delft, where he practiſed, was ſcarcely ten years free from the plague or ſome peſtilential diſtemper. (Obſervat. lib. vi.)

The effects of marſh or putrid effluvia in giving riſe to epidemic diſeaſes have, indeed, been evinced in moſt of the large cities, and ſtill more obviouſly in the camps of modern times. Sir John Pringle, ſpeaking of the hot weather, during one of the campaigns in the Netherlands, in 1748, obſerves, that though the heats were great, yet they were the cauſe of little ſickneſs, till the troops were cantoned in the marſhes, where a conſiderable degree of putrefaction and moiſture being joined, ardent, remitting, and intermitting fevers, and fluxes became general. It is remarkable that theſe pernicious exhalations do not riſe high, nor ſpread far from their ſource, at leaſt without ſuch dilution as diminiſhes their deleterious qualities. Dr. J. Hunter has affirmed, that in the barracks at Spaniſh Town, in Jamaica, (which conſiſted of two floors, the firſt upon the ground, the ſecond over the firſt,) the difference in health of the men on the two floors was ſo great as to engage the attention of the aſſembly of the iſland, and upon inveſtigation it appeared that three were taken ill on the ground floor for one on the other. Even at a few hundred feet above the level of the marſhes, the ſituations are extremely healthy. (Obſerv. on the Diſ. of the Army in Jamaica, note B. p. 268, 3d edit.) The air of a marſh or of a foul camp, the ſame author obſerves, may deſtroy an army almoſt as ſoon as the true plague. But the remedies in ſuch caſes are obvious, and conſiſt in getting at a proper diſtance from the noxious exhalations, or removing the cauſes of them. "A very ſmall ſpace frequently includes the limits of healthy and unhealthy ground." It is not now neceſſary to ſtate that agues, or intermittents, originate ſolely from the effluvia of marſhes.

Another ſpecies of effluvia, which is the ſource of epidemic diſeaſes in camps and in towns, when ill conſtructed and neglected, ariſes from ground contaminated with human and other excrements, the remains of victuals, the water uſed in cookery, for waſhing, the foul ſtraw rotting in tents, &c. Whenever a camp remains long on the ſame ground, eſpecially in hot and moiſt weather, fluxes, and intermitting and remitting fevers, ſeldom fail to become epidemic, unleſs great precautions are uſed to bury all excrementitious matter, and proper receptacles and drains under ground are prepared for the urine, water of cookery, &c. (See Dr. Hunter, loc. cit. p. 285.) In this caſe, however, as in that of marſh effluvia, the diſeaſes produced will diſappear, by moving the camp a few hundred yards from the foul ground.

Theſe facts throw great light on the epidemics of large cities, which were formerly ſo frequent and fatal. A large town may be conſidered as an extenſive camp, but deſtitute of the means of changing its ſituation, and, conſequently, liable to be infeſted with the ſame diſeaſes as are endemic and epidemic in camps, unleſs the precautions juſt alluded to, for the purpoſe of removing the ſources of the peſtilential effluvia, be fully adopted. And we find, accordingly, that during and previous to the 17th century, (and even later, in ſome countries,) the large towns were almoſt conſtantly infeſted, in the ſummer and autumnal months, with the plague, malignant, intermittent, and remittent fevers, and dyſentery; the ſame diſorders to which camps are liable. This was the condition of London during the period ſpecified. We have already remarked, that the plague was ſeldom abſent from the beginning of the 17th century to the year 1669, and that four dreadful viſitations of that calamity occurred within the ſame ſpace of time. Of the extent to which intermittent and remittent fevers prevailed, in this metropolis, we have alſo ample evidence. Dr. Short remarks, that early in the century, *viz.* between 1629 and 1636, "one of 40 of the whole that died of fevers, died of agues;" whereas, "now (1750) ſcarce *one* of 1100 that die of fevers die of this diſeaſe." (New Obſ. Nat. Moral, &c. on Bills of Mortality, 1750, p. 208.) Burnet, in his "Hiſtory of the Reformation," ſays, that in the laſt year of queen Mary's reign "intermitting fevers were ſo univerſal and contagious, that they raged like a plague." Both Sydenham and Morton have left us abundant evidence of the frequent epidemic prevalence of agues, as well as of remitting fevers, which laſt Morton affirms to have been extremely deſtructive for ſeveral years before the great plague, *viz.* from the year 1658 to 1664. He ſtates that Oliver Cromwell died of this fever in 1658; and that his own father, himſelf an experienced phyſician, alſo died of it; when his whole family, the writer included, were infected. (Morton, Pyretologia, App. ad Exercit. ii.) Even ſo late as from 1720 to 1729, according to Dr. Short, "they (intermittents) and remittents afflicted the whole nation grievouſly."

Sometimes together, and ſometimes alternating with thoſe autumnal fevers, the dyſentery was a frequent epidemic in London, in the times to which we allude, and was often attended with great fatality. For five and twenty years ſucceſſively, from 1667 to 1692, the bills of mortality ſhew the ſum of deaths under the titles of "bloody flux," and "griping in the guts," which muſt both be conſidered as dyſentery, to have amounted every year to above 2000. During the laſt century, the diſeaſe has gradually declined, (Dr. Heberden on Increaſe and Decreaſe of Diff. Diſeaſes, p. 34.) and the other fatal epidemics, juſt mentioned, have quite diſappeared. See Annual Medical Regiſter for 1808, vol. i. where the changes of diſeaſe in London are diſcuſſed at length.

We cannot doubt, that the preſent comparative healthineſs, and eſpecially the great freedom from all epidemics (the contagions of ſmall-pox, ſcarlet fever, and meaſles excepted) which this metropolis now enjoys, is to be aſcribed altogether to the meaſures, by which the ſources of the effluvia, which excite them, have been removed, and to the general habits of cleanlineſs and ventilation which are at preſent obſerved by the people. Theſe ſalutary meaſures are principally the conſtruction of privies, drains, and common ſewers; a hard and regular pavement, with a proper level for carrying off the humidity, and well cleanſed by ſcavengers; an abundant ſupply of water to every part of the town, &c.

In all theſe points, the condition of London, like that of moſt other large cities in Europe, during the 17th century, was extremely defective. In the preceding centuries its condition muſt have been ſtill more incommodious and filthy, ſo that few years elapſed without the occurrence of a conſiderable peſtilence. We have not room, in this place, to enter more at large into a deſcription of its circumſtances; but muſt content ourſelves with referring to the work of Dr. Heberden, jun. juſt quoted, where an abundant collection of evidence, as to the connection of thoſe epidemics with filth and negligence in the economy of this and of other large towns, will be found. (See alſo the Ann. Med. Regiſter for 1808. Maitland's and Nourthouck's Hiſtory of London.) See Plague.

It is extremely gratifying, both in a phyſical and moral point of view, to obſerve that the ſame means which contribute to our perſonal comforts, and to elevate us above the ſavage, *viz.* the progreſs of civilization and refinement, have led to baniſh the moſt loathſome and fatal diſtempers, to prolong life, and to diminiſh the prevalence and fatality of other diſeaſes of leſs fatality. "While the metropolis has extended itſelf in all directions, and multiplied its inhabitants to an enormous amount, *i.e.* while the apparent cauſes of its unhealthineſs have been augmented, it has actually become more favourable to health. In the year 1697, for example, the total mortality of London was 20,970; whereas, the total mortality of 1797 amounted only to 17,014: and when we take into conſideration the great increaſe of the population of the out-pariſhes at the latter period, the *comparative* healthineſs of London will appear in very ſtrong colours." Ann. Med. Regiſter, p. 321.

Sometimes the air of a particular diſtrict ſeems to have been impregnated with effluvia from putrefying animal and vegetable matter, which has occaſioned an epidemic in that neighbourhood. Foreſtus has mentioned the putrefaction of a large fiſh, of the whale kind, which was left by the tide, and died, on the coaſt of Holland, and, during its putrefaction, infected the country with a horrid ſtench, in conſequence of which a fatal epidemic fever broke out in the diſtrict of Egmont. (Obſ. lib. vi. 9. tom. i.) The ſame author informs us of a peſtilential fever, which raged at Venice in his time, and was produced by the corruption of a ſmall kind of fiſh in that part of the Adriatic. (Ibid.) Inſtances are alſo on record of epidemic fevers occaſioned by the effluvia of putrid cabbages, as well as of plants in marſhes. (Rogers on Epidem. p. 41.) Theſe ſources of epidemics, however, are rare, and can ſeldom occur under a well regulated police.

3. *A crowded Population.*—From the earlieſt periods of time, of which we have any record, peſtilential diſeaſes were known to be the effect of crowded population, and to rage peculiarly in cities, forts, and other confined places. In the ſacred writings peſtilence is every where mentioned as the peculiar ſcourge of *cities*. "The ſword is *without*," ſays the prophet Ezekiel, chap. vii., "and the peſtilence and famine *within*; he that is in the field ſhall die with the ſword; and he that is in the *city*, famine and peſtilence ſhall devour him." And again, chap. xxxiii., it is ſaid, "they that be in the *forts* and the caves ſhall die of the peſtilence." The city of Rome was ſubject to the moſt fatal epidemics from a very early period of its hiſtory: Athens ſuffered alſo extremely; and in modern Europe the great cities have been the common ſeats of plagues, from Conſtantinople to Moſcow, and from Cadiz and Marſeilles, to Copenhagen and Dantzic. (See an enumeration of the cities infected with the plague, and the dates of its occurrence, by Dr. Heberden, *loc. cit.* p. 81, *et ſeq.*) The ſame obſervation applies to the cities of Aſia and Africa; to Aleppo, Cairo, &c. &c., as well as to thoſe of America.

We have already ſtated, that the prevalence of epidemic and peſtilential diſeaſes in this metropolis was obviouſly connected with the exiſtence of filth of every ſpecies, and that their gradual diſappearance has been coeval with the improvements of the city, and the removal of theſe nuiſances. The ſame fact is obſervable in all the cities of Europe: and thoſe which, from natural or political cauſes, have been backward in adopting the improvements of modern times, have more lately exhibited the ſame effects of their negligence. The plague appeared at Copenhagen in 1764; and at Moſcow ſo late as the year 1771. It is farther obſervable, that peſtilential diſeaſes generally appear firſt in the moſt crowded and uncleanly parts of towns, and rage moſt ſeverely in the moſt crowded and dirty habitations, *i. e.* among the poor. The plague of 1665, in London, is ſaid to have been by many perſons called "the poor's plague." Thoſe of 1626 and 1636 broke out at Whitechapel, a part of the town which abounded with poor, and with ſlaughter-houſes: and that of 1665 is ſaid to have broke out firſt at St. Giles's; and there, Dr. Heberden remarks, it would probably break out again, if ever we ſhould ſuffer ſuch another calamity.

For it muſt be obſerved, that a crowded and uncleanly population contributes, in a double manner, to the origin and propagation of epidemic and peſtilential diſeaſes. It not only occaſions the accumulation of every ſpecies of filth externally, from which effluvia ariſe to contaminate the atmoſphere, in hot and moiſt ſeaſons, thus producing all the diſeaſes of camps; but it produces another ſpecies of effluvia, internally, in the habitations of men; *viz.* from the bodies of the ſick, and even of the healthy, which at once generate malignant fevers, and aggravate thoſe which ariſe from the other ſources. (See CONTAGION.) So that under the circumſtance of the combination of theſe cauſes, namely, when the heat and moiſture of autumn generate the effluvia from external filth, and contagion is ſuperadded from the accumulation of the corporeal effluvia, from the want of internal cleanlineſs and ventilation, diſeaſes of an epidemic nature are readily excited, and are propagated extenſively and fatally. Hence, before the value of theſe internal cautions was underſtood, malignant fevers ſo frequently occurred in hoſpitals and gaols, that they obtained the appellation of hoſpital-fever and gaol-fever. Indeed we are told that, ſo late as the latter end of the 17th century, in the gaol of Newgate, a contagious fever uſed to break out annually, in hot weather; and that the ſame was true of moſt gaols in Europe; (The City Remembrancer, quoted by Dr. Heberden) and ſeveral facts on record, prove, how readily any acute diſeaſe is thus propagated by contagion, under theſe circumſtances of crowded and filthy habitations; although originally, and in cleanly and airy apartments, it was incapable of ſpreading from one individual to another. Thus ſir John Pringle obſerved, that, "in autumn 1757, ſeveral ſoldiers were brought into the hoſpital at Portſmouth, with a diſorder compounded of the autumnal and gaol-fever; for when theſe men, upon being ſeized with the common fever of the ſeaſon, were confined to the holds of the crowded tranſports, their diſtemper aſſumed that form. (Diſ. of the Army.) So Dr. Lind has ſtated, that, upon admitting into an hoſpital one perſon with a flux, ſeveral other patients in the ſame ward have had this ſymptom added to their other complaints. (Lind on Fever and Infection.) And Dr. Blane has obſerved generally, that, ſuppoſing a ſhip's company be prediſpoſed to acute diſtempers, and one man or more ill of a dyſentery be brought on board, this will become the prevailing diſeaſe. (On the Diſeaſes of Seamen.)

Theſe facts, which evince the facility with which any acute diſeaſe, or its leading ſymptom, is communicated from individual to individual, in a cloſe and crowded apartment, when extreme cleanlineſs and ventilation are not attended to, will ſerve to explain ſeveral apparent anomalies in the hiſtory of ſeveral diſeaſes, which have been ſtated as the reſult of ſome myſterious epidemic principle in the atmoſphere. We allude to the occaſional ſpreading of particular maladies in hoſpitals, in a ſort of epidemic way; ſuch as the appearance of eryſipelas, connected with all ſlight injuries of the ſcalp, or other ſuperficial parts, as related by ſir William Blizard, of the London hoſpital, and as occurred in the ſurgical ward of the Royal Infirmary at Edinburgh, many years ago; the diſpoſition to inflammation and abſceſs about the perineum and neighbouring parts, mentioned by the ſame writer, &c. (See a Paper "On ſome epidemical Effects," Med. Facts and Obſ. vol. ii. 1792.) Such occurrences, we believe, are rare in proportion to the degree of cleanlineſs in thoſe receptacles of the ſick. We have been aſſured that the occurrences of this nature at Edinburgh have ceaſed, ſince a more rigid ventilation and purification have been adopted in the Royal Infirmary.

4. *Deficient and Depraved Aliment.*—The obvious cauſes of epidemic diſeaſes, already mentioned, may operate both as exciting and as prediſpoſing cauſes; but that to which we now direct our attention, perhaps, chiefly acts in inducing a debilitated and half-morbid condition of the body, which renders it liable to be affected by thoſe exciting cauſes. Certain it is that famine and peſtilence have been obſerved to go together, ſince the earlieſt ages of the world; and are conſtantly mentioned in combination, in the ſacred writings; to which war is frequently added. Dearth is almoſt neceſſarily a part of the deſolation of war; which, therefore, contributes to the production of peſtilence indirectly by producing dearth. Ὁ λοιμὸς μετὰ λιμον, "the plague after famine," was an old Greek adage. Where articles of food are extremely ſcarce, they are often alſo corrupted, and may thus contribute to reduce the human conſtitution to a ſtate prediſpoſed to diſeaſe. Foreſtus imputes the plague at Delft, in the year 1557, to the eating of mouldy grain, which had been long kept up by the merchants in a time of ſcarcity. (*Loc. cit.*) And ſir J. Pringle ſays, he had heard it obſerved, that in this iſland the dyſentery is frequent among the common people, in thoſe parts where they

live moſtly on grain, when the preceding crop has been damaged in a rainy ſeaſon, or kept in damp granaries. (*Loc. cit.* cap. vii. p. iii.) In ancient times the corruption, as well as ſcarcity of food, was aſſigned as the cauſe of peſtilence; as by Cæſar himſelf when beſieging Marſeilles, (De Bello Civili, lib. ii. 20.) "Panico enim vetere, atque hordeo corrupto, omnes (*ſcil.* Maſſilienſes) alebantur; quod ad hujuſmodi caſus antiquitus paratum, in publicum contulerant." When we advert to the fatal epidemic diſeaſe, termed Feu ſacrè, Mal des ardens, &c. by the French, and known to originate from *ergoted* rye, uſed as food, we ſhall not heſitate to aſcribe conſiderable effects to the ſort of food juſt mentioned. (See Philoſ. Tranſact. vol. lv. p. 110, and Mem. de la Soc. Royale de Medecine, for 1776.) Dr. Willan has obſerved, that the Morbus Hungaricus, deſcribed by Sennertus, "and ſome other diſeaſes reputed peſtilential, might be added to the liſt of epidemics, occaſioned by the *ergot;* or by a ſimilar degeneration in other grain. The ſweating-ſickneſs, which occurred more than once in England, at the beginning of the ſixteenth century, was perhaps owing to ſome diſeaſe or depravation in wheat, &c." (On Cutaneous Diſeaſes, part iv. p. 499.) It may be added, that the only epidemic occurrence of contagious fever in London for ſeveral years back, occurred after the exceſſively wet autumn of 1799, when corn was exceedingly damaged, and a conſiderable ſcarcity enſued.

5. *Exhauſtion by Fatigue, &c.*—Beſides the debility of conſtitution, and conſequent prediſpoſition to diſeaſe, induced by imperfect nouriſhment, during a famine, the exhauſtion produced by exceſſive corporeal exertions, loſs of ſleep, and the depreſſing paſſions, probably contributes in no ſmall degree to prediſpoſe the body to diſeaſes. Thus epidemic fevers have been obſerved to ariſe after great battles. Dr. Gottwald traced the origin of the plague at Dantzick to Pinozow, ſoon after the battle of the Swedes and Saxons, in 1702. (Ingram, Hiſt. of Plagues, p. 86.) To the ſame cauſe, perhaps, we may impute the contagious fever, which raged among the troops of the late ſir John Moore, on their return from the haraſſing campaign in Spain. (1809.) Van Swieten obſerves, that "ſtrong paſſions of the mind, particularly terror, augment the efficacy of infection, as all writers on the plague unanimouſly allow," and that the ſame paſſion contributes to render the diſeaſe more fatal. If this be correct, the extenſive operation of fear in beſieged towns, and countries which are the ſeat of war, muſt produce conſiderable influence; and it cannot be doubted, that the general panic, which rapidly ſpreads among the inhabitants of a town, where the plague is diſcovered to exiſt, contributes materially to its propagation.

On reviewing the facts above ſtated, it is obvious that the ſources of epidemic and peſtilential diſeaſes have been often traced to manifeſt circumſtances, in combination with one or more of which they have generally been obſerved to occur: and more eſpecially that the heats of ſummer and autumn appear to be abſolutely neceſſary to the propagation of a general peſtilence. The obſervation of Celſus, in regard to the ſalubrity of the different ſeaſons, has been confirmed by thoſe who have practiſed in warm climates, (Cleghorn on diſeaſes of Minorca) by the phyſicians of camps, (Pringle, *loc. cit.* part ii. chap. i.) and by the condition of this country in the time of Sydenham. "Saluberrimum ver eſt; proxime deinde ab hoc, hiems; perículoſior æſtas; *autumnus longe periculoſiſſimus.*" (Celſi De Med. lib. ii. cap. i.) But the experience of the laſt century, during which this order of the ſeaſons, in point of ſalubrity, has been almoſt reverſed, (for we now find July and Auguſt the moſt healthy months of the year, and February and March the moſt productive of diſeaſe,) has thrown conſiderable light even on the occult principle, the τὸ θεῖον, of the epidemic atmoſphere. It has ſhewn us, what Sydenham could not have anticipated, and what to him indeed muſt have been incredible, that, while the ſeaſons continue to occur, with their former viciſſitudes, and while the bowels of the earth (for aught that we know) continue to ſend forth their vapours as uſual, yet thoſe fatal peſtilential *conſtitutions* of the air no longer appear; the plague has not been ſeen, ſince the rebuilding of the city (1667); intermittents no longer infeſt the metropolis, and the autumnal remittents are alike almoſt unknown; eſpecially ſince the covering of Fleet ditch, and the other improvements, made in 1766; and the dyſentery, or bloody flux, now ſcarcely adds twenty to the annual bills of mortality! This occult principle, then, this epidemical *ſomewhat*, it muſt be inferred, neither owed its origin to the atmoſphere, nor to the bowels of the earth, nor to the eruptions of Ætna, nor to the approach of comets. For the former of theſe are, doubtleſs, unchanged; and the latter have continued to occur at intervals as uſual.

To what, then, are we to attribute the origin of thoſe *epidemic conſtitutions*, as they have been called, of particular years, in which certain diſeaſes extenſively prevail? We have not, perhaps, a ſufficiency of facts to enable us to deduce a decided concluſion; but the following inference ſeems to approximate to the truth, and to ſpring out of the facts already detailed.

The experience of camps, eſpecially in moiſt ſeaſons, teaches us how readily epidemical diſeaſes are produced, from the contamination of the lower portion of the atmoſphere with the effluvia of foul ground, and alſo how confined and local that contamination is, ſince a ſmall elevation, or a removal to the diſtance of a few hundred yards, from the ſource of the effluvia, is ſufficient to enable us to eſcape their noxious effects. The experience of gaols and hoſpitals, and other crowded and uncleanly habitations, has alſo demonſtrated the facility with which human effluvia, accumulated about the ſick, become contagious to thoſe in their immediate vicinity; and alſo how readily, in this prediſpoſed and contagious ſtate, any acute diſeaſe, *accidentally* introduced, is carried from individual to individual, ſo as to become the prevalent or epidemic diſeaſe. Now, London, and all other crowded cities in the 17th century, combined within themſelves both theſe peculiarities of condition, belonging as well to camps as to gaols and hoſpitals. The atmoſphere was contaminated with the local effluvia, which rendered it peſtilential externally; and, within the dwellings, eſpecially in the poorer parts of the town, infectious atmoſphere was produced, and thus whatever diſeaſe was generated, was propagated readily, and gave a character to the particular *conſtitution* of the epidemic ſeaſon. How variouſly the epidemics muſt be modified, according to the various degrees and combination of the exciting and pre-diſpoſing cauſes, muſt be obvious on reflection. When the bodies of the people happen to be pre-diſpoſed to diſeaſe by want of food, or actually diſordered by corrupted food, when the accumulation of filth, or the increaſe of marſhy ground from rains or inundations, ſend forth miaſmata in a moſt abundant and concentrated form, in conſequence of a peculiar autumnal ſeaſon, the moſt extenſive epidemic diſeaſes may be expected to ariſe. And we believe, that under ſuch a combination of obvious circumſtances, peſtilence never fails to appear.

On the other hand, although a large city cannot, like a camp, be removed from the ſource of the peſtilential effluvia, which it generates, yet induſtry may remove the ſource of theſe effluvia from it. And it appears to be a perfect confirmation of the preceding concluſions, that, as this removal has been accompliſhed in London, (for example,) as the arts of peace and civilization have advanced, and wealth has introduced the diſpoſition and the power to multiply perſonal comforts and conveniences; and as habits of cleanlineſs and ventilation have been generaly diffuſed; in the ſame proportion, and with equal ſteps, the improvement of the general health, the abſolute diſappearance of the plague and the other epidemics, and the increaſe of longevity, are to be remarked. Hence it is only within the laſt few years, that the deaths have fallen ſhort of the number of births within the bills of mortality of London.

We cannot, from our preſent knowledge of facts, however, account for all thoſe modifications of diſeaſes, nominally the ſame, which are obſerved to prevail at different ſeaſons, and which require different modifications of the treatment. It can only be ſtated as highly probable, that whether the epidemic diſeaſes originate from contagion, or human effluvia, or from the effluvia of foul ground, their degrees of violence may depend on the degrees of concentration of thoſe effluvia; and the contagion of a mild or ſevere diſeaſe may tend to propagate more particularly a diſeaſe of ſimilar character. We have already ſeen that peculiar ſymptoms, ſuperadded to an acute diſeaſe, as affections of the lungs or of the bowels with general fever, are readily propagated along with that fever, and have modified both its character and the requiſite treatment.

It has been juſtly obſerved, that "in military phyſic," (and the obſervation applies to epidemic diſeaſes in general,) "the great improvements to be made are not ſo much in the cure as in the prevention of diſeaſes, which depends altogether upon the knowledge of their cauſes." (Dr. John Hunter, *loc. cit.* p. 281.) Now one of the moſt important circumſtances to aſcertain, during the prevalence of an epidemic is, whether it ariſes from contagion, that is, from the influence of effluvia from the bodies of the diſeaſed, or from the contamination of the air by the effluvia of foul ground, &c. For "if a diſeaſe ariſe from contagion," as the author juſt quoted remarks, "there are ſure remedies againſt it, which are ſo well aſcertained, that while the plague, the moſt contagious and the moſt fatal of all diſeaſes, commits its greateſt ravages in large cities, individuals remain in the midſt of them in perfect ſecurity, truſting to a careful ſecluſion under proper regulations. (See CONTAGION.) Again, if diſeaſe ariſe from the air contaminated by the foul ground of a camp, or the exhalations of a marſh, it can only be avoided by a change of ſituation, or by taking care not to come within the ſphere of activity of ſuch noxious cauſes." Or in a large town, it may be added, by a ſtrict enforcement of public and private cleanlineſs. But it is often extremely difficult to decide upon this point; a generally operating cauſe affects ſuch a number of individuals about the ſame time, in the ſame ſituation, that they may ſeem to be infected by each other. So that, in fact, it has been diſputed whether the plague itſelf be a contagious diſeaſe; and in regard to the dreadful epidemics of America, medical obſervers are by no means agreed as to their contagious origin. The contagion of the plague will be diſcuſſed hereafter. In the mean time we ſhall ſtate ſome obſervations which may help to guide our deciſion in ſuch caſes.

By a contagious diſeaſe, is to be underſtood a malady in the courſe of which a poiſon is generated in the body of the ſick, which produces in others a ſimilar diſeaſe. The poiſon in ſome diſeaſes, as the ſmall-pox and chicken-pox, is ſufficiently apparent; and the other diſeaſes, which alſo ariſe from ſpecific contagion, and occur but once during life, as meaſles, ſcarlet fever, hooping-cough, &c. are well known. In others, again, as in typhus and the plague, it almoſt eludes our ſenſes, and is only active when concentrated or accumulated, or cloſe to the body of the ſick. Now theſe contagious diſeaſes equally affect all ages and deſcriptions, who ſuffer expoſure to their cauſe: wherever they prevail, the old inhabitants of a country ſuffer as much as thoſe that have lately arrrived. But this is never the caſe in the yellow fever, remittent fever, or even intermittent fever, which ariſe from external miaſmata; for ſuch as are ſeaſoned to the country or climate ſuffer infinitely leſs than new-comers. Again, diſeaſes proceeding from ſuch a cauſe, generally diffuſed, and operating upon all, do moſt conſtantly recur in the ſame perſons as long as they remain expoſed to the original cauſe; thus in camps and marſhy ſituations, the ſick are conſtantly relapſing in remittents and intermittents, till they change their ſituation. Dr. Hunter particularly obſerves, that the mortality among ſoldiers in the Weſt-Indies is, in a great meaſure, owing to theſe repeated attacks. But what the ſame writer conſiders as the *experimentum crucis*, to prove the non-exiſtence of contagion, is, when the ſick leave their uſual reſidence, and go to other places which are healthy, without ſpreading the diſeaſe. This conſtantly happens in the remittent fevers of the Weſt-Indies; for the good effects of changing the air of the towns for that of the mountains is ſo well known, that it is very generally practiſed; but certainly without the ſlighteſt ſuſpicion of any miſchief ariſing from any contagion carried by the ſick. If we try by this rule the fever epidemic in Philadelphia in 1793, we ſhall not pronounce it to be contagious. One obſervation more may be added: when diſeaſe ariſes from a cauſe generally diffuſed, ſeparation, which in contagious diſeaſes is commonly effectual, is here of no avail. Thus, ſhips of war have gone into a harbour in the Weſt-Indies, and have had no intercourſe with the people on ſhore, or with the crews of other ſhips, and yet in a few days the men have been ſeized with the prevailing fever in great numbers. (Hunter, ibid.)

With reſpect to the laſt argument but one, indeed, the inference is not perfectly concluſive; for malignant typhoid fevers, (and the plague, which is probably but an extreme degree of the ſame fever,) although they produce a contagion that is active and virulent in a confined and cloſe atmoſphere, nevertheleſs become much leſs contagious, in a clear and open air; ſo that we ſhould expect that, on a removal of the ſick to the country, the diſeaſe would aſſume a leſs virulent form. In the plague at Moſcow in 1771, we are told by Dr. Mertens, that the patients, who were conveyed to the neighbouring villages, communicated the diſeaſe to the inhabitants of thoſe places; which they would the more readily do, as probably their cleanlineſs was not ſuperior to that of Moſcow itſelf.

The ſpecific contagions, as they have been called, as ſmall-pox, meaſles, and ſcarlet-fever, which occur but once in the courſe of life, and chiefly attack children, become epidemic generally at pretty regular periods, in large towns. This may be principally explained, perhaps, by the circumſtance of the neceſſary interval requiſite for the production of ſubjects, who have not undergone theſe diſeaſes.

On the whole, however, although the progreſs of refinement in the comforts of human life, during the laſt century, have thrown much light on the nature and origin of epidemic conſtitutions, in different years; it muſt be allowed, nevertheleſs, that much farther obſervation of facts will be requiſite, in order to illuſtrate the ſubject completely.

EPIDENDRA, from επι, *upon*, and δενδρον, *tree*, in *Natural Hiſtory*, a word uſed by ſir Hans Sloane, and ſome other authors, to expreſs thoſe plants which grow upon others, ſuch as the miſletoe, which grows upon the apple-trees, &c. Theſe are more commonly diſtinguiſhed by the name of paraſitical plants. See Dodder.

EPIDENDRUM, in *Botany*, ſo named by Hermann, Linnæus, and others, from επι, *upon*, and δενδρον, *a tree*, becauſe moſt of the ſpecies, if not all, grow paraſitically on the trunks or branches of trees. Linn. Gen. 464. Schreb. 606. Willd. Sp. Pl. v. 4. 114. Mart. Mill. Dict. v. 2. Juſſ. 66. Swartz. Act. Holm. 1800. p. 240. Tracts on Botany, 182. Schrad. Journal, 1799. 209. t. 1. Orchid. in Schr. Neues Journ. v. 1. 79. Claſs and order, *Gynandria Monandria*. Nat. Ord. *Orchideæ*, Linn. Juſſ.

Gen. Ch. reformed. *Cal.* three-leaved. *Cor.* Petals two, nearly equal to the calyx-leaves, ſpreading; nectary a lip, turbinate and tubular at the baſe, connected with the ſtyle, deſtitute of a ſpur, its termination dilated, aſcending, ſpreading, either undivided or lobed. *Stam.* Anther an hemiſpherical, deciduous, terminal lid, of two or four cells; maſſes of pollen ſtalked, in pairs. *Piſt.* Germen inferior, oblong or obovate, erect, furrowed; ſtyle ſemi-cylindrical, often gibbous, concave in front; ſtigma either concave or convex, in the fore-part of the ſtyle near the top. *Peric.* Capſule oblong or obovate, with three or ſix ribs, with one cell and three valves, opening by clefts between the ribs. *Seeds* numerous, minute, each clothed with a chaffy tunic, inſerted into the downy internal ridges of the valves.

Eſſ. Ch. reformed. Calyx-leaves ſpreading. Lip tubular at the baſe, attached to the fore-part of the ſtyle, deſtitute of a ſpur. Anther a terminal lid, deciduous.

The original genus of *Epidendrum* in Linnæus, whoſe eſſential character is "Nectary turbinate, oblique, reflexed," comprehends many ſpecies which do not anſwer to that character, and which have, indeed, in ſeveral inſtances, been referred to this genus without a ſufficient knowledge of their flowers. Hence profeſſor Swartz has chiefly derived his genera of *Cymbidium*, *Dendrobium*, (ſee thoſe articles,) *Oncidium*, *Aërides*, and *Vanilla*, ſo that his *Epidendrum*, whoſe characters we have given above, is become a much ſmaller, as well as a more intelligible genus, though perhaps not more natural, it having the cloſeſt poſſible affinity to *Cymbidium* and *Dendrobium*. The ſpecies in Swartz are 23, in Willdenow 26. Profeſſor Martyn has, with great induſtry, collected 124 under the original genus. Dr. Swartz mentions 19 new ones as diſcovered in South America by the authors of the Flora Peruviana and Chiloenſis.

Among the genuine ſpecies of *Epidendrum*, as the genus ſtands at preſent, are

E. *cochleatum*, Linn. Sp. Pl. 1351. Curt. Mag. t. 572. Jacq. Ic. Rar. t. 605. Andr. Repoſ. t. 13. A native of Jamaica, and the firſt of its tribe that ever flowered in England. It is cultivated in a ſtove, in rotten bark, contrived ſo as to imitate, as much as poſſible, its natural ſituation in the clefts of aged trees, with occaſional ſupplies of water. The *bulbs* are green and ſmooth, of a compreſſed oval figure, each throwing out from its baſe numerous thick entangled fibres, which naturally adhering to the rugged bark, ſtrongly fix the plant and imbibe nouriſhment for its ſupport. A pair of oblong, rigid, recurved *leaves*, entire, as in all this natural order, ſpring from the ſummit of each bulb, and between them grows a *ſtalk*, about a foot high, bearing a ſpike of ſeveral *flowers*. Theſe are reverſed, the long pale-greeniſh calyx and petals hanging down, while the broad, concave, ſomewhat cordate nectary, of a chocolate hue ſpeckled with green, ſtands erect. The flower has little or no ſmell.

E. *fragrans*. Sw. Prod. 123. (E. cochleatum; Curt. Mag. t. 152.) A native alſo of Jamaica, flowered in the ſtove of Chelſea garden, under Mr. Fairbairn's care, in Feb. 1789. This has much reſemblance to the foregoing, but the *petals* are broader, the *nectary* pale ſtreaked with red, and tipped with a long point, and the flowers have a ſweet ſmell. The *ſtalk* moreover is ſhorter in this ſpecies than the *leaves*.

E. *amabile*. Linn. Sp. Pl. 1351. (Angræcum album majus; Rumph. Amb. lib. xi. 99. t. 43.) Native of the Eaſt Indies. This has beautiful white *bloſſoms*, twice as large as in Rumphius's plate, on a long ſlender branched *ſtalk*. The lip is five-lobed, and terminates beſides in a pair of very long, taper, almoſt capillary points. It would be a great acquiſition to our ſtoves.

E. *nutans*. Sw. Prod. 121. A native of Jamaica, flowered in Kew gardens in March 1791. This has a leafy *ſtem*, terminated by a ſtalk bearing a few pale *flowers*, whoſe lip is four-lobed. They are about the ſize of E. *fragrans*.

E. *ciliare*. Linn. Sp. Pl. 1349. Curt. Mag. t. 463. is a beautiful and magnificent plant, native of the Weſt Indies, which flowered at Mr. Whitley's nurſery, Old Brompton, for ſeveral years before 1799. *(Curtis.)* The *flowers* are numerous and fragrant; their calyx-leaves and petals each near two inches long, of a yellowiſh buff-colour; lip white, with two elegantly fringed lobes. This ſpecies is now not very rare in the Engliſh ſtoves.

E. *fuſcatum*. Sm. Spicil. t. 23. is rather ſingular than ornamental. The late Hon. Mrs. Barrington received it from Jamaica, and it bloſſomed in her garden in 1791. The *ſtem* is leafy, and terminates in a very long ſimple ſcaly ſtalk, bearing a denſe corymbus of ſmall *flowers*, which, like the whole plant, are of a brown purpliſh hue.

Several ſpecies, more or leſs a-kin to this laſt, occur in the works of Jacquin, as well as ſome more ſplendid ones with tall branching ſtalks, none of them yet introduced into our gardens.

EPIDERMIS, in *Anatomy*, is the thin inſenſible membrane which covers the true ſkin, and which conſtitutes, therefore, in all parts, the external ſurface of the body. See Skin.

Epidermis, in *Vegetable Anatomy*, from επι, *upon*, and δερας, the *ſkin*, or *hide*, is the ſcarf ſkin, or pellicle, which covers every part of a living plant, as a ſimilar cuticle covers the human ſkin. In the tender growing parts of vegetables this membrane is of the moſt delicate texture, pellucid and colourleſs, extremely thin, yet not deſtitute of tenacity, being wonderfully extenſible on ſtalks, or other parts, of quick growth. Under a high magnifier it is found to be porous in a regular manner, and differently in different plants, ſo as to allow of the paſſage of fluids in a definite degree, in either direction, according to the nature of each plant. Hence ſome leaves perſpire ſlowly, but imbibe moiſture with great rapidity, as thoſe of the ſucculent tribes; while others tranſmit their fluids, or imbibe external moiſture, with nearly equal facility, as aquatics. Such differences are detected by experience, but ſcarcely diſcoverable by microſcopical inveſtigation.

The *Epidermis* is of the moſt eſſential importance to the life of the plant, as of the animal, protecting the living parts which it covers from the injuries of the air, while it allows of due perſpiration and abſorption, as well as of the action of light through its nearly colourleſs ſubſtance. It differs greatly in thickneſs according to the part of the plant to which it belongs. Exquiſitely delicate on the fine organs of a flower, like the cuticle of the animal eye, it has conſiderably more ſubſtance on the leaf, and ſtill more on the branch of a tree. On old trunks it is generally obliterated or deſtroyed, being there no longer neceſſary, the dead layers of bark, (ſee Bark and Cortex,) anſwering all the purpoſes of protection, while the peculiar functions of an organized porous *epidermis* are not wanted. Yet in the birch, and a few other trees, the membrane in queſtion conſiſts of multiplied permanent layers, like the bark, and clothes the trunk as long as that part exiſts. The cuticle is eaſily ſeparable from young ſtalks in a rapid ſtate of vegetation, and from any part of a plant by means of maceration, boiling or putrefaction, being nearly, if not abſolutely, deſtitute of vitality, and very little ſubject to decompoſition.

Beſides the eſſential office of a guard to the living vegetable body againſt all hurtful ſtimulants, the *epidermis* anſwers many ſecondary purpoſes of protection. When naked, as uſual, it proves but a feeble defence againſt heat or cold, but it is often covered with hair or wool, in which caſe it becomes a very powerful one, particularly againſt the too violent action of a burning ſun. Flowers indeed, though peculiarly preſented to all the force of this luminary, have ſcarcely ever any ſuch woolly or downy defence; for the functions which they have to perform are often urgent with reſpect to light and heat. Many petals, notwithſtanding, are ſilky or downy on their outſide, apparently to protect them from cold, or poſſibly from too ſcorching a heat before they are full-grown, examples of which may be ſeen in *Convolvulus*, *Anemone*, and ſeveral other genera; but the inſides of ſuch petals are exquiſitely ſmooth.

Examples of a very firm ſmooth *epidermis*, of conſiderable ſtrength and thickneſs, may be found in the common currant, *Ribes rubrum*, the elder, *Sambucus nigra*, and the laburnum, *Cytiſus Laburnum*. On the branches of the latter it acquires almoſt a horny hardneſs; but it is ſtill more cartilaginous in the hard white tubercles ſprinkled over the leaves of *Aloe perlata*, and in the teeth of the foliage of ſome *Saxifragæ*, as well as the briſtly warts of ſeveral ſpecies of *Echium* and others of the *aſperifoliæ*. On the leaf of the white willow, and the *Protea argentea*, the cuticle has a fine ſilky clothing of a ſilvery hue; while in many more plants it is equally white, but deſtitute of gloſs. In the leaf of many kinds of mullein, *Verbaſcum*, and the fruit of the peach, we find it denſely covered with hairs, more or leſs branched. The herbage of the betony, *Betonica officinalis*, is clothed with rigid briſtles, fixed upon the cuticle, which in a dry ſtate excite ſneezing. Similar hairs on the cuticle of the ſtinging nettle are curiouſly perforated, to tranſmit a venomous fluid lodged in bags at their baſe, like the poiſon in a ſerpent's tooth. Graſſes, corn and horſetail, *Equiſetum*, have much flinty earth in their *epidermis*; while in the corktree, the common maple, and the Dutch elm, the ſame part is of a ſoft elaſtic fungous ſubſtance. The fruit of the plum, and leaves of the cabbage, have their *epidermis* covered with a fine blueiſh powdery reſinous ſecretion, which will ſcarcely allow rain to come in contact with them, yet ſuch plants readily abſorb moiſture.

Nothing can be more abſurd than the idea which ſome philoſophers have formerly entertained, that the *epidermis* was deſtined to give ſhape to a plant, and that certain lumps or excreſcences on the ſtems of trees were originally owing to a caſual wound or crack in this membrane. This opinion is eaſily refuted by purpoſely making ſuch a wound or opening, when it will be found that no tumour can be produced by any ſuch means; ſpontaneous tumours being in reality the cauſe, not the effect, of the burſting of the *epidermis*. S.

EPIDICASIA, Επιδικασια, among the *Athenians*. Daughters, inheriting their parents' eſtate, were obliged to marry their neareſt relations; which gave occaſion to perſons of the ſame family to go to law with one another, each pretending to be more nearly allied to the heireſs than the reſt. The ſuit was called επιδικασιας δικη; and the virgin, about whom the relations conteſted, επιδικος. Pott. Archæol. Græc. lib. 1. cap. 24. tom. i. p. 147.

EPIDIDIUM, in *Ancient Geography*, is the name which Ptolemy gave to that peninſula on the weſtern coaſt of Scotland, which forms part of the county of Argyle, called Cantyre and Knapdale; and including the iſles of Iſlay and Jura, which the Roman geographer conſidered as being part of it: but whether it then was integral, or not, cannot be aſcertained from his account. The peninſula might at an early period have been an iſland; ſuch changes has the ſea made upon our ſurge-beat coaſts: for "Dr. Smith derives this name from a ſimilar Celtic word, ſignifying the iſle of the Picts, who at that time were the principal inhabitants of that part of Scotland." Sir John Sinclair's Stat. Acc. vol. x. p. 519. But ſuch a concluſion is not juſtifiable by the rules of Celtic derivation. *Cyn*, in that language, ſignifies a wedge, and *tor*, land or territory; it is, therefore, obviouſly derived from thoſe two etymons conjoined, perfectly deſcriptive of ſuch a tongue of land, *i. e.* a wedge-ſhaped territory. Mr. Baxter imagines the Pepidii, ſynonymous with Epidii, to have derived their name from the Britiſh word Papidiauc, which ſignifies any thing ſhaped like a flute or pipe, as was the peninſula of Cantyre, the country of the Pepidii. From the ſouthern point, called the mull of Cantyre, promontorium Epidium, the coaſt of Ireland may be plainly ſeen; it being only 16 miles to the ſouth foreland in Coleraine.

EPIDIDYMIS, in *Anatomy*, a part of the teſticle, ſituated behind the body of that organ, and conſiſting of its excretory duct in a wonderfully convoluted form. It ends in a ſtraight tube, called the vas deferens. See Testis.

EPIDO'SIS, from επιδιδωμι, *to increaſe*, in *Surgery*, a preternatural enlargement of parts.

EPIDOT. See Strahlstein.

EPIDOTES, from επιδιδωμι, *I cauſe to grow*, in *Mythology*, deities which were ſuppoſed to preſide over the growth of infants.

EPIDROME, from επι, *upon*, and δρεμω, *to run*, in *Surgery*, an afflux of fluids, or, as they were formerly phraſed, humours, eſpecially when it aroſe from the application of a ligature round any part.

EPIDROMUS, of επι and δρομος, *courſe*, in the *Ancient Shipping*, a ſail near the ſtern, which was the largeſt but one in the ſhip.

EPIECIA, in *Ancient Geography*, a town of Greece, towards the ſea, and not far from Corinth; N. of Tenea.

EPIEZ, in *Geography*, a town of France, in the department of the Loiret, and diſtrict of Beaugency; 12 miles E. of Orleans.

EPIGÆA, in *Botany*, from επι, *upon*, and γεα, *the earth*, expreſſive of the proſtrate growth of this humble ſhrub. Linn. Gen. 219. Schreb. 295. Willd. Sp. Pl. v. 2. 615. Mart. Mill. Dict. v. 2. Juſſ. 161. Claſs and order, *Decandria Monogynia*. Nat. Ord. *Bicornes*, Linn. *Ericæ*, Juſſ.

Gen. Ch. *Cal.* Perianths double, cloſe together, permanent; the outer of three ovato-lanceolate, pointed leaves, of which the external one is larger than the reſt; inner in five deep, upright, lanceolate, pointed ſegments, ſomewhat longer than the outer. *Cor.* of one petal, ſalver-ſhaped; tube rather longer than the calyx, hairy within; limb ſpreading, in five deep ovate-oblong lobes. *Stam.* Filaments ten, thread-ſhaped, the length of the tube, and inſerted into its baſe; anthers oblong, acute. *Piſt.* Germen globoſe, with five furrows, downy; ſtyle cylindrical, as long as the ſtamens; ſtigma obtuſe, in five lobes. *Peric.* Capſule nearly globular, depreſſed, with five angles, five cells, and five valves. *Seeds* numerous, roundiſh. *Receptacle* large, ſeparating into five parts.

Eſſ. Ch. Outer calyx of three leaves; inner in five deep ſegments. Corolla ſalver-ſhaped. Capſule of five cells, with a central five-parted receptacle bearing the ſeeds.

The ſpecies are two.

1. E. *repens.* Linn. Sp. Pl. 565. Swartz Prod. 74. Andr. Repoſ. t. 102. Lamarck Illuſtr. t. 367. f. 1. "Leaves ovate, inclining to heart-ſhaped, entire. Tube of the corolla cylindrical." Native of pine foreſts in Virginia and Canada, but, like many plants of a cold or alpine climate, difficult to preſerve in our gardens. It flowers in April or May. The *root* throws out many woody, procumbent, creeping, branched, hairy, leafy *ſtems*, which form wide-ſpreading patches. *Leaves* alternate, on hairy foot-ſtalks, ovate, obtuſe, entire, heart-ſhaped at the baſe, veiny, ſhining, but roughiſh to the touch. *Stipulas* none. *Flowers* in terminal, denſe, bracteated cluſters, fragrant, of a pale bluſh-colour, each about the ſize of a ſmall cowſlip. It is increaſed by parting the roots, thrives in a light ſandy loam, but requires the ſhelter of a long-continued deep ſnow, or ſome equivalent protection, to ſurvive our winters. We ſaw it in great perfection at Meſſis. Lee and Kennedy's nurſery, Hammerſmith, in 1797.

2. E. *cordifolia.* Swartz Prod. 73. Lamarck Illuſtr. t. 367. f. 2. "Leaves heart-ſhaped, roundiſh, ſerrated, convex, hiſpid, rigid. Tube of the corolla ovate." Native of boggy places on the higheſt mountains of Guadaloupe and Cayenne. Smaller than the former, with pointed and more hiſpid *leaves*, whoſe foot-ſtalks are very ſhort. *Flowers* in like manner terminal, but with a more inflated tube. The young ſhoots are very hairy.

Epigæa, in *Gardening*, comprehends a plant of the low, trailing, ſhrubby, flowering kind. This is the creeping epigæa, or trailing arbutus (E. repens).

Method of Culture.—This is readily effected in this plant by the trailing ſtalks, which ſoon put out roots at the joints, and may then be cut off from the old or parent plants, and be ſet out in a ſhady ſituation, where the ſoil is moiſt, in the autumnal ſeaſon, that the plants may be well eſtabliſhed before the ſpring. In caſes where the winter proves ſevere, it may be neceſſary to lay a few dried leaves, or other light covering over them, to protect them from froſt; but after they become well rooted, they ſeldom require more than being kept clean from weeds.

Theſe are ornamental plants in the fronts of the borders of ſhrubberies.

EPIGASTRIC Artery, in *Surgery.* The proper mode of operating in certain caſes of ruptures, ſo as not to run any riſk of wounding this veſſel, will be explained in the article Hernia.

Epigrastric *Region*, in *Anatomy*, one of thoſe portions, into which the cavity of the abdomen is divided by anatomiſts in their deſcriptions. "The epigaſtric region," ſays Winſlow, "begins immediately under the appendix enſiformis at a ſmall ſuperficial depreſſion, called the pit of the ſtomach, and in adult ſubjects ends above the navel at a tranſverſe line, ſuppoſed to be drawn between the laſt falſe ribs on each ſide.

"This region is ſubdivided into three parts, one middle, named epigaſtrium, and two lateral, termed hypochondria. The epigaſtrium takes in all that ſpace which lies between the falſe ribs of both ſides, and the hypochondria are the ſpaces covered by the falſe ribs." Sect. 7. § 79, and 80.

EPIGASTRIUM. See Epigastric.

EPIGINOMENA, of επιγινομαι, *I ſupervene*, in *Medicine*, are new ſymptoms which occur in the progreſs of a diſeaſe. See Epiphenomena.

EPIGLOTTIS, in *Anatomy*, is a ſmall and thin piece of cartilage, placed at the back of the tongue, and having the office of cloſing the glottis, or opening of communication between the larynx and pharynx, when the food is paſſing into the latter cavity from the mouth. The anatomical deſcription of this part will be found in the article Larynx; its offices are deſcribed in that of Deglutition.

EPIGONIUM, επιγονιον, a muſical inſtrument among the ancients, with forty ſtrings, ſo called from its inventor Epigonius, a native of Ambracia, a city of Epirus. Mem. Acad. Inſcript. vol. v. p. 167.

EPIGONIUS, in *Biography*, was a mathematician of Sicyon, and a native of Ambracia, who is celebrated by the ancients for the invention of an inſtrument of forty ſtrings, which was called after his name, Epigonium. When he lived is uncertain, but as it was in times of ſimplicity, we may ſuppoſe that theſe ſtrings did not form a ſcale of forty different ſounds, but that they were either tuned in uniſons and octaves to each other, or accommodated to different modes and genera. The 12 ſemi-tones of our three-ſtopt harpſichords included thirty-ſix different ſtrings.

The Greeks were divided into numerous ſects of muſical ſpeculators, before and after the time of Ariſtoxenus: as the Epigonians, Damonians, Eratoclians, Agenorians, and many others enumerated by Porphyry, in his Commentary on the Harmonics of Ptolemy. Of theſe, however, all we know is, that they *differed*; it is, perhaps, little to be lamented, that we no longer know about *what.*

Muſic has many obligations to Epigonius. He was the firſt who played on ſtringed inſtruments without a *plectrum.* And, according to Athenæus, he firſt united the melody of flutes to that of the citharas; and by this means ſoftened the harſhneſs and inflexibility of the citharas when played alone. He invented the chromatic genus, and was the original author of choruſes.

EPIGRAM, in *Poetry*, a ſhort poem, or compoſition in verſe, treating only of one thing, and ending with ſome point, or lively ingenious thought.

The word is formed of επιγραμμα, *inſcription*, of επιγραφειν, *to inſcribe*, or *write upon.*

Epigrams then, originally, ſignify *inſcriptions*, and they derive their origin from thoſe inſcriptions placed by the ancients on their tombs, ſtatues, temples, triumphal arches, &c. See Inscription.

Theſe, at firſt, were only ſimple monograms: afterwards increaſing their length, they made them in verſe, to be the more eaſily retained: Herodotus, and others, have tranſmitted to us ſeveral of them.

Such little poems retained the name of epigrams, even after the deſign of their firſt inſtitution was varied, and people began to uſe them for the relation of little facts and accidents, the characteriſing of perſons, &c.

The Greeks confine their epigrams to a very narrow compaſs; for though, in the Anthology, we here and there meet with a very long one; yet, ordinarily, they do not exceed ſix, or, at moſt, eight verſes. The Latins were not always ſo ſcrupulous, and the moderns much leſs, as to theſe bounds.

M. le Brun, in the preface to his "Epigrams," defines an epigram a little poem, ſuſceptible of all kinds of ſubjects, and ending with a lively, juſt, and unexpected thought; which are three qualifications eſſential to the epigram; particularly the firſt and laſt of them, *viz.* brevity, and the point or cloſe of the epigram.

To attain brevity, only one thing is to be aimed at in the poem, and that to be purſued in the conciſeſt terms poſſible. Authors are much divided as to the length the epigram is to be confined to; the ordinary limits are from two to twenty verſes; though we have inſtances, both among the ancients and moderns, where they extend to fifty. But ſtill it is allowed, that the ſhorter the better, and more perfect, as it partakes more of the nature and character of this kind of poem. The point or turn is a quality much inſiſted on by the critics, who require the epigram conſtantly to cloſe with ſomething poignant and unexpected, to which all the reſt of the compoſition is only preparatory. Others there are, who exclude the point, and require the thought to be equally diffuſed throughout the whole poem, without laying the whole ſtreſs on the cloſe: the former is uſually Martial's practice, and the latter that of Catullus. Which is the moſt beautiful and perfect manner is diſputed by a third claſs of critics.

The Greek epigrams have ſcarce any thing of the point or briſkneſs of the Latin ones: thoſe collected in the Anthology have moſt of them a remarkable air of eaſe and ſimplicity, attended with ſomething juſt and witty; ſuch as we find in a ſenſible peaſant, or a child that has wit. They have nothing that bites, but ſomething that tickles. Though they want the ſalt of Martial, yet, to a good taſte, they are not inſipid; except a few of them, which are quite flat and ſpiritleſs. However, the general faintneſs, and delicacy of the pleaſantry in them, has given occaſion for a Greek epigram, or "epigram â la Greque," to denote, among the French, an epigram void of ſalt or ſharpneſs.

It is principally the point that characterizes the epigram, and diſtinguiſhes it from the madrigal. See Point.

In the modern verſification, as obſerved by F. Mourgues, the epigram and madrigal are diſtinguiſhed by the number of verſes and the cloſe. 1. By the number of verſes, which in the modern epigram does not go beyond eight, nor in the modern madrigal comes ſhort of ſix; and, 2. In that the cloſe, or period, of the epigram, has always ſomething more lively and ſtudied than that of the madrigal.

The epigram is the loweſt, and leaſt conſiderable of all the productions of poetry; and it is in general rather an effect of good luck, than of art, to ſucceed therein. The fineſſe, and ſubtilty, of the epigram, M. Boileau obſerves, ſhould turn on the words rather than the thought; which ſeems very little to the credit of this kind of compoſition, as it reduces it to the nature of the pun, or equivoque. F. Bouhours confirms the hint, in adding that the equivoque is what uſually ſhines the moſt in the epigram.

One great beauty of the epigram is, to leave ſomething for the reader to gueſs, or ſupply. Nothing pleaſes the mind ſo much, as to find ſomething in itſelf in the objects preſented it; nor does any thing diſguſt it more than to preclude it from ſhewing and exerciſing a faculty it values itſelf for. Segrais.

The epigram admits of great variety of ſubjects: ſome are made to praiſe, and others to ſatirize, which laſt are much the eaſieſt; ill-nature ſerving inſtead of point and wit. Boileau's epigrams are all ſatires on one or another. Thoſe of Des Reaux are all made in honour of his friends; and thoſe of Mad. Scudery are ſo many eloges. The epigram being only a ſingle thought, it would be ridiculous to expreſs it in a greater number of verſes; it muſt have its unity like the drama. The comedy has an action for its ſubject, and the epigram a thought.

We might ſelect a number of excellent epigrams in our own language, if our limits allowed of enlarging this article. We ſhall content ourſelves with ſubjoining the following. The firſt is that of Mr. Pope, ſaid to be written on a glaſs with the earl of Cheſterfield's diamond pencil.

> "Accept a miracle, inſtead of wit,
> See two dull lines by Stanhope's pencil writ."

The next is an epigram, expreſſed conciſely and cloſing beautifully, which was written on the leaves of a fan by Dr. Atterbury, late biſhop of Rocheſter:

> "Flavia the leaſt and ſlighteſt toy
> Can with reſiſtleſs art employ.
> This fan in meaner hands would prove
> An engine of ſmall force in love;
> Yet ſhe with graceful air and mien,
> Not to be told or ſafely ſeen,
> Directs its wanton motion ſo,
> That it wounds more than Cupid's bow.
> Gives coolneſs to the matchleſs dame,
> To every other breaſt a flame."

Mr. Prior laſhed the impertinence of a bad writer, who had taken the liberty of cenſuring him, in the following epigram:

> "While faſter than his coſtive brain indites,
> Philo's quick hand in flowing letters writes.
> His caſe appears to me like honeſt Teague's,
> When he was run away with by his legs:
> Phoclus, give Philo o'er himſelf command;
> Quicken his ſenſes, or reſtrain his hand.
> Let him be kept from paper, pen, and ink,
> So he may ceaſe to write, and learn to think."

The following epigram was written by Mr. Weſley, on occaſion of erecting a monument to Mr. Butler, author of Hudibras, in Weſtminſter Abbey:

> "While Butler, needy wretch, was yet alive,
> No generous patron, would a dinner give.
> See him, when ſtarv'd to death, and turn'd to duſt,
> Preſented with a monumental buſt!
> The poet's fate is here in emblem ſhown,
> He aſk'd for *bread*, and he receiv'd a *ſtone*."

See Butler.

EPIGRAPHE, Επιγραφη, *Superſcription*, an inſcription on a building, to ſignify its uſe, occaſion, the time when, and the perſon by whom it was built.

EPIGRAPHES, Επιγραφεις, among the Athenians, officers that rated all thoſe of whom taxes and contributions were required, according to every man's ability, kept the public accounts, and proſecuted ſuch as were behindhand with their contributions. Potter. Archæol. Græc. lib. i. cap. 14. tom. i. p. 81.

EPILA, in *Geography*, a town of Spain, in the province of Arragon, on the Xiloca; 17 miles W. of Saragoſſa.

EPILEPSY, in *Medicine*, ἐπιληψία, and ἐπιληψις, ſignifying *ſudden ſeizure*, is a diſeaſe which conſiſts of convulſions of the greater part of the muſcles of voluntary motion, attended with a loſs of ſenſe and feeling, and ending in a ſtate of inſenſibility, and ſeeming ſleep.

This diſeaſe has received a variety of denominations, eſpecially among the ancient writers. By the early Greeks it was called the *ſacred diſeaſe*, from a notion of its origin in ſupernatural influence ; ſome of the exorciſts and impoſtors of thoſe times even pretended to decide, from variations in the ſymptoms, whether the fits were occaſioned by Cybele, Neptune, Mars, or ſome of the heroes. Hippocrates ſeems to have been the firſt who combated theſe abſurd notions of his countrymen ; and ſeverely reprehends the impoſtures of the exorciſts, in pretending to ſet aſide what more than human power had inflicted, by incantations, magic ceremonies, and ſometimes by the moſt contemptible juggling. (See Hippoc. de *Morbo Sacro.*) Aretæus, however, remarks that it might have the denomination of *ſacred* on other accounts ; either from its magnitude, every thing great being deemed ſacred ; or becauſe it could not be removed by human means, but only by divine power ; or from the opinion that a dæmon had entered into the patient, or for all theſe reaſons together. (De Cauſis Affect. lib. i. See alſo Cæl. Aurelian. De Morb. Chron. lib. i. cap. iv.) In like manner the Romans call every thing remarkable and great "ſacred :" "*ſacra* anchora," "auri *ſacra* fames," &c. (Van Swieten. § 1071.) Upon the ſame ground epilepſy has been called morbus *Herculeus*, the Herculean diſeaſe. By the Romans, it was ſometimes termed morbus *comitialis*, "the aſſembly diſeaſe ;" either becauſe epileptic perſons were more frequently obſerved to be ſeized in a crowd of people, or becauſe the public meetings, called *comitia*, were adjourned if any one happened to be attacked with an epileptic fit. It has likewiſe been termed morbus *caducus*, or "falling ſickneſs," becauſe the patients, when they are ſeized with the paroxyſm, fall down.

The leading features and principal circumſtances of the epileptic convulſions are nearly the ſame in all the different perſons whom the diſeaſe affects. The diſeaſe conſiſts of fits, which attack ſuddenly often thoſe who are ſeemingly in perfect health, and, after laſting for ſome time, paſs off, and leave the perſons again in their uſual ſtate.

The individual attacked loſes ſuddenly all ſenſe and power of directing his muſcular actions ; ſo that, if ſtanding or ſitting, he falls immediately, or perhaps with convulſions is thrown to the ground. In that ſituation he is agitated with violent convulſive actions, variouſly moving his limbs and the trunk of his body, with a force that is altogether preternatural. Commonly the limbs on one ſide of the body are more violently agitated than thoſe upon the other. In all caſes the muſcles of the face and eyes are much affected, exhibiting various and violent diſtortions of the countenance. The tongue is often affected, and thruſt out of the mouth, while the muſcles of the lower jaw are alſo affected, and, ſhutting the mouth with violence, often wound the tongue grievouſly. While theſe convulſions continue, the face becomes red, then livid and ſwelled, from the interruption to the circulation through the head, and there is commonly at the ſame time a frothy moiſture iſſuing from the mouth ; and in the moſt ſevere caſes the urine and alvine excrements are involuntarily diſcharged. In ſome inſtances a hiſſing or ſtertorous noiſe is emitted. The convulſions have for a few moments ſome remiſſions, but are ſuddenly again renewed with great violence. Generally, after no long time, this terrible ſtruggle ceaſes altogether, and the patient remains for ſome time without motion, in a ſtate of abſolute inſenſibility, and under the appearance of a profound ſleep. After ſome continuance of this ſeeming ſleep, he ſometimes ſuddenly, but for the moſt part by degrees only, recovers his ſenſes and power of motion, but without any memory of what had paſſed from the firſt ſeizure of the fit, and complaining of head-ache, and exceſſive pain in all the limbs as if from ſevere fatigue. During the convulſions the pulſe and reſpiration are hurried and irregular ; but, when the convulſions ceaſe, they return to their uſual regularity and healthy ſtate.

In moſt caſes the attack of epilepſy comes on ſuddenly, without any warning ſymptom : but ſometimes it is preceded by certain ſenſations for a few moments previous to its actual commencement. Of theſe the moſt remarkable is that, which has been termed the *Aura epileptica* ; which is a ſenſation of ſomething moving in ſome part of the limbs or trunk of the body, and from thence creeping upwards to the head ; and when it arrives there, the perſon is immediately deprived of ſenſe, and falls into an epileptic fit. This feeling is deſcribed ſometimes as reſembling that of a cold vapour, ſometimes as like a fluid gliding, and ſometimes like the ſenſation of a ſmall inſect creeping along the body ; and very often the patients can give no other diſtinct idea of their ſenſation, than as in general of ſomething moving along. It might be ſuppoſed that this ſenſation aroſe from ſome affection of the extremity or other part of a nerve, acted upon by ſome irritating cauſe ; and that the ſenſation, therefore, followed the courſe of ſuch a nerve. But it is not found to follow the courſe of any nerve diſtinctly, and it generally ſeems to paſs along the integuments. There are occaſionally alſo other ſymptoms immediately preceding the fit, and generally referred to the head, where no *aura* is perceived. In ſome perſons a giddineſs comes on ; in others a ſpark of light, which increaſed to a bright beam, uſually uſhers in the paroxyſm ; depending probably on the ſudden turgeſcence of the veſſels in the head, which produces preſſure on the optic nerve, and occaſions this depraved ſenſation. Dr. Gregory uſed to mention in his lectures, at the college of Edinburgh, the caſe of an officer, who had a more ſingular perverſion of ſight, previous to the fit of epilepſy ; he always fancied that he ſaw an apparition of an old woman, with a blue cloak, holding a ſtaff in her hand, with which ſhe knocked him down. He alſo mentioned an inſtance of viſual depravation which occurred to Dr. Fothergill ; a young lady, whom the Dr. was attending as an epileptic patient, remarked that he was covered with ſpangles, (the more unuſual as an ornament to a quaker's coat,) and immediately ſhe fell down in a fit.

Under the article CONVULSIONS we have entered into a detail of the circumſtances which conduce to their origin and production ; and as the whole of thoſe obſervations apply to the epileptic convulſions moſt particularly, it will not be here neceſſary to repeat them. We have there ſtated that convulſions occur under two oppoſite conditions of the body, *viz.* of *repletion* and *inanition* ; or, in the language of Dr. Cullen, of *excitement* and *collapſe* (Firſt Lines, § 1286.) : and that various *irritations* in different parts of the body, but eſpecially in the head, give riſe to them in different inſtances.

Sauvages has deſcribed a great variety of ſpecies of epilepſy, which he has diſtinguiſhed chiefly according to the cauſes which produced them. Dr. Cullen has mentioned only three ſpecies, which (as to the utility of diviſion with a view to the curative indications) might be reduced to two. His firſt ſpecies is epilepſia *cerebralis* (from *cerebrum*, the brain), which attacks ſuddenly, without any evident cauſe, or preceding ſenſation, except perhaps a giddineſs or deprivation of ſight ; and includes the *plethoric* epilepſia and eclampſia of Sauvages, as well as his *cachectic* epilepſy. The ſecond ſpecies, is E. *ſympathica*, in which the *aura epileptica*, before deſcribed, precedes the attack ; a circumſtance which is ſcarcely of ſufficient importance to deſignate a ſpecies. The third, E. *occaſionalis*, includes thoſe inſtances of epilepſy which originate from manifeſt and accidental irritation, and which ſubſide when the irritation is removed. Theſe various cauſes of irritation are, wounds, or blows of the head, from falls, and other external injuries; pain in various degrees, as from parturition, dentition, worms in the alimentary canal; indigeſted food, or other ſubſtances in the ſtomach, as narcotic poiſons, ſpirituous liquors, &c; paſſions of the mind, eſpecially fear; and a variety of other ſources of diſturbance to the ſyſtem, as the eruption of ſmall-pox, and other febrile irritations, the venereal orgaſm, intenſe ſtudy, the ſuppreſſion of cuſtomary diſcharges, &c.; and, laſtly, the imitative propenſity, which is particularly conſpicuous in women and children, as illuſtrated at large under the head of CONVULSIONS.

We have there ſtated the impoſſibility of explaining the proximate cauſe of convulſive diſeaſes, in conſequence of our ignorance of the nature of the nervous power, or of the connection between the action of the muſcles and the brain, or the faculty of volition, in a ſtate of health. And it were ſufficient to mention the attempts to reaſon upon the ſubject, which the ableſt phyſicians have made, in order to prove their futility. The learned Boerhaave ſays, (*Aph.* 1086.) "Et patet quidem, cauſam proximam omnis epilepſiæ exquiſitæ ſemper eſſe nimiam cerebri in nervos motorios, nullam in ſentientes, actionem." "It is obvious that the proximate cauſe of every perfect epilepſy is always too great an action of the brain upon the nerves of motion, and too little upon thoſe of ſenſe:" which is only ſtating the fact in other words; for it amounts merely to this: "in every true epilepſy the motions of the body are violent, and the ſenſe is loſt: the proximate cauſe is ſtill as obſcure as before." Dr. Cullen ſcarcely pretends to form a theory upon the ſubject. "I might ſay," he obſerves, "that it is an affection of the energy of the brain, which, ordinarily under the direction of the will, is here, without any concurrence of it, impelled by preternatural cauſes. But I could go no further: for as to what is the mechanical condition of the brain, in the ordinary exertions of the will, I have no diſtinct knowledge; and therefore muſt be alſo ignorant of the preternatural ſtate of the ſame energy of the brain under the irregular motions here produced." (Firſt Lines, § 1284.) The indications of cure therefore cannot be formed from a knowledge of the proximate cauſe of the diſeaſe; but we obtain ſome uſeful intimations for the treatment, by diligently attending to the various remote cauſes; both thoſe which induce a prediſpoſition, and thoſe which occaſionally excite the diſeaſe. Our principal object, then, will be to avoid the occaſional cauſes, and to remove or correct the prediſponent.

The prediſpoſition to epilepſy, in the majority of inſtances, ſeems to conſiſt partly in what may be termed a morbid irritability, or mobility, of conſtitution, in which the action of ſlight irritations (which are applied to moſt perſons with impunity) excites great commotion in the nervous ſyſtem; and partly in a turgeſcence of the veſſels of the head, which accompanies a general plethora. This appears from the circumſtances, that plethoric perſons are very frequently the ſubjects of epilepſy; that it is often brought on by cauſes inducing any unuſual turgeſcence of the blood-veſſels; and that it has been frequently cured by diminiſhing the plethoric ſtate of the body, more frequently, we believe, than by any other ſyſtem of practice. This principle was inculcated by Dr. Cullen, and is ſtrenuouſly adopted by the preſent Dr. Gregory, his ſucceſſor. It was likewiſe maintained by the late Dr. Fothergill, who has left us the following excellent remarks on this point of practice.

After ſtating that many epilepſies occurred to him, which eluded all his endeavours to relieve them by means of the medicines ordinarily recommended as ſpecifics, and which therefore ſuggeſted the neceſſity of adpoting ſome other mode of procedure, he ſays, "I had obſerved that fits were moſt liable to return in the plenitude of health; that epileptics were often extremely incautious in reſpect to diet; that children, highly indulged, were liable to the diſeaſe; that in every other period of juveneſcence, and in middle aged adults, if they were at all ſubject to the diſeaſe, it was when they had either committed ſome exceſſes, or, by one means or another, were plethoric; and that, in habits ſubject to epilepſy, the diſeaſe ſeldom recurred, without either an habitual indulgence in eating, or a neglect of neceſſary exerciſe. This induced me to recommend, in many caſes, a total abſtinence from all animal food, and from all fermented liquors. Care was taken to regulate the ſecretions, and ſuch a courſe of medicine preſcribed, as might ſeem expedient to induce the patients, or their friends, ſcrupulouſly to comply with ſuch a courſe of diet. It was in vain to reſtrict the quantity of animal food. There are few who have, at all times, reſolution enough to ſubmit to the firſt intimations of ſatiety. It was, therefore, neceſſary to enjoin ſuch a kind of diet, as was accompanied with but ſlender provocations to exceſs, and which, at the ſame time, would afford the leaſt quantity of nutriment; by which that fullneſs, which, in many epileptic caſes, appears to be a ſtimulus ſufficient to produce the ſpaſms, would be avoided, and the parts, which were the immediate ſeat of irritation, might gradually recover a degree of ſtrength and firmneſs, that would be proof againſt every ſlight impreſſion.

"It often happens in diſeaſes, that a proper plan of diet is of much more importance in the cure than any thing we are acquainted with in the *Materia Medica*: it is, however, of not leſs neceſſity to engage the patients and their friends in a ſteady perſeverance of the method we direct. The generality of people have very little notion that diet can do more than merely ſupport their ſtrength; that it can be made ſubſervient to the cure of their diſeaſes, they cannot eaſily be brought to comprehend, &c.

"In young boys, I apprehend, the epilepſy moſt generally proceeds from their own craving appetites, and the neglect of thoſe who are about them. It may not be improbable, but in ſuch caſes worms may alſo have a ſhare in producing the fits. Be this as it may, anthelmintics, however powerful, ſeldom cure the diſeaſe; they may abate occaſionally the frequency, or the violence of the attacks, but they too often, at the ſame time, bring on a greater degree of irritability, and at length, if repeated frequently, and in conſiderahle doſes, ſeldom fail of confirming the diſeaſe. Moderate laxatives, with a light chalybeate interpoſed, and ſteadily continued, with a courſe of diet, conſiſting of milk, vegetables, fruit, and things prepared from them, and in moderate quantities, ſeldom fail of removing the diſeaſe in ſuch habits. Riding and bathing in cold water, and the uſual means of eſtabliſhing good health, muſt, at the ſame time, be attended to, and the plan purſued with patience; for it is not to be expected in diſeaſes that affect the nervous ſyſtem, the moſt remote and fineſt part of the economy, when once they have debilitated, or otherwiſe diſordered, theſe very feeling parts, and their influence is become habitual, that after-medicines, however active, penetrating, and efficacious, can, in a very ſhort time, reſtore the ability to perform their functions as they ought to do." (See Medical Obſ. and Inquiries, vol. vi. p. 72.)

This plan of light and moderate living, with occaſional laxatives, ſhould be adopted in every caſe of epilepſy, where it does not ariſe from loſs of blood, or other cauſes of inanition, or is not connected with a cachectic or emaciated habit: and even in the laſt caſe, the plan is often uſeful, eſpecially where a morbid change, ſuch as exoſtoſis, ſuppuration, or tumour of any kind, is going on in the head.

It might be ſuppoſed that artificial evacuations, eſpecially blood-letting, would be the moſt effectual means of diminiſhing the plethoric ſtate of the ſyſtem: and ſuch it certainly proves, when the plethora has become conſiderable; and if it threatens immediate diſeaſe, this evacuation ought to be made to the quantity that the urgency of the ſymptoms ſeems to require. It is, however, a matter of old obſervation, that blood-letting is not the proper mode of preventing the recurrence of the plethoric ſtate; but, on the contrary, that it is often the means of favouring it, eſpecially when the operation is performed at regular periods. There is, however, a caſe of epilepſy, as Dr. Cullen remarks, in which there is a periodical or occaſional recurrence of the fullneſs and turgeſcence of the ſanguiferous ſyſtem, giving occaſion to a recurrence of the diſeaſe. In ſuch caſes, when the means of preventing plethora have been neglected, or may have proved ineffectual, it is abſolutely neceſſary for the practitioner to watch the returns of theſe turgeſcences, and to obviate their effects by the only certain means of doing it, that is, by a large blood-letting. When the general plethora is not great, but the ſymptoms indicate conſiderable local turgeſcence in the head, the application of cupping-glaſſes, after ſcarification of the neck, or the uſe of a ſeton, bliſter, or iſſue, near the ſame part, will afford the means of ſome relief, by the evacuations which they produce. An open iſſue, indeed, in diſtant parts, as in the arm, has been found uſeful in ſome inſtances of epilepſy, by tending to obviate the plethoric ſtate, or, as Dr. Cullen ſuggeſts, by determining occaſional turgeſcences to thoſe parts, and, therefore, diverting them, in ſome meaſure, from their action upon the brain.

Epilepſy, however, as we have already ſtated, is alſo the reſult of a ſtate of debility, with which the exceſſive nervous mobility that is eaſily excited to convulſions is, in many other inſtances, obſerved to be connected; eſpecially in hyſteria, in the condition of infancy, &c. Where this debility has been the conſequence of inanition, as from loſs of blood, from previous diſeaſe, and ſo forth, a nouriſhing generous diet will be requiſite to reſtore the ſtrength; and inſtances are occaſionally ſeen, in which the propriety and ſucceſs of this practice are manifeſt. Where there is obviouſly a feeble ſtate of body, with pale complexion, and without any appearances of local plethora, the propriety of being much in the open air, of uſing the cold bath frequently, and of regular exerciſe, adapted to the ſtrength and habits of the patient, muſt be equally evident. He may ſtill farther contribute to remove debility, and its conſequences, eſpecially that great mobility which is a principal part of the prediſpoſition to epilepſy, by the uſe of tonic and antiſpaſmodic medicines.

By a ſort of routine, too generally purſued by indiſcriminating practitioners, remedies of the laſt mentioned claſſes are moſt commonly given in epileptic caſes, more particularly of late the metallic tonics, while the diet and regimen are not ſufficiently attended to. However, as the circumſtances of the conſtitution occaſionally favour their operation, it cannot be doubted that the diſeaſe has, in many inſtances, been removed by theſe means; and numerous caſes are on record, in which particular ſpecies of tonic remedies have effected the cure of epilepſy. The preparations of iron have been moſt commonly employed for this purpoſe, as the rubigo ferri, or the ſulphat of iron, or its combination with ammonia (ferrum ammoniacale); and cures have been ſaid to be accompliſhed by all theſe preparations. Dr. Cullen, however, obſerves, that he never found them effectual; which he attributes partly to their not having been always employed in the proper circumſtances of the diſeaſe, and partly to the inadequate quantities in which they have been given. (Firſt Lines, § 1335.) A preparation of copper, the cuprum ammoniacum of the Edinburgh Diſpenſatory, has been one of the moſt celebrated of the metallic tonics, and Dr. Cullen admits it to have been often ſucceſsful. It ſhould be given in the doſe of one grain at firſt, twice in the day, and gradually increaſed to as much as the ſtomach will bear. Zinc, eſpecially in the form of flowers of zinc, (as the oxide was formerly denominated,) has been much extolled for its virtues in the cure of epilepſy, and other ſpaſmodic diſeaſes, when it was uſed in ſmall doſes. Much larger quantities of it, however, have been adminiſtered lately, and its character of efficacy has been conſiderably diminiſhed. The ſulphat of zinc, or white vitriol, appears to be a more efficacious tonic. Arſenic has more recently been introduced as a remedy for epilepſy. The ſafety and great powers of this metal, as a medicine, eſpecially in the cure of *periodical* diſorders, ſuch as intermittent fevers, megrim, or intermittent head-ache, &c. have been fully eſtabliſhed, and afford an analogy in its favour. A writer on this ſubject, in the Edin. Med. and Surg. Journal (for July 1809) ſtates, that he has found arſenic ſucceſsful in the cure of epilepſy, when it "occurred in young ſubjects, principally anterior to the age of puberty, and of what is termed a delicate make, and feeble ſtamina, eſpecially when the diſeaſe aſſumes, or very nearly approaches, a periodic form. The drunken epileptic likewiſe, when not of a full plethoric habit, has found a cure from the firm and judicious uſe of this potent remedy, due attention having been paid to the alvine evacuations." There is ſtill another tonic of the metallic claſs, which has lately been recommended as an efficacious remedy for epilepſy, the nitrat of ſilver (or lunar cauſtic), and is ſaid to have cured the diſeaſe, when it had already been of many years ſtanding. (See two caſes of this nature, Med. and Phyſ. Journal, vol. i. p. 184. vol. ii. p. 70.) A quarter of a grain of this active ſubſtance, given three times a day, is a ſufficient doſe for an adult in the beginning; it may be afterwards carefully increaſed.

The vegetable tonics are admitted to poſſeſs leſs efficacy in alleviating this dreadful diſorder. Among theſe the bitters have chiefly been employed, and the cinchona is the moſt active. Like the arſenic, it is eſpecially adapted to thoſe epilepſies which recur at certain periods, and which are not at the ſame time accompanied with any plethoric ſtate, or turgeſcence of the blood: in ſuch periodical caſes, if the bark is employed ſome time before the expected recurrence, it may be uſeful; but it muſt be given in large quantity, and as near to the time of the expected recurrence as poſſible. The leaves of the orange tree have ſometimes proved uſeful in this diſeaſe, probably by the bitter quality which they poſſeſs.

But this caution muſt again be given, with reſpect to the employment of any of the above-mentioned tonics in this diſeaſe, that in all caſes where it depends upon conſtant or occaſional plethoric ſtate of the ſyſtem, theſe medicines are likely to be at leaſt ineffectual; and if ſufficient evacuations be not made at the ſame time, they are likely to be very hurtful. The various ſucceſs with which ſuch remedies have been adminiſtered is, doubtleſs, to be aſcribed partly to inattention to theſe circumſtances; although it is equally clear, that many epilepſies, connected with organic leſion in the head, or a connate diſorder of the habit, are beyond the power of any medicine.

With a view of diminiſhing the tendency to the convulſions of epilepſy, various antiſpaſmodic medicines have been employed, ſuch as valerian, caſtor, muſk, the fœtid gums, empyreumatic oils, and other ſubſtances of ſtrong and offenſive odour. But, although theſe remedies were generally adminiſtered at one period, and were much extolled for their antiſpaſmodic powers, they ſeem to have loſt their high character, in a great meaſure, and are much leſs employed than heretofore.

Several remedies have alſo been introduced, as *ſpecifics*, in the diſeaſe in queſtion; *i. e.* as remedies which poſſeſſed a peculiar influence over it, independently of any ſenſible quality or operation. Such are the viſcus quercinus, or miſletoe, the cardamine pratenſis, agaricus muſcarius, &c. Experience has not ſanctioned the recommendation of theſe medicines, which appear to be nearly inert. If the miſletoe were ever beneficial, it was probably in thoſe times when it was an object of religious ſuperſtition, and operated through the medium of an impreſſion on the mind. On the ſame principle, taking remedies that excited horror may have ſometimes ſucceeded in curing the diſeaſe; ſuch as the powder of human ſkulls, (pulvis cranix,) &c. A pamphlet has been publiſhed lately, however, in which the ſpecific efficacy of the miſletoe is again contended for by Dr. H. Fraſer. But the caſes, there related, are mentioned ſo briefly and uncircumſtantially, that no juſt inference as to the means of cure can be deduced; and the weight of negative evidence is, on the other hand, ſo great, that we are diſpoſed to attach little credit to the miſletoe. We have employed it, ſince the publication of the pamphlet alluded to; but without any effect.

Dr. Fothergill, whoſe experience and ſound obſervation led him to infer, that plethora was the moſt frequent cauſe of *curable* epilepſies, and the ſyſtem of diet and evacuation, before mentioned, the moſt effectual means of cure, was diſpoſed to attribute the reputed efficacy of all the laſt-named remedies for epilepſy to a very different operation, than was intended by the preſcriber: namely, to their impeding digeſtion, and conſequently preventing incurring plethora. "Valerian," he ſays, "caſtor, the fœtid gums, empyreumatic oils, and, if there be any thing ſtill more diſguſtful, commonly make a part of the medicines propoſed for this diſeaſe. There are ſome others, whoſe qualites, indeed, are not quite ſo repugnant to our taſte and ſmell, ſuch as the miſletoe, and the *flores cardamines;* but to balance this difference, it is requiſite to take theſe ſuch a length of time, and in ſuch quantities, as make them not leſs diſguſtful at length. May not, therefore, both theſe kinds of medicines, and moſt of thoſe made uſe of as ſpecifics from ancient authority, now and then confirmed with inſtances of benefit, derive the greateſt part of their conſequence from their quantity, or their diſguſting qualities, which, by leſſening the appetite, allow nature to recover herſelf, and ſhake off a diſeaſe, which indulgence principally produced." (Med. Obſ. and Inquir. vol. vi. p. 77.)

The ſight of others in a fit of epilepſy is the moſt common of the mental irritations which produce epilepſy: this, therefore, ſhould be guarded againſt, eſpecially among children, and more particularly in a family where epilepſy has already appeared. The famous caſes of epilepſy, thus communicated among the orphans at the hoſpital at Haerlem, are well known; (ſee Convulsions,) as well as Boerhaave's ſucceſsful cure, by threatening a ſevere puniſhment (burning with a hot iron) to the firſt who ſhould be ſeized with a fit. This counter-impreſſion upon the mind, which Dr. Cullen whimſically terms the *tonic* of fear, was ſufficient to obviate the effects of the other. (See Kaau Boerhaave impetum faciens, § 406.)

Some anti-epileptic powers have been attributed to opium, hyoſcyamus, or henbane, digitalis, and ſome other ſedative medicines; but it is obvious that theſe ſubſtances can only be ſerviceable in thoſe caſes where the diſeaſe depends upon irritation, or increaſed irritability, when their effects will be temporary; and that, when there is any plethoric or inflammatory condition preſent, they muſt, with the exception of digitalis, prove hurtful, eſpecially opium.

With reſpect to the fit itſelf nothing can be done, in general, except reſtraining the patient from injuring himſelf. He ſhould be removed from the ground, or from the vicinity of any hard body, againſt which he might be bruiſed by the convulſive motions of the limbs; and in thoſe caſes in which the tongue is apt to be protruded, and lacerated by the teeth, a ſort of gag ſhould be introduced. In very plethoric habits, where the determination of blood to the head is very great, it may be adviſeable to open a vein during the fit, in order to obviate the immediate danger of life, from a rupture of the veſſels of the brain.

When the fit is preceded by an *aura*, as before mentioned, which has been ſuppoſed to ariſe from irritation propagated along the courſe of ſome particular nerve, various means of preventing the fit have been ſuggeſted; ſuch as deſtroying the part, in which the *aura epileptica* ariſes, by means of the knife or cauſtic, applying a bliſter, or making an iſſue in it, or cutting the branch of the nerve along which the *aura* ſeems to paſs, or laſtly, applying a ligature upon the limb, above the part from which the *aura* ariſes. A tourniquet has been recommended for the laſt purpoſe, to be worn looſe upon the limb, and tightened the inſtant that the *aura* is perceived; by which means the epilepſy has been ſaid to have been prevented in ſeveral inſtances.

On diſſection after death from epilepſy, a variety of morbid and preternatural appearances have been in the head, to which the ſymptoms might be juſtly attributed, in conſequence of the mechanical irritation of the brain. Thus irregularity in the arrangement of the bones, or ſome other malformation of the cranium, inequalities or protuberances on its interior ſurface, ſplinters, or depreſſion of the bones from fracture; tumours, thickening, and oſſification in the membranes enveloping the brain; fluids of various acrimony effuſed, or collected within the brain, or on its ſurface, and tumours formed in the ſubſtance of the brain; have in various inſtances been diſcovered after epilepſy had proved fatal.

EPILESMON, from επιληθω, *I cauſe to forget*, a term uſed by the old writers in *Medicine*, to expreſs a loſs of memory.

EPILOBIUM, in *Botany*, a name adopted by Conrad Geſner, and explained by him as indicative of the character of this genus, επι λοβȣ ιον, *a violet*, or beautiful flower, growing upon a pod; in which he is followed by Dillenius and Linnæus. See Bauhin's Pinax 245, ſect. 7; Dill. Plantæ Agri Giſſenſis, 132; and Linn. Phil. Bot. 176. Willow-herb.—Linn. Gen. 188. Schreb. 251. Willd. Sp. Pl. v. 2. 313. Sm. Fl. Brit. 409. Mart. Mill. Dict. v. 2. Juſſ. 319. Gærtn. t. 31. (Chamænerion; Tourn. t. 157.) Claſs and order, *Octandria Monogynia*. Nat. Ord. *Calycanthemæ*, Linn. *Onagræ*, Juſſ.

Gen. Ch. *Cal.* Perianth ſuperior, of one leaf, deeply four-cleft; ſegments oblong, pointed, coloured, deciduous. *Cor.* Petals four, roundiſh, broadeſt upward, cloven, ſpreading, inſerted into the calyx between its ſegments. *Stam.* Filaments eight, awl-ſhaped, alternately ſhorter; anthers oval, compreſſed, obtuſe. *Piſt.* Germen inferior, cylindrical, very long; ſtyle thread-ſhaped; ſtigma thick, obtuſe, either undivided or four-cleft, the lobes revolute, downy. *Peric.* Capſule very long, cylindrical, with four furrows, four cells, and four valves, with a longitudinal linear partition originating from the centre of each. *Recept.* columnar, ſquare, its angles attached to the partitions, which at length ſeparate from it. *Seeds* numerous, oblong, crowned with down, and affixed in two rows to each angle of the receptacle.

Eſſ. Ch. Calyx in four deep ſegments. Petals four. Capſule oblong, inferior. Seeds feathered.

An elegant genus of plants, with flowers of a paler or deeper roſe-colour, natives of watery or boggy ſituations, chiefly in the cooler or mountainous parts of Europe. The *roots* in all are perennial, and often creeping. *Leaves* undivided. *Flowers* ſpiked or racemoſe, terminal. *Stamens* in ſome direct, in others declining.

The ſpecies in Willdenow are twelve, to which are to be added E. *roſeum*, Schreb. Lipſ. 147. Sm. Fl. Brit. 411. Engl. Bot. t. 693, and E. *alſinifolium*, Villars Dauph. v. 3. 511. Engl. Bot. t. 2000, both by him made varieties of E. *montanum*. The Britiſh ſpecies therefore, at preſent aſcertained, are nine.

E. *anguſtifolium*, Linn. Sp. Pl. 493. Curt. Lond. faſc. 2. t. 24. Engl. Bot. t. 1947, called the French or Perſian Willow, or Roſebay Willow-herb, is one of the moſt handſome, though moſt common, of the whole. It rarely with us occurs wild, but thrives and bloſſoms abundantly in any garden, whether the ſituation be moiſt or dry, even in almoſt any part of London. Linnæus ſays, Fl. Lapp. n. 146, "it frequently, like a garden, ſurrounds the hut of the wild Laplander, who vies with Diogenes in the ſimplicity of his houſehold furniture, but whoſe habitation ſeems the palace of a divinity, when this ſtately plant is in bloom." This is an inſtance, among many, of a truly alpine plant ſucceeding well in the ſmoke of a city, while others require the pureſt air poſſible.

EPILOGUE, Epilogus, in *Oratory*, &c. The peroration, or laſt part of a diſcourſe, or treatiſe; containing ordinarily a recapitulation of the principal matters delivered.

The word is Greek, επιλογος, formed of the verb επιλεγω, *I ſay after*; the epilogue being the end, or concluſion of a diſcourſe.

Epilogue, in *Dramatic Poetry*, is a ſpeech addreſſed to the audience, when the play is over, by one of the principal perſons or actors in the piece; containing uſually ſome reflections on certain incidents in the play, particularly thoſe of the part of the perſon who ſpeaks it.

In the modern tragedy, the epilogue has uſually ſomewhat of pleaſantry in it; intended, perhaps, to compoſe the paſſions raiſed in the courſe of the repreſentation, and ſend the audience away in good humour; though how far that deſign is good and laudable will bear ſome diſpute: an ingenious author in the Spectator compares it to a merry jig on the organ, after a good ſermon, to obliterate any impreſſions that might have been made thereby, and ſend the people away juſt as they came.

In effect, though the epilogue, in this ſenſe, may ſeem an abuſe, yet has it the countenance of antiquity; the Romans had ſomething of the ſame nature, though under another name. Their exodium was a kind of farce, brought on the ſtage when the tragedy was over: "ut quicquid lacrymarum ac triſtitiæ cepiſſent ex tragicis affectibus, hujus ſpectaculi riſus detergeret," ſays the ſcholiaſt of Juvenal. The epilogue is but of modern date, much later than the prologue. Many, indeed, have taken the exodium of the ancient Greek drama for an epilogue, becauſe Ariſtotle defines it to be a part rehearſed after the chorus had ſung for the laſt time; but in reality, it was of a quite different nature. The exodium was the laſt of the four parts of the tragedy: containing the unravelling and cataſtrophe of the plot, and anſwering to our laſt, or fifth act.

EPIMEDIUM, in *Botany*, as at preſent underſtood, is certainly different from the επιμηδιον of Dioſcorides, which ſeems to be *Oſmunda Lunaria*, though his deſcription does not exactly agree even with that plant. The derivation of the name has always appeared obſcure. Ambroſini deduces it "from επιμυω, *to cloſe*, or *ſhut up*, becauſe the leaves conceal the flowers; or from επι μηδια, becauſe of its growing frequently in Media." Neither of theſe is ſatiſfactory, and the word ſeems rather to have a reference to the plant μηδιον, a *Campanula*, or ſomething very near that genus, which immediately precedes it in Dioſcorides. However this may be, the name *Epimedium* is now univerſally applied to the Barren-wort. Linn. Gen. 59. Schreb. 79. Willd. Sp. Pl. v. 1. 660. Sm. Fl. Brit. 187. Prod. Fl. Græc. 103. Mart. Mill. Dict. v. 2. Juſſ. 287. Tourn. t. 117. Claſs and order, *Tetrandria Monogynia*. Nat. Ord. *Corydales*, Linn. *Berberides*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, of four ovate, obtuſe, concave, ſmall, ſpreading, deciduous leaves, placed directly under the petals. *Cor.* Petals four, ovate, obtuſe, concave, equal, ſpreading. Nectaries four, pouch-ſhaped, blunt at the baſe, the ſize of the petals and lying upon them, fixed to the receptacle by the edge of their orifice. *Stam.* Filaments four, awl-ſhaped, preſſed cloſe to the ſtyle; anthers oblong, erect, of two cells and two valves, the latter ſeparating from their baſe upwards, leaving the partition free. *Piſt.* Germen ſuperior, oblong; ſtyle ſhorter than the germen, as long as the ſtamens; ſtigma ſimple. *Peric.* Pod oblong, pointed, of one cell and two valves. *Seeds* numerous, oblong.

Eſſ. Ch. Petals four. Nectaries four, pouches lying on the petals. Calyx oppoſite to the petals, caducous. Pod ſuperior, of one cell, with many ſeeds.

E. *alpinum*. Linn. Sp. Pl. 271. Engl. Bot. t. 438. Fl. Græc. ined. t. 150. Ger. em. 480. The only ſpecies, a native of ſhady mountainous places in ſeveral parts of Europe, not very difficult of cultivation in our gardens, flowering in May. The *root* is perennial, creeping, ſlender, blackiſh. *Stems* upright, ſimple, about a foot high, round, ſmooth, bearing one large, twice or thrice compound leaf, divided irregularly in a three-fold order, and compoſed of large, pendent, tremulous, thin, delicate, heart-ſhaped, pointed, finely ciliated, ſmooth leaflets, glaucous beneath; and one upright *panicle*, alternately branched, whoſe ſtalks are red, and rough with glandular hairs. *Flowers* ſingular and elegant, drooping, with dark red petals, and yellow pellucid nectaries. Dr. Smith, in his Engliſh Botany, ſuggeſts that "perhaps what is called the ſtem ought to be reckoned only the footſtalk of the leaf, which, as in *Turnera*, bears the flowerſtalk."

EPIMENIDES, in *Biography*, a Cretan philoſopher and poet, who was contemporary with Solon, and of whom many fables are related. Among others it is ſaid, that, being ſent by his father in ſearch of a ſtraying ſheep, he ſlept in a cave, where he repoſed himſelf for 50 years, and when he awoke, found to his ſurpriſe, that he was become an old man, that every thing about him was become new and ſtrange. It is alſo recorded of him, that he could diſmiſs the ſoul from his body, and recal it at pleaſure; and that he had familiar intercourſe with the gods, and poſſeſſed the gift of prophecy. Moſt of theſe fictions may probably have originated with the Cretans, who were, to a proverb, famous for their powers of invention. (Titus, i. 12.) The more credible account of Epimenides is, that he was a man of ſuperior talents, who pretended to intercourſe with the

the gods, and in order to juſtify his pretenſions, lived in retirement upon the ſpontaneous productions of the earth, and practiſed various arts of impoſture. At the time of his pretended inſpiration he might, poſſibly, have the art of appearing totally inſenſible and entranced, which would be conſidered by ignorant and deluded ſpectators as a power of diſmiſſing and recalling his ſpirit. Such was his reputation for ſanctity, and for the performance of religious rites, that, during a plague in Attica, which happened in the 46th olympiad, about 596 years B.C., the Athenians ſent for him to perform a ſacred luſtration: in conſequence of which, as it is ſaid, the gods were appeaſed and the plague ceaſed. Of this ceremony we have given a particular account under the article ALTAR. On occaſion of this viſit to Athens, Epimenides became acquainted with Solon, the Athenian legiſlator, who is ſaid to have diſapproved the conduct of the Athenians in this inſtance of ſuperſtition; and yet availed himſelf of the advice of the philoſopher in compiling his celebrated code. The Athenians, however, were delivered from the peſtilence, and were diſpoſed liberally to requite Epimenides for his ſervices. The philoſopher declined accepting their offered recompence, and contented himſelf with a branch of the ſacred olive, which grew in their citadel, and with this he returned to his native country, after having concluded a league between the Gnoſſians of Crete and the Athenians. Soon after his return to Crete he died, as Laertius ſays, at the age of 157 years, or, as the Cretans pretend, at the age of 299 years. The ſuperſtitious Cretans paid him divine honours after his deceaſe; and he has been reckoned by ſome the 7th wiſe man of Greece, to the excluſion of Periander from this number. Laertius enumerates a variety of pieces written by Epimenides, both in proſe and verſe. Among the former was a treatiſe "On Sacrifices," and "An Account of the Cretan Republic;" and among the latter "The Genealogy and Theogony of the Curetes and Corybantes," in 5000 verſes; "Of the Building of the ſhip Argo, and Jaſon's Expedition to Colchis," in 6500 verſes; "Of Minos and Rhadamanthus," in 4000 verſes; and a treatiſe "Of Oracles and Reſponſes," mentioned by St. Jerome, from which St. Paul is ſaid to have taken the quotation in his epiſtle to Titus, ch. i. 12. Laert. l. i. c. 10. Brucker's Hiſt. Phil. by Enfield, vol. i.

EPIMETRON, επι and μετρον, *meaſure*, in *Antiquity*, an allowance given the tax-gatherers in the Roman provinces, over and above the juſt quantity of wine or grain they were obliged to furniſh. The epimetron, or over-meaſure, in different provinces, was different, being always greater in thoſe that were remote, than in the nearer provinces. The different kinds of things wherein it was given made likewiſe a difference in the quantity allowed. The reaſon of allowing an epimetron, or over-meaſure, was to make good the leakage of the wine and waſte of grain, that would neceſſarily happen by tranſporting it to Rome.

The provinces whoſe taxes were converted into money, and paid in ſpecie, were free from epimetron.

EPIMORIOS, Επιμοριος, *ſuperparticular*, of μειρω, *I divide*, an epithet given by Galen to certain differences in the pulſes with reſpect to their inequality as to the time of their beating. All times, rythms, or modulations of the pulſe, according to number, conſiſt, he obſerves, of equal or unequal proportions. Of equal, when the time of the diſtenſion is equal to that of contraction; and of unequal, when the one of theſe exceeds the other; and this inequality may be from certain or uncertain exceſſes. The certain exceſſes may be either in multiple proportion, or as number to number, which is the epimorion.

EPIMULIS, of επι, *upon*, and μυλη, *whirle bone on the top of the knee*, a name given, by ſome anatomiſts, to the patella, or knee-pan.

EPIMYLIA, in the *Ancient Muſic.* We are told, in Athenæus, that the epimylia, and the ſong called "Hymæus," were the ſame (ſee HYMÆUS): Athenæus adds, that it is probable that the word epimylia comes from εμυλις, which in Dorian ſignifies ſometimes the return, and ſometimes the augmentation and ſurplus of nouriſhment given to thoſe who labour at the mill. But perhaps after all, this word comes from μυλα, *a mill.*

EPIMYTHION, Επιμυθιον, in *Rhetoric.* See FABLE.

EPINA, or HARPINA, in *Ancient Geography*, a town of Triphylia, upon the river Parthenia, N. of Phryga.

EPINAC, in *Geography*, a ſmall town of France, in the department of Saône and Loire, chief place of a canton in the diſtrict of Autun, with a population of 1128 individuals. The canton contains 11 communes and 5802 inhabitants, on a territorial extent of 155 kiliometres.

EPINAL, or ESPINAL, a town of France, in the department of the Voſges, chief place of the diſtrict of the ſame name, with a population of 7321 individuals. It is ſituated on the river Moſelle, 12 miles N.W. of Remiremont, and 480 miles of Paris, and 42 miles S.E. of Nancy. N. lat. 48° 22'. The canton has a territorial extent of 297½ kiliometres, 19 communes, and 14,709 inhabitants.

As chief place of a diſtrict, Epinal has a ſub-prefect, a ranger, a brigadier-general, who commands in the department, a captain of the national gendarmerie, two courts of juſtice, and a regiſter office. It has ſeveral paper-mills. The ſoil produces wheat, rye, oats, hemp, and flax. Its principal trade is with hemp and flax, hemp and flax ſeed, oil, and the produce of a few manufactures of linen and cotton ſtuffs, and writing paper. The whole diſtrict compriſes five cantons, 116 communes, and 62,592 inhabitants, on a territorial extent of 1285 kiliometres.

EPINAY, a ſmall town of France, in the department of l'Ille and Vilaine; three miles W. of Vitré, which, before the revolution of 1789, conferred the title of marquis on the lord of the manor.

EPINENEUCOS, from νευω, *I nod*, in the old writers of *Medicine*, a word uſed to denote a ſort of unequal pulſe, beating differently in the different parts of the ſame artery; as when it riſes ſtrongly againſt the two middle fingers of the phyſician who feels it, and weaker at the extremes; this ſort of pulſe is deſcribed by Galen as common to hectic patients, and is called alſo perineneucos.

EPINEPHELOS, of επι and νεφηλη, *clouds*, in the *Writings of the Ancient Phyſicians*, a term uſed to expreſs the cloudy matter ſeen floating in the urine in fevers, &c. See ENEOREMA.

EPINETTE, *Fr.* in *Muſic.* See SPINET.

EPINEU *le Chevreuil*, in *Geography*, a town of France, in the department of the Sarte and diſtrict of Sillè; 12 miles W. of Le Mans.

EPINEUL, a town of France, in the department of the Yonne, and diſtrict of Tonnerre; 1½ mile N. of Tonnerre.

EPINEUX *des Lombes*, in *Anatomy*, a name given by Winſlow, and ſome other of the French authors, to certain ſmall muſcles of the loins, not mentioned by the old anatomiſts; but called by Albinus interſpinales lumborum.

EPINICINION, Επινικινιον, in the *Ancient Muſic*, a ſong of victory, by which the Greeks celebrated the triumph of conquerors.

EPINICION, Επινικιον, from επι, *on*, νικη, *victory*, in the *Greek and Latin Poetry*, denotes, 1. A feaſt, ceremony, or rejoicing, on occaſion of a victory obtained. 2. A poem or compoſition, on the ſame ſubject. Scaliger treats expreſsly of the epinicion in the Poetics, lib. i. cap. 44.

EPINOI, in *Geography*, a ſmall town of France, in the department of the North; 9 miles S. of Lille, and 9 miles N. of Douai.

EPINYCTIS, (from επι, and νυξ, *night*,) in *Surgery*, a kind of puſtule, of the nature of the furunculus, originating in the night-time; or, according to Ætius and Paulus, attended at this period with the moſt pain.

EPIODIUM, in the *Ancient Muſic*, a funeral ſong or dirge with the Greeks; called Mænia by the Romans.

EPIPACTIS, in *Botany;* according to Hederic, from επιπηγνυμι, or επιπηγνυω, to congeal, or to grow together at the ſummit. In this ſenſe the name may very well apply to the *Helleborine* of ſome authors, for which Haller and Swartz retain it, and which has always been taken for the επιπακτις of Dioſcorides, whoſe account of the matter is too ſhort and vague to afford much light. The petals of this plant do indeed approach each other, towards the upper part, more than in many of the *Orchideæ*, and ſuch an explanation is more correct than that of Ambroſini, who derives the word from παγος, ice, or πηκτος, frozen, "becauſe the herb grows in very cold places, as it were upon or above the ice;" which circumſtance by no means applies to it. Haller in Act. Helvet. v. 4. 100. Hiſt. Stirp. Helvet. v. 2. 147. Swartz. Act. Holm. 1800. p. 231. t. 3. f. N. Tracts on Botany, 159. Schrad. Neues Journ. v. 1. 62. Willd. Sp. Pl. v. 4. 83. (Helleborine; Tourn. t. 249. Serapias; Linn. Gen. 462. Schreb. 503. Juſſ. 65. Gærtn. t. 14.) Claſs and order, *Gynandria Monandria*. Nat. Ord. *Orchideæ*.

Gen. Ch. reformed. *Cal.* three-leaved; leaflets direct, a little ſpreading, concave, acute. *Cor.* Petals two, rather ſmaller than the calyx, ſlightly ſpreading. Nectary a lip proceeding from the lower part of the ſtyle, tapering, or concave, or keeled, at the baſe, uſually longer than the calyx, deflexed, entire or cloven, concave or flattiſh, often furrowed above. *Stam.* Anther an hemiſpherical, moveable, permanent, terminal lid, of two cells, attached by its poſterior edge to the top of the ſtyle; maſſes of pollen oblong, powdery, granulated, ſometimes lobed. *Piſt.* Germen inferior, obovate, erect, furrowed, ſometimes twiſted; ſtyle erect, roundiſh, notched at the top; ſtigma in front, oblique, under the anther. *Peric.* Capſule inferior, oval, with ſix ribs and one cell, opening by clefts between the ribs. *Seeds* numerous, minute, tunicate.

Eſſ. Ch. reformed. Calyx-leaves direct, ſlightly ſpreading. Lip without a ſpur. Anther a terminal permanent lid. Pollen powdery, granulated.

Swartz and Willdenow enumerate fourteen ſpecies of this genus, eight or nine of which are Britiſh. They are divided into two ſections, eight of them having an undivided lip, and ſix a cloven one. The former are,

1. E. *latifolia.* (Serapias latifolia; Linn. Syſt. Veg. ed. 14. 814. Sm. Fl. Brit. 942. Engl. Bot. t. 269.) A native of cool, ſhady, rather mountainous woods, throughout Europe. The *roots* are perennial and creeping. *Stems* ſimple, about two feet high, leafy, roughiſh. *Leaves* ovate, or broad-lanceolate, ribbed and plaited, claſping the ſtem alternately. *Flowers* in a long terminal ſpike, with bracteas at leaſt as long as the germen, the lower ones longer than the whole flower. *Calyx* and *petals* of a browniſh green. *Nectary* ſhorter than either, heart-ſhaped in front, purpliſh, acute,

2. E. *paluſtris.* (Serapias paluſtris; Scop. Carn. v. 2. 204. Lightf. 527. Sm. Fl. Brit. 943. Engl. Bot. t. 270.) An elegant native of watery, boggy meadows, in England and other parts of Europe, flowering in July and Auguſt. The *flowers* are fewer, but larger and more ſpecious than the laſt, being variegated with white, purple and yellow, and the lip is crenate. Linnæus has called this S. *longifolia*, but very incorrectly, and from miſtake.

3. E. *microphylla.* Sw. (Serapias parvifolia; Ehrh. Herb. 120.) A native of Germany and Switzerland; poſſibly alſo of England, as we have ſome ſuſpicion of its being the Helleborine altera, atrorubente flore, of Ray's Synopſis, 383. It moſt reſembles the firſt ſpecies, but has much ſmaller leaves.

4. E. *grandiflora.* (E. pallens; Sw. Serapias grandiflora; Sm. Fl. Brit. 944. Engl. Bot. t. 271.) Frequent in the beech woods of Berkſhire and other midland counties of England, flowering in June. The *flowers* are few, cloſed, large and elegant, white with yellow lines upon the lip. *Leaves* elliptical.

5. E. *enſifolia.* Willd. (Serapias enſifolia; Sm. Fl. Brit. 945. Engl. Bot. t. 494. S. xiphophyllum; Linn. Suppl. 404.) Confounded by Haller, Hudſon and others with the laſt, from which it differs in its minute *bracteas*, narrower and longer *leaves*, ſhorter *lip*, and more ſlender *germen*. It grows in Switzerland, and very rarely in the mountainous parts of Yorkſhire and Worceſterſhire.

6. E. *rubra.* (Serapias rubra; Linn. Syſt. Veg. ed. 14. 816. Sm. Fl. Brit. 946. Engl. Bot. t. 437.) Native of ſhady mountainous woods in ſeveral parts of Europe, rare in England. It is diſtinguiſhed by its elegant roſe-coloured *flowers*, whoſe lip is marked with yellow wavy ridges, and auricled at its baſe.

7, 8. E. *erecta* and *falcata*, natives of Japan, are the only remaining ſpecies of this ſection; and theſe, as Willdenow obſerves, appearing to have a ſpur to the flower, are perhaps ſpecies of *Limodorum*.

The ſpecies in Swartz and Willdenow with a cloven lip are,

9. E. *Nidus avis.* (Ophrys Nidus avis; Linn. Sp. Pl. 1339. Sm. Fl. Brit. 931. Engl. Bot. t. 48.) A paraſitical plant, growing in ſhady beech woods, chiefly on a chalky ſoil, and ſingular for its uniform pale brown hue. The *root* conſiſts of numerous cluſtered juicy fibres. *Leaves* none, except ſmall ſcales on the ſtem. *Flowers* numerous, forming a denſe ſpike, inodorous, with a cloven divaricated lip.

10. E. *ovata.* (Ophrys ovata; Linn. Sp. Pl. 1340. Sm. Fl. Brit. 932. Engl. Bot. t. 1548. Curt. Lond. faſc. 3. t. 60.) Frequent in woods, flowering in June like moſt of its genus. The *ſtem*, a foot high, bears only two oppoſite, broad, oval leaves, and a ſpike of numerous ſmall green *flowers*, whoſe long pendulous lip produces a ſmall drop of honey in front, thus proving its right to the title of nectary. See Sm. Introd. to Botany, 461.

11. E. *cordata.* (Ophrys cordata; Linn. Sp. Pl. 1340. Sm. Fl. Brit. 933. Engl. Bot. t. 358.) Grows on boggy mountainous heaths in Scotland and the north of England, as well as in Switzerland, &c. It is ſcarcely a quarter ſo large as the laſt, and has heart-ſhaped *leaves*, and a four-lobed lip.

12. E. *convallarioides.* Sw. in Web. and Mohr. Beitr. v. 1. t. 1. (Ophrys cordata; Michaux Fl. Boreali-Amer. v. 2. 158.) Native of the Weſt Coaſt of North America, and of Newfoundland. A ſlender delicate ſpecies, with a pair of roundiſh heart-ſhaped *leaves*, capillary racemoſe *flower-ſtalks*, narrow *calyx* and *petals*, and a dilated lip.

13. E. *camtſchatea.* Sw. and Willd. (Ophrys camtſchatea; Linn. Sp. Pl. 1343. Neottia; Amœn. Acad. v. 2. 361. t. 4. f. 24.) Native of Siberia. Deſtitute of *leaves*, except a few ſheathing ſcales. The *flowers* are much like the laſt, but have a more linear nectary.

14. E. *unifolia.* (E. porrifolia; Sw. and Willd. Ophrys unifolia; Forſt. Prod. 59.) Found by Forſter in New Zealand. The *leaf* is ſolitary and ſheathing, riſing above the ſtalk, which it embraces, and which bears a ſhort denſe ſpike of ſmall *flowers*. We ſee no advantage in changing the original ſpecific name.

EPIPEDOMETRY, of επι, ϖȣς, *foot*, and μετρω, *I meaſure*, in *Mathematics*, ſignifies the meaſuring of figures that ſtand on the ſame baſe.

EPIPETRON, in *Botany*, a name given, by Theophraſtus and Ariſtotle, to a plant, ſuppoſed by many to be the ſame with the empetrum of Dioſcorides. But there is great reaſon to doubt whether the epipetron of the two older authors be the ſame plant; and whether, if they mean two different plants by this name, either of them agree with the empetrum of Dioſcorides. Theophraſtus ſays, that his epipetron never flowers: and Ariſtotle ſays, that his epipetron grows on rocky places, and continues to grow after it is taken up, as the orpin and ſome other plants will do.

EPIPHÆNOMENA, of επι and Φαινομενον, *ſymptom*, in the *Writings of the Ancient Phyſicians*, a term uſed to expreſs ſuch of the ſymptoms, in certain diſeaſes, as did not uſually appear till the time that the diſeaſe was actually formed, called alſo epiginomena.

EPIPHALLUS, in the *Ancient Muſic.* It appears by a paſſage in Euſtathius, often quoted by Meurſius, that this was alſo the name of a dance, performed to flutes.

EPIPHAN, in *Geography*, a town and diſtrict of Ruſſia, in the government of Tula, ſituated on the Don.

EPIPHANES. See Epiphanius. This term in Greek, Επιφανης, denoted eminent or illuſtrious, and thus it was applied to Antiochus, which ſee.

Epiphanes, of επι and Φαινομαι, an epithet given to Jupiter, becauſe he manifeſted his preſence by lightning and thunder, &c.

EPIPHANIA, a word uſed, by ſome of the ancient phyſicians, to expreſs the external habit of the body.

Epiphania, in *Ancient Geography*, a town of Aſia Minor, in Cilicia, near the Mediterranean, between the branches of mount Amanus, on the river Carſus; probably denominated Epiphania in honour of Antiochus Epiphanes, king of Syria, who poſſeſſed Cilicia. We learn from Tacitus, that the part in Cilicia, in which this town was ſituated, became ſubject to the dominion of Rome under Lucullus, about the year of the city 683. It was afterwards epiſcopal under the metropolis of Anazarba.

Epiphania *on the Euphrates*, a town of Aſia, ſituated on that river.

Epiphania, a town of Syria, on the Orontes; which was ſubjected to the Romans about the year 690, during Pompey's expedition into the territory of Apamæa and into Coeleſyria. This town was ſituated between Lariſſa and Arethuſa; and it was reckoned by the Orientals one of the moſt ancient towns in the world, founded, as they imagined, by Hamath, one of the ſons of Canaan; and that its name was changed by the Macedonians in honour of Antiochus Epiphanes. (See Hamath.) It was epiſcopal under the metropolis of Apamæa.

Epiphania, a town of Aſia Minor, in Bithynia. Steph. Byz.—Alſo, a town of Aſia, on the banks of the Tigris, called by Steph. Byz. *Arſecicerta.*

EPIPHANIUS, or Epiphanes, in *Biography*, the ſon of Carpocras, or Carpocrates, an hereſiarch in the ſecond century, was inſtructed by his father in the whole circle of the ſciences, and particularly in the Platonic philoſophy; but his death, when he was 18 years of age, diſappointed the hopes which the Carpocratians entertained concerning him. After his death he was honoured by them as a god, particularly in the iſland of Cephalonia, where a temple was erected to him, with altars, a grove, and a muſæum, and where the day of his nativity was celebrated with hymns, libations, ſacrifices, and feaſtings. Theſe are the reports of Clement of Alexandria and of Epiphanius, unconfirmed by the teſtimony of other writers. Epiphanes is now claſſed with the Valentinians. Lardner Hiſt. Heret. c. iii. § 1.

Epiphanius, biſhop of Salamis in the iſland of Cyprus in the fourth century, and dignified by the Catholics with the title of Saint, was born in the vicinity of Eleutheropolis, in Paleſtine, about the year 320. In his youth he went into Egypt, where he inclined to the ſect of the Gnoſtics, but ſeparating from them, he joined himſelf to the Egyptian Aſcetics, imbibing their principles and conforming to their manners. In his 20th year he returned to his own country, and became a diſciple of Hilarion, the father of Paleſtine monkery. After ſome time he founded a monaſtery at Bezanduce, the village in which he was born, over which he preſided for the greateſt part of his life. In 367 or 368, he was appointed biſhop of Salamis, afterwards called Conſtantia, where his piety and ſanctity were held in high eſtimation, and where he was aſſiduouſly employed in writing defences of the orthodox doctrines againſt the attacks of heretics. His zeal, however, involved him in many troubles, which embittered a conſiderable portion of his life. One of the principal circumſtances which contributed to embarraſs and embroil him, and to entail diſgrace on his memory, was his inveterate oppoſition to the opinions of Origen. This produced a conteſt with John biſhop of Jeruſalem, who favoured theſe opinions, which, after many mutual invectives and recriminations, terminated in a breach between the two biſhops, that convulſed the eaſtern churches by the hatred and perſecuting ſpirit manifeſted in the conduct of their reſpective partiſans. Theophilus, biſhop of Alexandria, was an active adherent to the cauſe of Epiphanius, and held a council in 399, which condemned the writings of Origen, and prohibited all perſons from reading them, or having them in their poſſeſſion. This example was followed by a council of the biſhops of Cyprus, ſummoned by Epiphanius himſelf in the year 401. Failing of ſucceſs by the decrees of theſe councils and by the perſecution againſt Origen, which they were the means of inſtigating, the determined and zealous prelate took a voyage to Conſtantinople, in order to induce the biſhops in that city to adopt and ſanction the decrees of Alexandria and Cyprus. On his arrival, he declined holding any intercourſe with Chryſoſtom, biſhop of that city, unleſs he joined in the condemnation of Origen, and in withdrawing his protection from the exiled Egyptian monks. Exaſperated by the diſappointment of his views, he reſolved to preſent himſelf to the people in the church of the Apoſtles, and openly to condemn the books of Origen, and all his advocates. But before he could execute his purpoſe, he was warned of the irregularity of his proceedings, and of the ſedition which they might occaſion; and he, therefore, thought it moſt prudent to abandon his deſign. His next attempt was that of intereſting the court in his favour; and ſo violent and implacable was his zeal againſt thoſe who favoured Origen, that when the empreſs Eudoxia beſought his prayers in behalf of the younger Theodoſius, who was dangerouſly ill, he aſſured her that he ſhould not die, if ſhe would conſent to diſcard the heretics, who were ſheltered under the imperial patronage. The princeſs very properly reproved this arrogant and impious meſſage; and his impetuoſity was alſo checked by the Egyptian monks, who convicted him of being unacquainted with the principles of the perſons, againſt whom he had been induſtriouſly exciting univerſal indignation. Thus foiled and abaſhed, he ſet out on his return to Cyprus, and died either on his voyage, or ſoon after his return, in the year 402 or 403, at a very advanced age. The piety of Epiphanius was unqueſtionable; but it was blended with a gloomy ſuperſtition, which led him to promote the auſtere diſcipline of the cloiſter, and to employ his epiſcopal influence in multiplying monaſtic inſtitutions. In offices of charity for the relief of the indigent, he expended not only his own private fortune, but the greateſt part of the revenues of his church, and large ſums entruſted to his diſpoſal. His learning was conſiderable, for, according to St. Jerome, who mentions him in terms of high commendation, and calls him πενταγλωττος, a man of five languages, he underſtood Greek, Syriac, Hebrew, Egyptian, and partly Latin. It is allowed, however, that he was deficient in judgment, and unſkilful in wielding the weapons of controverſy. Careleſs in his tranſcripts from ancient authors, and credulous in admitting unauthenticated reports, he has been betrayed into various contradictions and abſurdities, ſo that his works, with reſpect to authority and reference, are depreciated in value. His ſtyle is mean, harſh, and unpoliſhed, without perſpicuity, and without connection. In his remaining works he has given ſeveral catalogues of the books of the Old and New Teſtament. His canon of the Old Teſtament was much the ſame with that of the Jews. (See Canon.) The books of the New Teſtament received by him are the ſame with thoſe generally received by us. For both theſe claſſes of ſacred books he profeſſes the higheſt regard; nor does he ever make uſe of Chriſtian apocryphal books, written in the name of apoſtles and falſely aſcribed to them. With reſpect to the books of the New Teſtament, he ſays, that Matthew preached, and wrote his goſpel in Hebrew, and that he was the only writer of the New Teſtament who uſed this language. He had heard, however, that the goſpel of St. John, and the Acts of the Apoſtles, had been tranſlated from Greek into Hebrew, and were in the library of the Jews at Tiberias. Matthew wrote firſt, and ſoon after Mark, who was Peter's companion at Rome. The third goſpel, in his enumeration, was that of Luke. John wrote his goſpel at the age of 90 years, and Epiphanius ſays, that it was occaſioned by the errors of the Ebionites, the Cerinthians, the Merinthians, and Nazarenes. He aſcribes the book of the Acts to Luke. He frequently quotes the epiſtle to the Hebrews as Paul's; he alſo cites the epiſtle of James, the two epiſtles of Peter, John's firſt and ſecond epiſtles, and the Catholic epiſtle of Jude. He alſo received the book of Revelation. Of the baptiſm of Chriſt, he ſays, that it took place when he was 29 years and 10 months, thus underſtanding St. Luke's words, iii. 23. He ſays, there are two paſſovers in our Lord's miniſtry, according to St. John's goſpel, and that he ſuffered at the third paſſover, in the 33d year of his life on earth; and therefore he did not think the "feaſt of the Jews," mentioned John, v. 1. to be a paſſover. He ſays, that the apoſtles did not preach themſelves, but Jeſus Chriſt, Lord. Therefore there was no ſect, or church, called after the apoſtles; for we never heard of Petrians, or Paulians, or Bartholomeans, or Thaddeans, but of Chriſtians only; as they were called at Antioch. The works of Epiphanius were firſt printed in Greek at Baſil by Oporinus in 1544; and the ſubſequent impreſſions have been numerous, of which the moſt valuable is that publiſhed at Paris in 1622, in two volumes folio, by the learned Petavius, who gave a new Latin verſion, with critical notes and obſervations. This edition was afterwards printed at Cologne in 1682, in two volumes folio. Cave's H. L. vol. i. ſub ſæc. Arian. Lardner's Works, vol. iv.

Epiphanius, ſurnamed "The Scholaſtic;" a native of Italy, and an eminent Greek and Latin ſcholar, was born about the year 510. At the requeſt of Caſſiodorus he tranſlated into the Latin language the eccleſiaſtical hiſtories of Socrates, Sozomen, and Theodoret, a verſion more entitled to commendation for its fidelity than its elegance. Caſſiodorus was alſo indebted to Epiphanius for the improved verſion of the "Codex encyclicus," or collection of ſynodal letters of the year 458, addreſſed to the emperor Leo, in defence of the council of Chalcedon. Cave H. L. vol. i. ſub ſæc. Eutych.

Epiphanius, patriarch of Conſtantinople in the 6th century, ſtrenuouſly vindicated the orthodox doctrines againſt the Eutychians, and after elevation to his dignity in the year 520, procured the condemnation of the latter in a ſynod of biſhops held at Conſtantinople. Whilſt he was patriarch, the decrees of the council of Chalcedon were confirmed, and a reconciliation was completed between the churches of Conſtantinople and Rome, after a ſchiſm which laſted 35 years. Five letters of this patriarch to pope Hormiſdas on the ſubject of the union are extant in the 4th volume of the collection of the Latin councils. Cave H. L. vol. i. ſub ſæc. Eutych.

EPIPHANY, in *Eccleſiaſtical Antiquity*, the feaſt of kings; a double feſtival, of the firſt rank, ſolemnized on the ſixth of January, commonly called "Twelfth day," in honour of the appearance of Jeſus Chriſt to the three kings, or magi, who came to adore, and bring him preſents.

The feaſt of Epiphany, now held in honour of the adoration of the magi, had its firſt inſtitution among the Greeks, from a different object, *viz.* our Saviour's birth; and was called theophany, and epiphany, that is, appearance, and manifeſtation, of God.

Pope Julius, who reigned from the year 337 to 352, was the firſt who taught the church to diſtinguiſh the feaſts of the nativity and epiphany. Papebroch. Paral. ad Conat. p. 23. Act. SS. Maii, tom. vii.

The word in the original Greek, επιφανεια, ſignifies *appearance*, or *apparition*; and was applied, as ſome critics will have it, to this feaſt, on account of the ſtar which appeared to the Magi. St. Jerom and St. Chryſoſtom, take the Epiphany for the day of our Saviour's baptiſm, when he was declared to men by the voice, "Hic eſt Filius meus dilectus, in quo mihi complacui: This is my beloved Son, in whom I am well pleaſed." And accordingly it is ſtill obſerved by the Cophtæ and Ethiopians in that view. (See Ludolph. Hiſt. Æthiop. lib. xxi. cap. 2.) Others contend, that the feaſt of Chriſtmas, or the nativity of our Saviour, was held in diverſe churches on this day; which had the denomination Epiphany, or appearance, becauſe of our Saviour's firſt appearance on earth, as at that time. And it muſt be allowed, that the word is uſed among the ancient Greek fathers, not for the appearance of the ſtar to the magi, but for that of our Saviour to the world. In which ſenſe, St. Paul uſed the word επιφανεια, *epiphania*, in his ſecond epiſtle to Timothy, chap. i. ver. 10. Ammianus Marcellinus makes mention of this feaſt, lib. xxi. cap. 2.

and obſerves, that it was held in January. Upon which paſſage Valeſius, in his notes, endeavours to ſhew, that the hiſtorian meant by Epiphany the feaſt of the nativity.

The heathen writers uſed the word epiphania in the like ſenſe, *viz.* to expreſs the appearance of their gods on earth. And the Chriſtians, after their example, applied it, in the general, to expreſs any appearance, or manifeſtation of the Deity.

EPIPHEOS, in *Botany*, the name given by the ancients to the dodder, or cuſcuta, which grew upon the ſhrub they called phæos. This was the ſtæbe of the modern Greeks, deſcribed by Honorius Bellus. It was a cuſtom, among the old writers, to name the cuſcuta, or dodder, from the plant it was found growing upon, as they ſuppoſed that it in ſome degree partook of the virtues of that plant. Thus that which grew upon thyme was called epithymum, and that upon the nettle, epiurteca, and that upon flax, epilinum; ſo of many others.

The ſhrub phæos was alſo called ſtæbe by Dioſcorides and Theophraſtus; and hence this dodder was ſometimes called epiſtæbe.

EPIPHLEBOS, of επι and φλεψ, *a vein*, in the *Writings of the Old Phyſicians*, a term uſed to denote ſuch perſons as were lean, and of a hot temperament, and whoſe veins, for that reaſon, appeared uſually very turgid and prominent in the hands, &c.

EPIPHLOGISMA, (from επι, and φλογιζω, *to inflame*,) in *Surgery*, a violent inflammation, accompanied with pain, ſwelling, and redneſs. Alſo, a great internal heat: likewiſe, the affection uſually called eryſipelas.

EPIPHONEMA, Επιφωνημα, *Acclamation*, in *Rhetoric*, a ſententious ſort of exclamation, which is frequently added after a narrative, or rehearſal of any thing remarkable; containing uſually a lively, cloſe reflexion on the ſubject there ſpoken of and intended to give it greater force, and render it more affecting to the hearers.

Such is that of St. Paul, when, after diſcourſing of the rejection of the Jews, and the vocation of the Gentiles, cries out,

"O the depth of the wiſdom and knowledge of God!"

Such alſo is that of Lucretius, after relating the ſtory of Agamemnon's ſacrificing his daughter Iphigenia:

"Tantum religio potuit ſuadere malorum."

This figure is frequently expreſſed in a way of admiration. Such is that of Cicero, when after having obſerved, that all men are deſirous of living to an advanced age, but uneaſy under it when attained, he makes this juſt reflection upon their conduct: "So great is their inconſtancy, folly, and perverſeneſs!" (Cic. de Senect. c. 2.)

The epiphonema is uſually expreſſive of the milder and more gentle paſſions, and is not ſo vehement and impetuous as exclamation.

EPIPHORA, (from επιφερω, *to carry with force*,) in *Surgery*. The original import of the word "epiphora" ſeems to have been a violent determination of fluids to any part of the body. At preſent, however, all ſurgeons confine the meaning of the term to an affection, in which the tears, not being able to paſs in a proper manner down into the noſe, accumulate in front of the eye, and trickle over the cheek. The diſorder is alſo not unfrequently denominated the "watery eye."

Whoever is in the habit of conſulting ſurgical books, will ſoon perceive, that writers do not make a clear diſtinction between the epiphora, and ſome ſtates of the fiſtula lachrymalis. Thus Mr. Ware has particularly conſidered the ſpecies of epiphora, which, he ſays, "is produced by an obſtruction to the free paſſage of the tears from the eye into the noſe. This obſtruction (he adds) may take place either in the ducts leading from the puncta lachrymalia into the lachrymal ſac, or in the ſac itſelf. When the ducts are obſtructed, a caſe which rarely occurs, the tears fall over the cheek, and the ſac is conſtantly empty. Preſſure on the ſac, therefore, can produce no regurgitation, either of tears, or mucus, into the eye. The method of cure is here evident. A ſmall probe of a ſuitable ſize muſt be introduced through the puncta of the obſtructed ducts into the ſac, and this operation be daily repeated until the obſtruction be removed. But, (continues Mr. Ware,) the part in which the obſtruction more commonly lies, is in the ſac itſelf; and in this caſe, the tears, mixed ſometimes with mucus, flow back into the eye through the puncta, when preſſure is made on the ſac." Now, this latter kind of diſeaſe, Pott, Scarpa, and other diſtinguiſhed ſurgical authors, conſider only as one ſtage of the fiſtula lachrymalis.

We do not mean, however, by what has been ſtated, to make any attempt to defend the manner in which the expreſſion "fiſtula lachrymalis" is employed; our ſole aim is to ſhew, that, unleſs a line of diſtinction is drawn between what ſhould be called "epiphora," and what "fiſtula lachrymalis," the comprehenſion of the ſubject is rather embarraſſed, than promoted, by having two different terms, which ſo glaringly encroach upon each other in the extent of their ſignification. The epiphora, in the meaning of a mere weeping of the eye, may ariſe from a variety of cauſes, which muſt be removed, ere the complaint can be cured. An encanthis, or any other kind of tumour in the inner angle of the eye, a polypus in the noſe, an ectropium, a trichiaſis, &c. may obſtruct the due flowing of the tears into the noſe, and thus make them fall over the ſubjacent cheek, ſo as to occaſion an epiphora. This latter diſorder may alſo be the conſequence of a part of the caruncula lachrymalis having been loſt, either by diſeaſe, or an unſkilful employment of the knife in ſome previous operation. An epiphora is always attendant on obſtructions in the ductus naſalis. Mr. Ware obſerves, with regard to another ſpecies of epiphora, originating from a too copious ſecretion of tears, that, if it does not depend on an affection of the mind, its more remote cauſe is uſually an inflammation of the eye. In this inſtance, a cure is to be effected by ſubduing the ophthalmy, and afterwards ſtrengthening the eye by mild aſtringent applications, ſuch as cold water, either alone, or containing a ſmall quantity of the zincum vitriolatum.

When the membrane, which lines the lachrymal ſac, is in a morbid ſtate, the mucus which it ſecretes is often ſo thickened, that it becomes incapable of paſſing through the ſac, and lodging in this ſituation, prevents the natural and regular deſcent of the tears from the eye into the cavity of the noſe.

This ſpecies of epiphora has occaſionally been benefited by the unguentum hydrargyri nitrati, applied to the edges of the eye-lids, and rubbed into the ſkin over the lachrymal ſac. Relief is alſo alleged to have been derived from the uſe of ſtimulating applications to the inſide of the noſe, which applications are ſuppoſed to have acted by increaſing the ſecretion from the pituitary membrane.

However, we muſt confeſs, that no men of experience, at the preſent day, place ſufficient reliance on the preceding methods, to recommend them to be tried by their patients. At the ſame time it ſhould be underſtood, that theſe plans are ſometimes exceedingly proper to be adopted in conjunction with other more efficacious meaſures.

In the year 1712, M. Anel recommended the introduction of a probe, and then the injection of a fluid, through the puncta lachrymalia, with a view of clearing away whatever matter might prevent the tears from readily finding their way through the lachrymal ſac and naſal duct into the noſe. M. Anel relates, that he accompliſhed many ſtriking cures in this manner; and Heiſter confirms the efficacy of the plan, by appealing to his own practice, in which he had often produced a complete recovery in the ſhort ſpace of three days.

In the year 1780, ſir William Blizard conſidered, that when water was injected through the punctum lachrymale, it not only had but very little ſpecific weight, but was driven through the lachrymal ſac in an unfavourable direction. Theſe reflections led him to make the propoſal of introducing quickſilver through a ſmall pipe, which communicated with a long tube full of this metal. Sir William Blizard was of opinion, that the quickſilver, in conſequence of its great weight, would have more power when the ſac was filled with it, of removing the obſtruction, than the mere injection of water. This gentleman alſo, in a paper read to the Royal Society, ſtates, that he had produced a cure by the introduction of quickſilver in an example which had laſted ſeven months; and that the mercury paſſed readily through the ductus naſalis, at the third and fourth times of repeating the operation.

When the celebrated Mr. Ware was in Paris, in the year 1791, he learnt from Meſſieurs Grandjean and Monſieur Arrachart, eminent oculiſts in that city, that the plan of injecting water through the puncta lachrymalia, in incipient caſes of fiſtula lachrymalis, was not given up in France. Mr. Ware even ſaw ſome troubleſome caſes cured on the continent in this way. Hence he was determined, on his return to London, to give Anel's operation a fuller trial than he had previouſly done. For this purpoſe he got Mr. Pepys, in the Poultry, to conſtruct a ſmall ſilver ſyringe, with pipes of different ſizes adapted to it.

The following caſe, which afforded Mr. Ware the firſt opportunity of aſcertaining more carefully the efficacy of Anel's treatment, is related in his own words, and will ſerve to inform the reader of ſeveral uſeful practical circumſtances.

" A lady in Great Ruſſel-ſtreet came under my care, who for many months had been ſubject to an epiphora of the left eye, which prevented her both from reading and working with her needle, without undergoing great inconvenience. Whenever ſhe employed herſelf in any way that required cloſe attention, her eye became overſpread with tears, and the ſight was ſo much confuſed, that it obliged her to leave off almoſt as ſoon as ſhe began. A great variety of remedies had been applied, under the direction of different medical men, but none of them produced any eſſential amendment. On examining the eye, I obſerved that the tunica conjunctiva, near the inner angle of the eye-lids, was ſlightly inflamed; and on preſſing the lachrymal ſac with my finger, I perceived that a tear regurgitated through the lower punctum. This appearing to be a proper caſe for the uſe of the ſyringe, I immediately determined to employ it. But I found, that though a tear came through the lower punctum on my preſſing the ſac, yet this punctum was ſo ſmall that it would not admit the point of the ſmalleſt ſyringe I then had. I introduced into it, however, a ſmall probe, and by means of this I ſo far dilated the orifice, that it admitted the point of the ſyringe on the next day without any difficulty. Upon my firſt uſing the injection, the water eſcaped through the upper punctum almoſt as faſt as it was introduced through the lower; but, notwithſtanding this, I perſevered in urging the liquor on, until the whole contents of the ſyringe were exhauſted. I repeated the injection three times the ſame day in immediate ſucceſſion. The lady, however, was not ſenſible that any part of the water paſſed through the duct into the noſe during either of theſe operations; and indeed it ſoon became evident that none had paſſed; for, having cleared her noſe before I began, on her blowing it again immediately afterwards, ſhe could produce no moiſture on her handkerchief. I repeated the operation three times, both on the ſecond and on the third day; and each day, during the time that the water was paſſing, I not only endeavoured to prevent it from coming through the upper punctum, by covering it with the point of my finger, but I occaſionally preſſed the lachrymal ſac in order to give the water an inclination downward. On the fourth day I very plainly perceived, on the patient's clearing her noſe after the operation, that a part of the water had paſſed through the duct; and, the next morning, I had the ſatisfaction to hear, that the eye, on the preceding day, had watered much leſs frequently than it had done for a conſiderable time previous to it. I repeated the proceſs above-mentioned about ten times, in as many days, and I obſerved that the quantity of water which paſſed through the duct was augmented every time I uſed it. The tears, after this, reſuming their natural courſe, the lady recovered the power to read and work without any inconvenience." (See Ware on the Epiphora.)

Mr. Ware, in his practice, uſes common water for the injection, ſometimes in a cold ſtate, but more frequently warmed. The pipes which this gentleman employs, are alſo much ſhorter than the one repreſented by Mr. Benjamin Bell in his Syſtem of Surgery, (vol. iii. pl. 37). They are alſo a little arched towards their point. Mr. Ware thinks, that when they are made in this manner, they can be more conveniently introduced into the punctum lachrymale, than when long and ſtraight. He recommends always having ready ſeveral pipes of different ſizes, and uſing the largeſt one which can be introduced without pain. He finds it alſo advantageous to ſtand either behind the patient or on the ſide oppoſite to that of the diſeaſed eye; and high enough to have a full command of the patient's head. Thus the operator will gain a complete view of the lower punctum, which will alſo be in a convenient poſition to receive the pipe of the ſyringe. Mr. Ware, moreover, adviſes us to remove the finger from the lower eye-lid as ſoon as the pipe is introduced, and to place it over the upper punctum, ſo as to prevent the fluid from eſcaping through this aperture. The ſame finger is likewiſe to be occaſionally uſed in making preſſure on the lachrymal ſac, in order to aid in forcing the injection down into the noſe.

Mr. Ware has publiſhed ſome additional remarks on the epiphora, and makes ſome very valuable obſervations on the treatment of another ſpecies of the diſorder; we allude to that kind which proceeds from a thickening of the membrane which lines the lachrymal ſac and duct, and a ſpaſmodic conſtriction in any part of this paſſage, conjoined, perhaps, with a morbid ſecretion of thickened mucus. Mr. Ware imputes a few occaſional failures, in the above ſimple mode of treatment, to the cauſes of the diſeaſe being ſometimes of this nature. The following extract will explain the different methods to which this celebrated oculiſt has recourſe in different caſes.

" I in general begin the treatment by injecting ſome warm water through the inferior punctum lachrymale, and I repeat the operation four or five days in ſucceſſion. If, in this ſpace of time, none of the water paſs through the duct into the noſe, and if the watering of the eye continue as troubleſome as it was before the injection was employed, I uſually open the angular vein, or direct a leech to be applied near the lachrymal ſac; adding here a caution, that the leech be not ſuffered to fix on either of the eye-lids, leſt it produce an extravaſation of blood in the adjacent cells. About the ſame time that blood is taken away in the neighbourhood of the eye, I uſually vary the injection, and try the effects either of a weak vitriolic, or anodyne, lotion. In ſome inſtances alſo, when I have found it impoſſible, after ſeveral attempts, to inject any part of the liquid through the duct, I have introduced a golden probe, about the ſize of a briſtle, through the ſuperior punctum lachrymale, and, attending to the direction of the duct, have inſinuated its extremity through the obſtruction, and conveyed it fully into the noſe; immediately after which I have found, that a liquid, injected through the inferior punctum, has paſſed without any difficulty; and, by repeating theſe operations, for a few ſucceſſive days, I have at length eſtabliſhed the freedom of the paſſage, and completed the cure. In other inſtances, I have recommended a ſtrongly ſtimulative ſternutatory to be ſnuffed up the noſe, about an hour before the time of the patient's going to reſt, which, by exciting a large diſcharge from the ſchneiderian membrane, has ſometimes alſo greatly contributed to open the obſtruction in the naſal duct.

"Caſes occur very rarely which may not be relieved by ſome of the means above related." (Ware's Additional Remarks on the Epiphora.)

When the diſcharge has been fetid, Mr. Ware has ſometimes found, that a vitriolic lotion, injected into the ſac, has quickly corrected the quality of the matter.

Scarpa, in his "Oſſervazioni ſulle principali Malattie degli Occhi," maintains, that the chief part of the yellow viſcid matter, which accumulates in the lachrymal ſac, is ſecreted by the lining of the eye-lids, and by the little glands of Meibomius; and that the altered quality of this ſecretion has a principal ſhare in the cauſe of the diſeaſe. He ſtates, that the truth of this fact may at once be aſcertained by everting the eye-lids; and eſpecially the lower one of the affected ſide; and by comparing them with thoſe of the oppoſite eye. The former will always exhibit an unnatural redneſs of the internal membrane, which has a villous appearance, all along the extent of the tarſus, while their edges are ſwollen; and numerous varicoſe veſſels are diſtinguiſhable on its ſurface. The follicles of Meibomius are alſo turgid and prominent.

Hence, Scarpa adviſes making ſuch applications to the inſide of the eye-lids, as have a tendency to improve the quality of the ſecretion from them, at the ſame time, that attempts are made to remove the obſtruction in the ductus naſalis. Mr. Ware, indeed, had previouſly noticed, that ſuch treatment may occaſionally be proper.

"When an epiphora is occcaſioned by an acrimonious diſcharge from the ſebaceous glands on the edges of the eye-lids, it muſt be evident, that injections into the ſac will be very inſufficient to accompliſh a cure, becauſe the ſac is not the ſeat of the diſorder. The remedies that are employed muſt be directed, on the contrary, to the ciliary glands themſelves, in order to correct the morbid ſecretion that is made by them; and for this purpoſe, I do not know any application that is ſo likely to prove effectual as the unguentum hydrargyri nitrati of the new London Diſpenſatory, which ſhould be uſed here in the ſame manner in which it is applied in common caſes of the pſorophthalmy. It will be proper to cleanſe the eye-lids every morning, from the gum that collects on the edge during the night, with ſome ſoft unctuous application; and I uſually adviſe to apply to them two or three times in the courſe of the day a lotion compoſed of three grains of white vitriol, in two ounces of roſe, or elder-flower, water."

Mr. Ware very judiciouſly cenſures the plan of applying collyria to the eye by means of linen, wet in them; and he recommends eye-glaſſes for the purpoſe, or inſinuating the fluid, between the eye and eye lids, with a camel-hair pencil, thoroughly wet in the application. (Additional Remarks on the Epiphora.)

Scarpa alſo extols waſhing the eye, three or four times a day, with a vitriolic collyrium; and, beſides praiſing the ointment recommended by Mr. Ware, he recommends Janin's ophthalmic ointment, to be ſmeared over the margins and lining of the eye-lids every morning and evening.

℞. *Adipis Suillæ. Tutiæ præp. Bol. Armen. ſing.* ʒij. *Calcis Hydrarg. alb.* ʒj. *Miſce.* To be uſed at firſt lowered with a larger proportion of lard, than is above ordered. See Fistula *Lachrymalis.*

EPIPHYLLOSPERMOUS Plants, of επι, φυλλον, *leaf*, and σϖερμα, *ſeed*, are the ſame with the capillaries, herbs which bear their ſeed on the back part of their leaves. See Capillary.

EPIPHYLLUM, in *Botany*, επι, *upon*, and φυλλον, *a leaf*, from the mode in which the flowers grow upon a flat ſtem reſembling a leaf, ſee Cactus *Phyllanthus*, ſp. 40.

EPIPHYSIS, in *Anatomy*, is a name given to certain parts of bones at a particular period of their formation. See Bone.

EPIPLA'SMA, from επι, and ϖλασσῶ, *to ſpread*, in *Surgery*, the name of an application to wounds: it conſiſted of wheat meal boiled in hydrelæum.

EPIPLOCE, Επιπλοκη, in *Rhetoric*, the ſame with climax, which ſee.

EPIPLOCE'LE, from επιπλοον, *the omentum*, and κηλη, *a tumour*, in *Surgery*, an omental hernia, or a rupture formed by a protruſion of a piece of omentum from the cavity of the abdomen.

Le Dran informs us, that in an epiplocele there is nothing to be felt, except a doughy ſoftneſs, which neither abſolutely yields to the touch, nor very ſenſibly reſiſts it. The tumour has a flabby unequal feel; and, when there is no ſtricture, is perfectly indolent. It is more compreſſible than that ariſing from protruded inteſtine, and, when the quantity of omentum is large, the epiplocele may, in ſome meaſure, be diſtinguiſhed by its weight.

As the ſubject of omental ruptures will be particularly conſidered under the head Hernia, we ſhall, for the preſent, content ourſelves with referring to the latter article.

EPIPLOIC, in *Anatomy*, a term applied to parts which belong to the epiploon, or omentum; thus we have epiploic arteries, &c.

EPIPLOO'MPHALON, from επιπλοον, *the omentum*, and ομφαλος, *the navel*, in *Surgery*, an omental hernia protruding at the navel.

EPIPLOON, in *Anatomy*, called alſo omentum or cawl, is a membranous expanſion contained in the cavity of the abdomen: and continued from the peritoneal covering of ſome of the viſcera. There are two very diſtinct productions, of the nature juſt deſcribed, diſtinguiſhed by the appellations of minus and majus, from their difference in ſize; and by thoſe of hepatico-gaſtricum, and colico-gaſtricum from their ſituation. But when the epiploon, or omentum, is ſpoken of generally, the greater or colico-gaſtric portion is underſtood. To the peritoneal ſurface of the large inteſtine are attached numerous ſmall proceſſes, which reſemble the epiploa in their apparent ſtructure, and are called *appendices epiploicæ*.

Although the omenta are uſually repreſented by anatomiſts as proceſſes of the peritoneum, their organization differs eſſentially from the ſtructure of that membrane. Their groundwork or baſis conſiſts of the moſt delicate and tranſparent membrane of the body; which is lacerated on the application of very ſlight force. This membrane is compoſed obviouſly of two layers, connected by cellular tiſſue, and containing numerous venous and arterial ramifications. A greater or ſmaller quantity of fat is depoſited between theſe layers, and in the courſe of the veſſels. When this depoſition is very conſiderable, as in very corpulent individuals, or in animals who have been fattened for the ſlaughter, the peculiarly tranſparent delicate appearance of the omental membrane is entirely deſtroyed, and the part is converted into a layer of fat. Ordinarily, however, the adipous ſubſtance is confined to the neighbourhood of the blood-veſſels, accompanying them in their ſubdiviſions, but leaving intervals in which the membrane exhibits its diſtinguiſhing diaphanous appearance. In emaciated ſubjects, during the period of infancy, and particularly in the fœtal ſtate, the quantity of fat is very trifling. Under ſuch circumſtances we can obſerve moſt diſtinctly that the depoſition of fat is confined to the courſe of the veſſels. As the omenta are entirely unconnected to the parts on which they lie, as well as to thoſe by which they are covered, both their ſurfaces are ſmooth and gliſtening, and moiſtened like thoſe of other ſerous membranes, by a ſerous exhalation, which facilitates their motions over the neighbouring organs. Analogy warrants us in aſcribing this ſecretion to the arteries of the omenta; and we conſequently conſider theſe organs as an extenſion of the general ſerous ſurface of the abdominal cavity.

Experiments on living animals, and ſurgical operations, clearly prove that the membrane of the omenta poſſeſſes little, if any, ſenſibility in its healthy ſtate.

The *leſſer epiploon*, *meſogaſter*, *omentum minus*, or *hepatico-gaſtricum*, is the portion extended from the ſmall arch of the ſtomach to the concave or under ſurface of the liver. It ariſes, behind, from the poſterior half of the tranſverſe fiſſure of the liver; on the right it is continuous with the peritoneum covering the neck of the gall-bladder and the beginning of the duodenum; towards the left it is reflected immediately from the diaphragm. Advancing from theſe points, in two cloſely united layers, towards the ſtomach, it is attached to the end of the œſophagus, to the whole leſſer arch of the ſtomach, to the pylorus, and commencement of the duodenum. At this line its layers divide, and expand over the ſtomach, one of them forming the ſuperior, and the other the inferior peritoneal covering of this viſcus. Between the layers of the leſſer omentum are contained the hepatic veſſels and biliary ducts, the coronary veſſels of the ſtomach, ſome branches of the cœliac plexus of nerves, and of the par vagum, and a few abſorbent glands. Fat is rarely depoſited here in ſo large a quantity as in the large epiploon, ſo that we can uſually ſee through it that portion of the liver called lobulus ſpigelii, which is in contact with its inferior ſurface.

The biliary ducts, the hepatic veſſels with numerous accompanying branches of nerves from the cœliac ganglia, and a conſiderable portion of the hepatic and cyſtic abſorbents, connected and ſurrounded by adipous and cellular ſubſtance, are incloſed in the right edge of the leſſer omentum. This part is called *capſula Gliſſoni*, from an Engliſh anatomiſt, who deſcribed it minutely in a work entitled "De Hepate." The very margin of the omentum is occupied by the biliary ducts, and the neck of the gall-bladder. At this border the two ſurfaces of the little omentum are continuous. Behind the unconnected edge, round which the peritoneum turns, is found the foramen of Winſlow, or *foramen epiploicum*, large enough to admit one or two fingers, which can thus be placed in immediate contact with the back part of the liver, and the inferior ſurface of the little omentum. This opening is ſituated between the neck of the gall-bladder, and the beginning of the duodenum, with the hepatic veſſels in front, and the vena cava behind. It is not unuſual to find its edges adhering together. We ſhall have occaſion to mention it again after deſcribing the large omentum.

The great omentum, *epiploon majus*, *vel gaſtro-colicum*, is the looſe membrane, more or leſs loaded with fat, lying in front of the bowels, and generally meeting our eye in laying open the abdomen. It differs extremely in length and ſituation; in ſome caſes reaching as low as the pelvis, and often deſcending in ruptures to the very bottom of the ſcrotum; while in others it extends but a ſhort way below the umbilicus. It is always ſhorter in children than in adults. We often find it folded, or rolled on itſelf, and drawn to ſome one part of the abdomen, or tucked up over the ſtomach, ſo as to leave the ſmall inteſtines expoſed to our immediate view. Its natural ſituation between the bowels, and the parietes of the abdomen, explains the frequency of its protruſion, together with the inteſtines, in herniæ. Some anatomiſts aſſert that it hangs lower on the left than on the right ſide of the abdomen.

The great omentum is a continuation of the peritoneal covering of the ſtomach. We have already deſcribed this as being formed by the ſeparation of the two layers which conſtitute the little omentum. At the great curvature of the ſtomach theſe layers again coaleſce into one ſheet of membrane, are produced till they meet with the tranſverſe arch of the colon, to incloſe which they again ſeparate. Meeting at the oppoſite line they once more unite, and are continued under the name of the tranſverſe meſocolon to the root of the meſentery. The origin of the great epiploon, when minutely examined, commences in the left from the end of the œſophagus, and from the notch of the ſpleen (where it forms a membranous connection between this organ and the ſtomach) and includes the whole of the great arch of the ſtomach nearly as far as the pyloris. The portion of membrane thus formed deſcends looſely before the tranſverſe arch of the colon, and reaches to different lengths beyond it, conſtituting the anterior layer, or *lamina gaſtrica* of the great epiploon. At the lower or floating border this membranous expanſion is doubled on itſelf, and turning upwards again to meet the tranſverſe arch of the colon, forms the poſterior layer, or *lamina colica* of Haller. On the right ſide the great omentum is not only attached to the tranſverſe portion of this inteſtine, but is continued along its hepatic flexure, and for ſome way down the aſcending colon. In ſome inſtances it reaches as low as the cœcum. It is this lateral extenſion of the great omentum which conſtitutes the *omentum colicum* of Haller. Each of the layers is compoſed of a duplicature of peritoneum, as we have before ſtated, containing its proper veſſels, and fat, and united cloſely by cellular tiſſue. It will be evident, from our deſcription, that the great omentum is formed by the anterior layer alone in the ſpace between the ſtomach and tranſverſe arch of the colon; below the latter it is compoſed of the two layers, the lamina gaſtrica, and the lamina colica lying in contact with each other, but having no further connection in a healthy ſtate of the oppoſing ſurfaces.

From this diſpoſition of the great and little epiploa, there reſults, in conjunction with the inferior ſurface of the ſtomach, and the ſuperior ſurface of the tranſverſe meſocolon a membranous bag, called uſually the bag of the omentum. It offers every where on the inſide a continuous ſerous ſurface, where the ſides of the cavity are in cloſe contact, but not adherent. The communication between this pouch, and the general cavity of the peritoneum, is formed by the foramen of Winſlow. In order to demonſtrate this fact, as well as to diſplay the bag formed by the omenta, we introduce into this opening a pipe, ſurrounded by ſome ſoft ſubſtance, to prevent the eſcape of the air. By blowing gently we are enabled to ſeparate the layers of the great omentum, which were in contact, and give to the whole the form of a large membranous bag, interſected by veſſels and bands of fat, between which the membrane riſes in pouches of various ſizes. The lines formed by the ſtomach, and tranſverſe arch of the colon, are but faintly ſeen, owing to the diſtention of the epiploon, which appears, as it were, ſuſpended between them. To inſure the ſucceſs of this experiment ſome conditions are neceſſary, which we are not always happy enough to bring together. There muſt be no adheſion of ſurfaces, no large accumulation of fat, the ſubject young, and the whole conducted with the greateſt delicacy, as the ſlighteſt rent in the membrane is ſufficient to prevent ſucceſs. In the fœtus, and in young children, the laminæ of the great omentum are eaſily ſeparable throughout their whole extent. In adults, and more ſo in old perſons, they are generally more or leſs united, ſo that the cavity of the omenta is confined to the ſpace contained between the little omentum, the under ſurface of the ſtomach, and the tranſverſe meſocolon.

The arteries of the great omentum are derived from the right and left gaſtro-epiploic veſſels. They are in general ſmall, and deſcend between the layers of the lamina gaſtrica, giving off branches on either ſide, which anaſtomoſe freely in every direction. At the lower border of the omentum the trunks turn up again to meet the tranſverſe arch of the colon, with the arteries of which inteſtine they form communications. The veins accompany the arteries in their courſe, and join the large venous trunks which end in the vena portarum. The few nerves it poſſeſſes are derived from the hepatic, and ſplenic plexuſes.

The *appendices epiploicæ*, or *omentula*, are principally obſerved on the firſt parts of the great inteſtine, being in leſs number on the ſigmoid flexure of the colon and the rectum. They are irregularly diſpoſed, hanging in fringes, generally unconnected with each other, ſometimes united by intermediate membranous productions. They are uſually dependent from the pouches of the inteſtine, and not from the longitudinal bands. They are obviouſly formed by the peritoneal covering of the inteſtines, united by cellular membrane, and containing a depoſit of fat in almoſt every inſtance.

The uſe of the omenta is entirely unknown: The leſſer epiploon offers a covering, and connecting medium to ſome nerves belonging to the ſtomach, and to the hepatic veſſels and ducts. To the great epiploon many offices have been aſcribed, none of which are ſatisfactorily aſcertained. It varies ſomewhat in ſize according to the ſtate of the ſtomach; ſince, when the latter is diſtended, it appears to enter between the layers of peritoneum forming the anterior fold, which loſe in this caſe their form of omentum, and become the temporary covering of this organ. What may be the probable advantages of this conſtruction it is not eaſy to decide. It has been ſuppoſed again to ſecrete a lubricating fluid from its ſurface, which preſerves the free motion of all the chylopoietic viſcera between each other. That it increaſes the ſerous ſurface of the abdominal cavity is evident; but in what manner this becomes an advantageous diſpoſition is more than we have the means of determining. The omentum colicum, and appendices epiploicæ are ſubject to the ſame obſervations, being ſimilar in ſtructure, and conſequently in uſes. It is certain that a conſiderable portion of the great omentum may be cut away, without any ſubſequent inconvenience to the patient, as has been frequently obſerved in caſes of omental hernia.

An epiploon is found in all the mammalia, where it is ſeen under every variety of form and ſize; ſo that no inferences can be drawn from its diſpoſition in theſe particulars. In all it contains more or leſs of fat between its membranes, the accumulation of which would appear to bear ſome proportion to the active, or ſluggiſh habits of the animal. In the hybernating ſpecies during the winter, it is loaded with fat, which exiſts but in minute quantities during the ſummer. The epiploon is not found in the other claſſes of animals, at leaſt there is nothing analogous to it, but a membranous production between the liver and ſtomach, anſwering to the little omentum.

EPIPLO'SCHEOCE'LE, from επιπλοον, *the omentum*, οσχεον, *the ſcrotum*, and κηλη, *a tumour*, in *Surgery*, an omental rupture, ſituated in the ſcrotum.

EPIPOGUM, in *Botany*, επι, *upon* and πογον, a *beard*, becauſe the beard, or rather lip, is turned upwards. Gmel. Sib. v. 1. 11. t. 2. f. 2. is *Satyrium Epipogium* of Linnæus; *Limodorum Epipogium* of Swartz and Willdenow. See LIMODORUM.

EPIPOLÆ, in *Ancient Geography*, was originally a piece of high ground without the city of Syracuſe, and afterwards ſo little inhabited that it is not mentioned by Cicero in his deſcription of this city. As it was the moſt elevated ſituation, and commanded Tyche and Neapolis, it was judiciouſly incloſed by Dionyſius I., who encompaſſed it with a wall nearly 4 miles in extent. Its additional defence was the fortreſs of Labdalon, at its bottom, on the eaſt; and that of Euryalus, at its top, on the north. See SYRACUSE.

EPIPOMPEUTICA, in the *Ancient Muſic*. Voſſius, in his poetical inſtitutes, informs us, that this was a title given to ſongs compoſed and ſung on occaſions of great magnificence.

EPIPORO'MA, from επιπωροω, *to harden*, in *Surgery*, a hard tumour on a joint: a tophus.

EPIPROSLAMBANOMINOS, *Gr.* in the *Ancient Muſic*, a name given to the ſtring or ſound below proſlambanominos, which word correſponds with gamut in the Guido ſcale.

EPIRE, in *Geography*, an ancient kingdom of Greece, now united with Albania, and included in that country, of which it forms the ſouthern part, extending from Valona to Arta.

EPIROTS, in *Ancient Geography*. See the next article.

EPIRUS, a country of Greece, bounded on the eaſt by Ætolia, on the weſt by the Adriatic, on the north by Theſſaly and Macedon, and on the ſouth by the Ionian ſea. This was the ancient kingdom of the Æacidæ, and was firſt called "Epirus Dodonæa," *i. e.* the continent of the Dodonæans, and afterwards Epirus, or "the continent," that being the import of the Greek word Ηπειρος. It was anciently divided into three diſtricts or provinces; *viz.* Chaonia, Theſprotia, and Moloſſis; to which ſome authors add Caſſopia, Caſſiope, or Cæſtrine, and Pindus. This country is ſaid to have been firſt peopled by Dodanim, the ſon of Javan, and grandſon of Japhet, or at leaſt by ſome of his poſterity. We find among the nations which occupied Epirus, before they were united into one people under the common name of Epirots, the Selli, who are thought to have been the firſt inhabitants of Epirus, and to have miniſtered in the temple of Dodona, the Chaones, the Moloſſi, the Dolopes, the Dryopes, the Ænianes, the Pelaſgi, &c. The form of government which prevailed in Epirus was unqueſtionably monarchical, the whole country being divided into many ſmall independent kingdoms. Homer, and other ancient writers, mention ſeveral kings who reigned here at the time of the Trojan war. But while the other Epirotic nations continued to be governed by princes of their own blood, the Moloſſi became ſubject, at an early period, to the power of Pyrrhus, a foreign prince, whoſe deſcendants were denominated Æacidæ, from Æacus, the founder of his family. Some of theſe petty kingdoms, in proceſs of time, exchanged the monarchical into a republican form of government; for Thucydides informs us, that in his time the Theſprotæ and Chaones were governed, not by kings, but by annual magiſtrates. However, the kingdom of the Moloſſi ſoon eclipſed all others; the Moloſſian princes having ſubjected the whole country, and united the ſeveral ſmall kingdoms of which it conſiſted into one, known to the ancients under the name of Epirus.

Pyrrhus, the firſt of the Æacidæ, was the ſovereign of this country at the period when regular and authentic hiſtory commences; and he is ſaid to have diſtinguiſhed himſelf at the ſiege of Troy, when his father was killed. His reign ſoon terminated by a premature death; for he was murdered by Oreſtes in the temple of Delphi, on account of his having married Hermione, the daughter of Menelaus, who had been betrothed to Oreſtes. He was ſucceeded by his ſon Moloſſus, and ſeveral other princes, whoſe names it is needleſs to record. At length Admetus was the ſovereign of Epirus, when Xerxes invaded Greece. This prince, upon the defeat of the Perſians, wiſhed to enter into an alliance with the Athenians, about the year 478 or 479 B. C. The ſucceſſors of Admetus were Tharymbas, who is ſaid to have introduced the ſciences into this country, and to have formed an excellent code of laws; and Alcetes, at whoſe death the kingdom was divided between his two ſons, Neoptolemus and Arybas, the latter of whom, when his brother died, became ſole ſovereign of the country, and conducted the government with great prudence, equity, and moderation. He alſo encouraged literature by extending his patronage to thoſe who excelled in it. His niece Olympias, of whoſe education he had taken great care, was married to Philip, king of Macedon, who had by her Alexander the Great. At his death, he was ſucceeded by Alexander, one of his nephews; who is ſaid to have been little inferior, in courage and conduct, to his nephew Alexander the Great; but he had the misfortune to engage, on his firſt ſetting out, with nations inured to the toils of war, and no leſs brave than his own Epirots; whence he uſed to ſay, that the country, which he propoſed to conquer, was inhabited by men, whereas the provinces his nephew Alexander went to ſubdue, were peopled by women only. (Aul. Gell. l. xvii. c. 21.) The immediate ſucceſſors of Alexander were Æacides and Alcetes II.; and the latter was ſucceeded by Pyrrhus, deſcended by the father from Achilles, and from Hercules by the mother. (See Pyrrhus.) After two or three ſhort reigns, Deidamia, great grand-daughter to Pyrrhus, ſucceeded her father Pyrrhus III. and having no iſſue, ſhe gave the Epirots their liberty, who formed themſelves into a republic, which was governed by magiſtrates annually elected in a general aſſembly of the whole nation. The Macedonians on one ſide, and the Illyrians on the other, taking advantage of the inteſtine diviſions, which generally attend a popular government, ſeized on ſeveral provinces belonging to the Epirots, and annexed them to their reſpective crowns. The Romans, after having conquered Philip of Macedon, reſtored them to their ancient liberty; but they ungratefully took up arms againſt their benefactors, and joined Perſes; which induced the Romans to ſend orders to Paulus Æmilius, after the reduction of Macedon, to plunder their cities and level them with the ground. This order was punctually, though reluctantly, executed throughout the whole country in one day. One hundred and fifty thouſand of the inhabitants were made ſlaves, and ſold to the beſt bidder for the benefit of the republic. All the cities of Epirus, to the number of 70, were diſmantled, and the chief men of the country carried to Rome, where they were tried, and moſt of them condemned to perpetual impriſonment. After this cataſtrophe, Epirus never recovered its ancient ſplendour. Upon the diſſolution of the Achæan league, it was made part of the province of Macedon; but when Macedon became a dioceſe, Epirus was made a province of itſelf, called the province of Old Epirus, to diſtinguiſh it from New Epirus, another province lying to the eaſt of it. On the diviſion of the empire, it fell to the emperors of the eaſt, and continued under them till the capture of Conſtantinople by the Latins, when Michael Angelus, a prince nearly related to the Greek emperor, ſeized on Ætolia and Epirus. He was ſucceeded by his brother Theodorus, who ſo far enlarged his dominions, that, diſdaining the title of deſpot, he aſſumed that of emperor, and was crowned by Demetrius archbiſhop of Bulgaria. Charles, the laſt prince of this family, dying without lawful iſſue, bequeathed Epirus and Acarnania to his natural ſons, who were expelled by Amurath II. Great part of Epirus was afterwards held by the noble family of the Caſtriots, who, though they were maſters of all Albania, yet ſtyled themſelves princes of Epirus. Upon the death of the famous George Caſtriot, Epirus fell to the Venetians, who were ſoon diſpoſſeſſed of it by the Turks, in whoſe hands it ſtill continues; being now known by the name of Albania, which comprehends the Albania of the ancients, all Epirus, and that part of Dalmatia which is ſubject to the Turks. Plutarch tells us, that the Epirots enjoyed the beſt ſort of liberty under their kings; for, as he ſays, a general aſſembly of the people was annually convened at Paſſaron, a city in the province of Moloſſis, where the king bound himſelf by a ſolemn oath to govern agreeably to the laws, and the people to obey and ſupport him as long as he ſhould make the laws the rule of his government.

EPISARCIDIUM, from επι and σαρξ, *fleſh*, a name given by many of the old authors to an anaſarca.

EPISCAPHIA, from επι and σκαφη, *boat*, feaſts celebrated by the Rhodians.

EPISCENIA, from επι and σκηνη, *tent*, feaſts celebrated by the Lacedæmonians.

EPISCENIUM, Επισκηνιον, in *Antiquity*, a place upon the top of the theatre, where all the machines for moving the ſcenes were kept. Potter. Archæol. Græc. lib. i. cap. 8. p. 42.

EPISCEPSIS, Επισκηψις, an action brought to prove the diamartyria, or proteſtation, that the perſon deceaſed had left an heir, to be falſe and groundleſs. Potter. Archæol. Græc. lib. i. cap. 24. i. p. 128.

EPISCIRA, Επισκιρα, or Episcirosis, a feſtival celebrated at Scira in Attica, in honour of Ceres and Proſerpine. Potter. Archæol. Græc. lib. ii. cap. 20. tom. i. p. 395.

EPISCHESES, from ἐπεχω, or ἐπισχω, *I reſtrain*, in *Medicine*, a term uſed by Dr. Cullen to denote the fifth order of his fourth claſs of diſeaſes, which includes the retention of accuſtomed evacuations, *viz.* conſtipation of the bowels, ſuppreſſion of urine, of the catamenia, &c.

EPISCHION, from εϖι and ισχιον, *iſchium*, a name given by the old Greek writers to the pubes.

EPISCOPACY, the quality of epiſcopal government, or that form of church diſcipline, wherein dioceſan biſhops are eſtabliſhed, diſtinct from, and ſuperior to, prieſts or preſbyters. See BISHOP, EPISCOPAL, EPISCOPALIANS, and HIERARCHY.

Epiſcopacy, and preſbytery, have been alternately eſtabliſhed and aboliſhed in Scotland.

EPISCOPACIDE, from εϖισκοϖος, *biſhop*, and *cædo*, *I kill*, the crime of murdering a biſhop by one of his own clergy. By the ancient laws of England, the ſame obedience is due from a clergyman to his biſhop as from a ſervant to his maſter; and therefore the offences of murdering either are made equal, that is, they are both petty treaſon.

EPISCOPAL, ſomething that belongs to a biſhop.

The word is formed of the Greek εϖισκοϖος, *overſeer*, derived from εϖισκοϖεω, *inſpicio*, *I inſpect*, or *overlook*.

Epiſcopal government, is the government of a dioceſe, wherein one ſingle perſon, legally conſecrated, preſides over the clergy of a whole diſtrict, in quality of head, or ſuperintendant thereof; conferring orders, and exerciſing a ſort of juriſdiction.

The preſbyterians reject the epiſcopal eſtabliſhment, and condemn the epiſcopal orders as a human inſtitution, the mere reſult of ſecular policy, or of pride and ambition.

Among the epiſcopal functions, the principal part is that of holding frequent viſitations of the dioceſe.

EPISCOPALES VALVULÆ, called alſo, by ſome, valvulæ mitrales, two valves in the pulmonary vein, which prevent the reflux of the blood to the heart.

EPISCOPALIA, is ſometimes uſed in the ſame ſenſe with pontificalia.

EPISCOPALIA, is alſo uſed to denote ſynodals, or cuſtomary payments, due to the biſhops from the clergy of their dioceſe.

Theſe cuſtomary payments have been otherwiſe called onus epiſcopale; and were remitted, by ſpecial privilege, to free churches and chapels of the king's foundation which were exempt from epiſcopal juriſdiction.

EPISCOPALIANS, or EPISCOPISTS, a name given to thoſe who adhere to the church of England, and particularly to the eccleſiaſtical hierarchy, ſuch as it was in the Romiſh church before the Reformation; who affect the diſcipline of biſhops, prieſts, canons, the office, or liturgy, &c. and retain the greateſt part of the canon law, with the decretals of the popes, more cloſely than the Catholics themſelves of ſeveral countries; though, as to matters of doctrine, or faith, they agree in moſt points with the Calviniſts, or Reformed.

In Scotland, the principal diſſenters are the Epiſcopalians; lay Epiſcopalians enjoy all the ſame civil privileges with thoſe of the eſtabliſhed church. They are under no reſtrictions; tied to no teſts, but are employed in all places of truſt, upon taking the oaths to the government. But the epiſcopal miniſters are liable to ſeveral penal laws; many of them having been nonjurors.

EPISCOPI MULTA. See MULTA.

EPISCOPISSA, a word uſed by writers of the middle ages, to denote a biſhop's wife.

EPISCOPIUS, SIMON, in *Biography*, a Dutch divine of the Arminian perſuaſion, was born at Amſterdam in the year 1583. Having entered on his academical ſtudies in the univerſity of Leyden in 1600, and graduated M. A. in 1606, he purſued his theological ſtudies with great aſſiduity; but on account of the diſputes that ſubſiſted between the Gomariſts and Arminians, he found obſtacles in the way of his admiſſion to the miniſterial office, which the burgomaſters of Amſterdam wiſhed him to aſſume. Diſguſted by this illiberal treatment, he left Leyden in 1609, and removed to the univerſity of Franeker, where he had to contend with ſimilar difficulties, on account of his attachment to the Arminian doctrines. In the year 1710, however, he was admitted to the profeſſion of the miniſtry, and appointed to a church at Bleſwyck, in the neighbourhood of Rotterdam. In the following year he appeared as one of the deputies at the conference held at the Hague, before the ſtates of the province, between ſix anti-remonſtrant and ſix remonſtrant miniſters, where he diſtinguiſhed himſelf by his defence of the opinions of his party. In 1712 he was choſen profeſſor of divinity at Leyden, in the room of Gomarus, who ſurrendered that office. In this ſituation he conducted himſelf with ſingular prudence, as well as ability, ſo that he lived on terms of amity with Polyander, his colleague, who belonged to the party of Gomariſts. The controverſy concerning predeſtination was at this time the occaſion of great animoſity; and Epiſcopius, and his friends, were objects of enmity and perſecution to the deluded populace. Their condition was rendered more perilous by the partiſans of Maurice, prince of Orange, by whom they were calumniated, not only as heretics in their theological ſentiments, but as enemies to the proteſtant religion, and to the United Provinces. At length Maurice and the Gomariſts, of whom he was the head, ſucceeded in obtaining a decree of the States for convening a national ſynod; but the Arminians remonſtrated againſt the meeting of ſuch a ſynod, becauſe they well know that it would be compoſed of their inveterate enemies, who on this occaſion would appear both as their accuſers and their judges. However, it met at Dort in the year 1618, (See *Synod* of DORT,) and the buſineſs of the ſeſſions was conducted as Epiſcopius and his party apprehended. The ruling members were invincible, and required implicit ſubmiſſion to their deciſions. It was in vain that Epiſcopius and his brethren demurred and remonſtrated againſt their proceedings. They were expelled from the ſynod, and their cauſe was tried during their abſence. The reſult was a ſentence, which charged them with peſtilential errors, and with being corrupters of the true religion. This ſentence was followed by their excommunication, a deprivation of their offices, eccleſiaſtical and civil, a prohibition to exerciſe their miniſtry, and beſides fines and impriſonment, baniſhment from the territories of the republic. Accordingly Epiſcopius, as well as ſeveral of his adherents, retired to Antwerp, where he drew up various publications in defence of his oppreſſed party, ſome of which are, "A Confeſſion of Faith," expreſſed for the moſt part in words and phraſes of ſcripture: a treatiſe, entitled "Antidotum adverſus Synodi Dordracenæ Canones," and two letters, addreſſed to Wadingus, a Jeſuit, who wiſhed to ſeduce him into his church, one on the rule of faith, and the other upon the worſhip of images. In 1609, Epiſcopius withdrew into France, and endeavoured to confirm and comfort his brethren, as well as to diffuſe the opinions for which he ſuffered, both by his correſpondence and publications. In 1626, after the death of prince Maurice, and the acceſſion of prince Frederick Henry, he returned to his native country, and enjoyed the benefits of toleration and tranquillity. The place of his ſettlement was Rotterdam, where he exerciſed his miniſtry for about 8 years, and compoſed ſeveral pieces of a theological and controverſial nature, which were publiſhed during his life and after his death. The Arminians, having remained for ſome years unmoleſted, eſtabliſhed a college at Amſterdam, of which Epiſcopius was the firſt theological profeſſor, and this appointment occaſioned his removal to Amſterdam in the year 1634. In the honourable and diligent diſcharge of the duties of this office, he continued till his death, which happened in 1643. Epiſcopius was a man of ſolid and extenſive learning; a cool and accurate judgment, a lively genius, and commanding powers of eloquence. His controverſial pieces, though occaſionally intermixed with unbecoming ardour and bitterneſs, are generally diſtinguiſhed by a ſpirit of candour and moderation. His character was highly exemplary. His ſentiments coincided with thoſe of Arminius, which he reduced into a ſyſtematic form, and recommended by the graces of compoſition. His works, conſiſting of commentaries, theological inſtitutions, controverſial treatiſes, &c. form two volumes in folio; which were edited by Peter Curcellæus, who has prefixed an account of the author. A larger life of him was publiſhed by Philip â Limborch, the ſon of his brother's daughter, written in the Dutch language, of which a Latin verſion appeared at Amſterdam in 1701. 8vo. Bayle. Moſheim. Moreri. Gen. Biog.

EPISCOPUS PUERORUM, *biſhop of the boys*, a ludicrous kind of office, formerly exerciſed in churches, in that called the feaſt of fools, or the feaſt of the kalends. See *Boy* BISHOP.

EPISEMASIA, from εϖισημαινω, *I ſignify*, in *Medicine*, is the very time that a diſeaſe firſt ſeizes a perſon, and is properly called ſignificatio. Blancard.

EPISODE, Εϖεισοδιον, from εϖι, *upon*, and εισοδος, *entry*, is commonly conceived to be a ſeparate incident, ſtory, or action, which an hiſtorian, or poet, inſerts, and connects with his principal action; to furniſh out the work with a greater diverſity of events; though, in ſtrictneſs, all the particular incidents whereof the action or narration is compoſed, are called epiſodes.

EPISODE, in *Dramatic Poetry*, was the ſecond part of the ancient tragedy.

The origin and uſe of epiſodes is deſcribed by M. Hedelin, and F. Boſſu. Tragedy, in its original, being only a hymn ſung in honour of Bacchus, by ſeveral perſons, who made a kind of chorus, or concert of muſic, with dancing, and the like; to diverſify the repreſentation a little, and divert the audience, they determined at length to divide the ſinging of the chorus into ſeveral parts, and to have ſomething rehearſed in the intervals.

At firſt, a ſingle perſon, or actor, was introduced, then two, then more; and what the actors thus rehearſed, or entertained the audience with, being ſomething foreign, or additional to, or beſide, the ſong of the chorus, and no neceſſary part thereof, was called εϖεισοδιον, *epiſode.*

And hence tragedy came to conſiſt of four parts, the prologue, epiſode, exode, and chorus. The prologue was all that preceded the firſt entrance of the chorus, and concluded with the firſt interlude, or choral ode, between the acts. The epiſode, all that was interpoſed between the ſingings of the chorus, and extended in general from the firſt to the laſt of the interludes. The exode, all that was rehearſed after the chorus had done ſinging, or comprehended all that was ſaid after the laſt interlude. And the chorus, was the grex, or company, that ſung the hymn. See each of theſe articles.

And as this recitation of the actors was in ſeveral parts, and inſerted in ſeveral places, it might either be conſidered together as a ſingle epiſode, conſiſting of ſeveral parts; or each part might be called a diſtinct epiſode.

Theſe ſeveral epiſodes in the ſame tragedy might either be taken from ſo many different ſubjects, or from the ſame ſubject divided into a proper number of recitations, or incidents.

To conſider only the firſt occaſion, and inſtitution of theſe foreign or additional pieces, it appears no ways neceſſary, that they ſhould be taken from one and the ſame ſubject; three or four recitations of different actions, no wiſe related, or connected to each other, would eaſe the actors, and amuſe the people, in the intervals of the chorus, as well as if they were all ſo many parts of the ſame action. By degrees, what was at firſt only an addition to the tragedy, became the principal part thereof. Then the ſeveral pieces, or epiſodes, began to be conſidered as one ſingle body which was not to have parts, or members of different nature, and independent of each other.

The beſt poets took the thing in this light, and drew all their epiſodes from the ſame action; which practice was ſo fully eſtabliſhed in Ariſtotle's time, that he lays it down as a rule. Thoſe tragedies wherein this unity and connexion were not obſerved, he called epiſodic pieces. See TRAGEDY.

EPISODE, in *Epic Poetry.* The term epiſode, by being tranſplanted from the ſtage to the epopœia, did not change its nature. All the difference Ariſtotle makes between the tragic and epic epiſodes, is, that the latter are more ample than the former.

Ariſtotle uſes the word in three different ſenſes: the firſt taken from the enumeration already made of the parts of the tragedy, *viz.* prologue, chorus, epiſode, and exode; whence it follows, that in tragedy, every thing is epiſode that is none of the other parts; ſo that as, among us, there are tragedies without either prologue, chorus, or epilogue, the tragic epiſode includes the whole tragedy; conſequently the epic epiſode muſt be the whole poem, in like manner; all there is to retrench from it being the propoſition and invocation, which ſtand in lieu of the prologue. In this ſenſe, the epopœia and tragedy have each only one epiſode; and if the parts or accidents be ill connected together, the poem will be epiſodic and defective.

But farther, as all that was ſung in the tragedy was called the chorus, in the ſingular number, yet this ſingularity did by no means prevent every part or diviſion of the ſame from being called a chorus, without making ſeveral choruſſes; ſo it was with the epiſode; each incident, and part of the fable and action, is not only a part of the epiſode, but it is an epiſode itſelf.

The term epiſode, therefore, in this ſenſe, ſignifies every part of the action expreſſed in the plan, or firſt draught of the fable; as the abſence and wanderings of Ulyſſes, the diſorders in his family, and his preſence, which retrieved and ſet all to rights again.

Ariſtotle furniſhes us with a third kind of epiſode; in ſhewing that what is contained and expreſſed in the firſt plan of the fable is proper, and that all the reſt is epiſode.

By *proper* he means what is abſolutely neceſſary; and by epiſode, what in one ſenſe is neceſſary, and in another not; ſo that the poet is at liberty to uſe, or let it alone.

Thus, Homer, having made the firſt draught of the fable of his Odyſſey, was not at liberty either to make Ulyſſes abſent from his country, or not. His abſence was eſſential; and therefore Ariſtotle ranks it among the things he calls *proper.* But he does not beſtow that appellation on the adventures of Antiphates, Circe, the Sirens, Scylla, Charybdis, &c. The poet was at liberty to have left theſe alone, and to have choſen others in their room; ſo that they are epiſodes diſtinct from the firſt action, to which they are not immediately neceſſary.

The third ſenſe of the word epiſode comes to the ſecond: all the difference between them is, that what we call epiſode in the ſecond ſenſe, is the ground or plan of the epiſode in the third; and that the third adds to the ſecond certain circumſtances which are only probable, and not neceſſary, as the places, princes, and people, among whom Ulyſſes was caſt by Neptune.

It muſt be added, that in an epiſode in the third ſenſe, the incident, or epiſode in the firſt ſenſe, whereon it is grounded, is to be extended and amplified; otherwiſe, an eſſential part of the action and fable does not become an epiſode.

Laſtly, it is in this third ſenſe that we are to underſtand that precept of Ariſtotle, not to make the epiſodes till after the names of the perſons have been choſen. Homer would not have ſpoken of the fleets and ſhips as he has done, if, in lieu of the names of Achilles, Agamemnon, and Iliad, he had choſen thoſe of Adraſtus, Capaneus, and Thebaid.

Upon the whole, the term epiſode, in the epic poem, as uſed by the father of the critics, Ariſtotle, does not ſignify any foreign or accidental adventure; but the whole narration of the poet, or a neceſſary and eſſential part of the action and ſubject, amplified with probable circumſtances.

Thus Ariſtotle enjoins that the epiſode be not added to the action, or fetched from elſewhere; but that it be a part of the action; and never uſes the word *adding*, in ſpeaking of epiſodes, though it occurred ſo naturally to his interpreters, that they have generally uſed it in their tranſlations and comments. He does not ſay, that after laying the plan and chooſing the names, the poet is to add the epiſodes; but uſes the derivative of the word epiſode, επισοδȣν, as if in Engliſh we ſhould ſay epiſodify his action.

From what has been ſaid, we may venture to define epiſodes to be neceſſary parts of the action, extended and filled up with probable circumſtances. Now an epiſode is only a part of an action, and not a whole action; and this part of the action, which is the baſe or ground of the epiſode, muſt not, when epiſodified, retain any thing of the ſimplicity which it had when firſt expreſſed in general, in the plan of the fable.

The ſubject of a poem may be lengthened two ways; either by the poet's making uſe of a great many of his epiſodes; or by his amplifying and giving a greater extent to every one. By this latter method, chiefly, it is, that the epic poets lengthen their poems much beyond the dramatic. It muſt be added, that there are certain parts of an action, which of themſelves do not naturally preſent or afford more than one epiſode; ſuch as the death of Hector, of Turnus, or the like: whereas there are other parts of the fable more copious and fertile, and which oblige the poet to make diverſe epiſodes on each, though laid down in the firſt plan with as much ſimplicity as the reſt: ſuch are the battles of the Trojans and Grecians, the abſence of Ulyſſes; the wanderings of Æneas, &c. For Ulyſſes's abſence ſo many years from his own country, required his preſence elſewhere; and the deſign of the fable was to throw him into ſeveral dangers, and different countries. Now each peril, and each new country, furniſhed an epiſode, which the poet might uſe if he pleaſed.

The reſult of the whole is, that epiſodes are not actions, but parts of actions; that they are not added to the action and matter of the poem, but make the action and matter themſelves; that of courſe they are not to be fetched from elſewhere, but raiſed from the ground or baſis of the action; that they are not united and connected with the action, but with one another; that all the parts of an action are not ſo many epiſodes, but only ſuch as are amplified, and attended with particular circumſtances; and laſtly, that their union with each other is neceſſary in the ground of the epiſode, and probable in the circumſtances.

Epiſodes, ſays Dr. Blair, (Lectures. vol. iii.), as the term is now underſtood, are certain actions, or incidents, introduced into the narration, connected with the principal action, yet not of ſuch importance as to deſtroy, if they had been omitted, the main ſubject of the poem. Of this nature are the interview of Hector with Andromache, in the Iliad; the ſtory of Cacus, and that of Niſus and Euryalus in the Æneid; the Adventures of Tancred with Erminia and Clorinda, in the Jeruſalem; and the proſpect of his deſcendants exhibited to Adam, in the laſt books of Paradiſe Loſt. Such epiſodes as theſe, are not only permitted to the epic poet; but, provided that they be properly executed, are great ornaments to his work. The rules that ſerve to regulate them are ſuch as follow: they muſt be naturally introduced, and have a ſufficient connection with the ſubject of the poem; they muſt ſeem to be inferior parts belonging to it, and not mere appendages annexed to it. In the next place, epiſodes ought to preſent to us objects of a different kind, from thoſe which go before, and thoſe which follow, in the courſe of the poem. For epiſodes are introduced into an epic compoſition, principally for the ſake of variety. Laſtly, as an epiſode is a profeſſed embelliſhment, it ought to be particularly elegant and well-finiſhed; and, accordingly, it is, for the moſt part, in pieces of this kind, that poets put forth their ſtrength. The epiſodes of Taribezus and Ariana, in Glover's Leonidas; and of the death of Hercules, in the Epigoniad, are the two greateſt beauties in theſe poems. With regard to epiſodes in didactic poetry; ſee Didactic *Poetry*.

EPISODIC, in *Poetry*. A fable is ſaid to be epiſodic, when it is ſwelled with unneceſſary incidents; and its epiſodes are not neceſſarily, nor properly, connected with each other.

Ariſtotle lays it down, that thoſe tragedies are moſt defective, whoſe epiſodes have no connection, or dependence on each other, which he calls epiſodic, *q. d.* ſuperabundant in epiſodes; becauſe ſo many little epiſodes can never compoſe one whole one, but neceſſarily remain in a vicious plurality.

If an epiſode be uſed, the names and circumſtances whereof are unneceſſary, and whoſe ground and ſubject make no part of the action, that is, of the matter of the poem, ſuch an epiſode renders the fable epiſodic. This irregularity is diſcovered, when one may take away a whole epiſode, without ſubſtituting any thing in its room; and yet leave no chaſm, or defect, in the poem. The hiſtory of Hypſipule, in Statius's Thebaid, affords an inſtance of theſe faulty epiſodes. If the whole ſtory of that illuſtrious nurſe were retrenched, the ſequel of the principal action would be the better for it. Nor would any body imagine he had forgot any thing, or that there was any member of his action wanting. Boſſu, and Ariſt. Poet. cap. 9.

EPISPASTIC, from ἐπὶ and σπάω, *I draw*, in *Medicine*, a term denoting the quality of thoſe ſubſtances, which, when applied to the ſkin, draw the humours to the part, or excite inflammation and veſication in it. The word, therefore, is nearly ſynonymous with veſicatory, or bliſtering. See Blister.

EPISPHÆRIA, from επι and σφαιρα, *a ſphere*, in *Anatomy*, are windings and turnings in the outer ſubſtance of the brain, that the ſanguiferous veſſels may paſs more ſecurely.

EPISTÆBE, in *Botany*, a name given to the cuſcuta or dodder, found growing on the plant ſtæbe of the ancient Greeks. See Epiphæos.

EPISTAPHYLINUS, in *Anatomy*, a name under which the azygos uvulæ muſcle has been deſcribed. It will be found, in different writers, under the names of ſtaphylinus, columellæ muſculus teres, muſculus uvulæ, or muſcle de la luette. It is deſcribed in the article Deglutition.

EPISTATES, Επιϛατης, derived from επι, *over*, and ιϛημι, *I ſtand*, in *Antiquity*, a perſon who has the command and direction of an affair, or of a people.

The term is of conſiderable uſe, in ſpeaking of the government of Athens, where the epiſtates was the ſenator in command for that day, or whoſe turn it was to preſide that day. The conſtitution was this: the ten tribes of Athens formed by Cliſthenes, elected every year by lot, each of them, fifty ſenators, which made a ſenate of five hundred. Every tribe had the precedence in its turn, and ſurrendered it again ſucceſſively to another. The fifty ſenators in office were called prytanes; the particular place where they aſſembled, prytaneum, and the term, or duration of their office, *viz.* thirty-five days, prytanea. During theſe thirty-five days, ten of the fifty prytanes preſided weekly, under the name of proedri; and of theſe proedri there was one to preſide each day of the week, under the title of epiſtates.

No perſon was allowed to hold his office more than once in his whole life, leſt he ſhould acquire too much the taſte of dominion: the ſenators of all the other tribes ſtill voted, according to the order the lot had given them; but the prytanes laid the buſineſs before them, and the epiſtates took their votes and opinions.

It muſt be added, that of the ten proedri, of each week, there were but ſeven that would preſide each his day in the quality of epiſtates; the ten proedri elected the ſeven prytanes.

EPISTAXIS, from επιϛαζω, *inſtillo*, in *Surgery*, hemorrhage from the noſe.

When bleeding from the noſe takes place in ſuch a degree as to be dangerous, or likely to bring on exceſſive debility, the further effuſion of blood may be ſtopped in the following manner. Roll a conſiderable piece of lint round the end of a probe; wet it completely through with a ſtrong ſolution of the zincum vitriolatum; introduce it into the noſtril, and preſs it as ſtrongly as poſſible againſt the part whence the blood iſſues. As ſoon as the blood ceaſes to flow, we may conclude that the preſſure acts on the bleeding point. This plan generally ſucceeds.

When the blood, however, flows from ſome point which lies very deeply in the noſtril, it might be found impracticable to make preſſure exactly on the bleeding veſſels. At all events, we may then paſs a piece of catgut through the noſtril, and bring it out of the mouth, from the fauces, by means of a pair of common forceps. A tent of lint may next be faſtened to the ligature, and drawn backward through the mouth into the noſe, ſo as completely to ſtop up the poſterior opening of the noſtril. The front aperture may be eaſily filled with a proper doſſil of lint. In this manner, it is clear that no further hemorrhage can happen, as the blood cannot poſſibly find its way outward.

EPISTEMONARCH, derived from επιϛημη, *knowledge*, and αρχη, *command*, a dignitary, in the *Ancient Greek Church*, appointed to watch over the actions of the church, and to inſpect or ſuperintend every thing relating to the faith, in quality of a cenſor. His office anſwered pretty much to that of magiſter ſacri palatii at Rome.

EPISTHOTONOS, from επισθε, *forwards*, and τεινω, *to extend*, in *Surgery*, a ſpecies of tetanus, in which the body is bent forwards. See Tetanus.

EPISTITES, from επιϛημι, *I keep off*, in *Natural Hiſtory*, the name of a ſtone, deſcribed by the writers of the middle ages, as being of a beautiful red, and ſhining very elegantly. It was renowned for its many magical virtues, according to the idle tradition of theſe times; they ſaid it drove away all noxious animals, and kept off ſtorms from the place where any one was who had it about him.

EPISTLE, a letter miſſive.

The word is formed of επιϛελλω, *I ſend*.

The term epiſtle is now ſcarcely uſed, but for letters wrote in verſe, and letters dedicatory.

In ſpeaking of letters written by moderns, or rather in the modern languages, we never uſe the word epiſtle. Thus, we ſay, the letters, not epiſtles of the cardinal D'Oſſat, of Voiture, of Balzac, of Howel, of Pope, &c.: but thoſe wrote by the ancients, or rather in the ancient language, we call epiſtles; as the epiſtles, not letters in Cicero, Pliny, Seneca. The epiſtles of St. Paul, St. Peter, St. John, &c. to the Romans, Corinthians, &c.

A Table of St. Paul's Epiſtles, in the order of time, with the places where, and the times when they were written.

Epiſtles.	Places.		A.D.
1 Theſſalonians 2 Theſſalonians	Corinth		52
Galatians	Corinth, or Epheſus	Near the end of or the beginning of	52 53
1 Corinthians	Epheſus	The beginning of	56
1 Timothy	Macedonia		56
Titus	Macedonia, or near it	Before the end of	56
2 Corinthians	Macedonia	About October	57
Romans	Corinth	About February	58
Epheſians	Rome	About April	61
2 Timothy	Rome	About May	61
Philippians	Rome	Before the end of	62
Coloſſians	Rome	Before the end of	62
Philemon	Rome	Before the end of	62
Hebrews	Rome, or Italy	In the ſpring of	63

A Table of the Seven Catholic Epiſtles, ſo called becauſe they were written to Chriſtians in general, and the Revelation, with the places where, and the times when they were written.

Epiſtles.	Places.		A.D.
The Epiſtle of St. James	Judea	61 or beginning of	62
The 2 Epiſtles of St. Peter	Rome		64
St. John's 1ſt Epiſtle	Epheſus	About	80
His 2d and 3d Epiſtles	Epheſus	Between	80 and 90
The Epiſtle of St. Jude	Unknown		60 or 65
The Revelation of St. John	Patmos, or Epheſus		95 or 96

See Lardner's Credibility of the Goſpel Hiſtory, vol. xvi. and vol. xvii.

Learned writers are not abſolutely agreed as to the dates of theſe ſeveral epiſtles, nor the places whence they were written. It would lead us too far to examine and produce the various authorities and arguments that have been uſed for ſettling theſe particulars: we ſhall only mention that Dr. Doddridge dates the 1ſt Epiſtle to the Corinthians about the year 57; and the 2d Epiſtle in 58; thoſe to the Epheſians, Philippians, Coloſſians, and Philemon, in 63; the 1ſt to Timothy, in 58 or 65; the 2d to Timothy, in 66 or 67; the Epiſtle to Titus, between St. Paul's firſt and ſecond impriſonment at Rome; the Epiſtle of St. James, in 60 or 61; the 1ſt of Peter in 61; the 2d, in 67; that of St. Jude, ſome time after the 2d of Peter, according to Dr. Mills, in the year 90. As to the general deſign of theſe ſeveral epiſtles, it is obſerved by Dr. Doddridge, who is deſervedly eſteemed an excellent and uſeful expoſitor, that the Epiſtle to the Romans is intended to fix in the minds of the Chriſtians, to whom it is addreſſed, a juſt ſenſe of the excellency of the goſpel, and to engage them to act in a manner agreeable to their profeſſion of it: the Epiſtles to the Corinthians are deſigned to reſolve ſome important queries propoſed by them, and to correct the various criminal irregularities and diſorders, of which they were guilty: the principal deſign of the Epiſtle to the Galatians was to aſſert and vindicate the apoſtle's authority and doctrine, and to confirm the churches of Galatia in the faith of Chriſt, eſpecially wih reſpect to the important point of juſtification; to expoſe the errors that were introduced among them, and to revive thoſe principles of Chriſtianity which he had already taught them. In the Epiſtle to the Epheſians, that apoſtle endeavours to eſtabliſh them in the faith; and to this end to give them more exalted views of the divine love and the excellence of Chriſt; to ſhew them that they were now, though Gentiles, made partakers of equal privileges with the Jews; to encourage them, by his own example and concern for their welfare; and to engage them to the practice of duties becoming their Chriſtian character. The Epiſtle to the Philippians is deſigned to comfort them under the concern they felt on his account; to check a party-ſpirit that had broke out among them, and to promote union and affection; to guard them againſt the ſeduction of judaizing teachers; to ſupport them under their trials, and to inſpire them with an ambition of excelling in ornamental and diſtinguiſhed attainments. The Epiſtle to the Coloſſians is deſigned to excite them to a temper and conduct worthy of their ſacred character, and to ſecure them from the influence of thoſe Pagan ſophiſts or Jewiſh bigots, who endeavoured to ſeduce them from the purity of the Chriſtian faith. The two Epiſtles to the Theſſalonians are intended to confirm them in their adherence to the Chriſtian faith, and to engage them, from the ſufferings they had already endured, and the extraordinary character they had hitherto maintained, to make great advances, and to excel ſtill more in religion and virtue; and alſo to rectify ſome erroneous apprehenſions they entertained about the coming of Chriſt, and to direct them in the proper exerciſe of Chriſtian diſcipline The firſt Epiſtle of Timothy was partly intended to direct him in managing the affairs of the church, and chooſing proper perſons for the various offices it required; and partly to caution him againſt the influence of judaizing teachers, to urge him to pay a conſtant regard to the intereſts of practical religion, and to animate him to diligence, fidelity, and zeal. The ſecond epiſtle prepares Timothy for the ſufferings that awaited him, forewarns him of the apoſtacy that was beginning to appear in the church, and animates him to the perſevering diſcharge of every part of the miniſterial office. The Epiſtle to Titus contains a variety of prudent inſtructions and cautions. The deſign of the Epiſtle to the Hebrews was to confirm the Jewiſh Chriſtians in the faith and practice of the goſpel, which they might be in danger of deſerting through the inſinuation or ill-treatment of their perſecutors. St. James, in his epiſtle, aims to correct theſe errors both in doctrine and practice into which the Jewiſh Chriſtians had fallen, which might otherwiſe have produced fatal conſequences; and then to eſtabliſh the faith, and animate the hope of ſincere believers under their preſent and approaching ſufferings. The Epiſtles of St. Peter are deſigned to induce the Chriſtian converts in various parts of the world to maintain a conduct inoffenſive and amiable; to ſupport them under their trials, and to encourage their conſtancy, notwithſtanding the artifices of falſe teachers, and the perſecution of their moſt inveterate enemies. The leading deſign of St. John in his firſt epiſtle, is to evince the vanity of faith ſeparate from morality; to inſpire the minds of Chriſtians with mutual charity, and to guard them againſt the ſnares and efforts of Antichriſt, and of all who were endued with his ſpirit. The Epiſtle of Jude deſcribes the characters of the falſe teachers, repreſents the divine judgments which ſuch perſons had reaſon to expect, and thus cautions Chriſtians againſt being perverted by them. See Doddridge's Fam. Expoſitor, vol. iv. v. and vi. in the general introduction prefixed to each epiſtle. See alſo an account of the writers of theſe epiſtles, and of the churches to which they were addreſſed.

Epistle, *Poetical*, a ſpecies of didactic poetry, the ſubjects of which are the manners and characters that occur in ordinary life, and that require to be treated with ſomewhat of the eaſe and freedom of converſation. When theſe epiſtles are employed on moral and critical ſubjects, they ſeldom riſe into a higher ſtrain of poetry than *ſatires*, which ſee. Many other ſubjects may be diſcuſſed in the form of an epiſtle; ſuch as love poetry, or elegiac; ſpecimens of which occur in Ovid's "Epiſtolæ Heroidum," and his "Epiſtolæ de Ponto." As theſe works are deſigned to be merely ſentimental, and their merit conſiſts in being proper expreſſions of the paſſion or ſentiment which forms the ſubject, they may aſſume any tone of poetry that is ſuited to it. But didactic epiſtles ſeldom admit of much elevation. The poet, commonly reſtricting himſelf to obſervations on authors, or on life and characters, and not intending to compoſe a formal treatiſe, or to confine himſelf ſtrictly to regular method, gives ſcope to his genius on ſome particular theme, which, at the time, has prompted him to write. Much of the grace of this kind of writing conſiſts in a ſpirited conciſeneſs, which gives to ſuch compoſition an edge and livelineſs, that ſtrike the fancy and keep attention awake. Much of their merit depends alſo on juſt and happy repreſentations of characters. Unſupported by thoſe high beauties of deſcriptive and poetical language, which adorn other compoſitions, the reader expects them to entertain him with lively paintings of men and manners; and therefore in theſe a certain ſprightlineſs and turn of wit find their proper place, and contribute to the beauty and effect. Of this kind of poetry Mr. Pope's ethical epiſtles furniſh an almoſt perfect model. In theſe his wit diſcovers itſelf to ſuch a degree as to give a proper ſeaſoning to grave reflections. His paintings of characters are natural and lively; and, never was any writer ſo happy in that conciſe ſpirited ſtyle, which gives animation to ſatires and epiſtles. His rhyme likewiſe adds to the ſtyle an elevation which otherwiſe it could not have poſſeſſed, while at the ſame time he manages it ſo artfully, that it never appears in the leaſt to incumber him, but, on the contrary, ſerves to increaſe the livelineſs of his manner. In this ſpecies of writing, eaſe and elegance are the diſtinguiſhing characters; nothing, therefore, ſhould be forced or unnatural, laboured or affected, but every part of the compoſition ſhould manifeſt an eaſy, polite, and unconſtrained freedom.

EPISTOLARES, among the Romans, under-ſecretaries to the "magiſter ſcrinii epiſtolarum," or ſecretary who wrote the emperor's leters. They were thirty-four in number. See MAGISTER.

EPISTOLARY, a term uſed in the phraſe epiſtolary ſtyle. As the matter of an epiſtle is the ſame with that of converſation, it ſhould not differ in the manner of expreſſion; and, therefore, all pomp and ſtudy of language are not only needleſs but very improper: the moſt plain and eaſy way of conveying our thoughts muſt certainly be beſt, as being moſt natural. Purity in the choice of words, and juſtneſs of conſtruction, joined with perſpicuity, are the chief properties of this ſtyle: to which purpoſe Cicero obſerves, "that in writing letters we make uſe of common words and expreſſions." (Ad Fam. lib. ix. cap. 21.) And Seneca ſays, "I would have my letters be like my diſcourſes, when we either ſit or walk together, unſtudied and eaſy." (Ep. 75. ad Lucill.)

The firſt and fundamental requiſite in epiſtolary writing is to be natural and ſimple, for a ſtiff and laboured manner is as bad in a letter as in converſation. This does not baniſh ſprightlineſs and wit. Theſe are graceful in letters as well as in converſation; when they flow eaſily, and without being ſtudied; when employed ſo as to ſeaſon, and not to clog. A perſon, who either in converſation or in letters affects to ſhine and ſparkle always, will not pleaſe long. The ſtyle of letters ſhould be neat and correct, but not too highly poliſhed. Nicety about words betrays ſtudy; and on this account muſical periods, and appearances of number and harmony in arrangement, ſhould be carefully avoided in letters. Thoſe that are written with the greateſt facility are commonly the beſt. Nevertheleſs, it ſhould be remembered, that the eaſe and ſimplicity of epiſtolary writing are not to be underſtood as importing entire careleſsneſs. In writing to the moſt intimate friend, a certain degree of attention, both to the ſubject and the ſtyle, is requiſite and becoming. The firſt requiſite both in converſation and correſpondence, is to regard all the proper decorums, which our own character, and that of others demand. An imprudent expreſſion in converſation may be forgotten and paſs away; but with the pen in hand, we ſhould remember the well-known adage, "Litera ſcripta manet."

As the ſubjects of epiſtles are various, they will neceſſarily acquire ſome variety in the manner of expreſſion. If the ſubject be weighty and momentous, the language ſhould be ſtrong and ſolemn; in things of a lower nature, more free and eaſy; and upon lighter matters, jocoſe and pleaſant. In exhortations, it ought to be lively and vigorous; in conſolations, kind and compaſſionate; and in adviſing, grave and ſerious. In narratives, it ſhould be clear and diſtinct; in requeſts, modeſt; in commendations, friendly, without adulation; in proſperity, chearful; and mournful, in adverſity. In a word, the ſtyle ought to be accommodated to the particular nature of the ſubject about which it is converſant. Although there ſhould be nothing very conſiderable in the ſubject; yet if the ſpirit and turn of the correſpondence be agreeable, if the letters be written in a ſprightly manner, and with native grace and eaſe, they may ſtill be entertaining, more eſpecially if there be any thing to intereſt us in the characters of thoſe who write them. As letters from one friend to another make the neareſt approach to converſation, we may expect to ſee more of character diſplayed in theſe than in other productions, which are ſtudied for public view. We are pleaſed with beholding a writer ſo ſituated as to allow him to be at his eaſe, and to give occaſional vent to the overflowings of his heart. Beſides, the different character of the perſon, to whom the letter is written, requires a like difference in the modes of expreſſion. Superiors ſhould be addreſſed with reſpect; inferiors, with courteſy; and equals, with civility. Old men and young, the grave and facetious, courtiers and philoſophers, friends and ſtrangers, require ſome variety in the mode of addreſs. The epiſtles of Cicero, the ſtyle of which is plain and ſimple, and yet pleaſant and engaging, furniſh a proper model in this reſpect. They are the moſt valuable collection of letters in any language, as they are letters of real buſineſs, written to the greateſt men of the age, compoſed with purity and elegance, but without the leaſt affectation; and, what adds greatly to their merit, written without any intention of being publiſhed to the world. Pliny's letters are elegant and polite; and exhibit a very pleaſing and amiable view of the author; but, according to the vulgar phraſe, they ſmell too much of the lamp. They are too elegant and fine: and the author ſeems to be caſting an eye towards the public, when he is appearing to write only to his friends. His ſtyle abounds ſo much with turns and quibbles upon the ſound of words, as to render it more ſtiff and affected than agrees with converſation, or than a man of ſenſe would chooſe to uſe in diſcourſe, if it were in his power. This, indeed, was owing to the age in which he lived, at which time the Roman eloquence was ſunk into puns, and an affectation of wit; for Pliny was otherwiſe a man of fine ſenſe and great learning. We need not here recommend Melmoth's tranſlation of the letters of Cicero and Pliny. The moſt diſtinguiſhed collection of letters in the Engliſh language is that of Mr. Pope, Dean Swift, and their friends; publiſhed partly in Mr. Pope's works, and partly in thoſe of Dean Swift. Many letters in this collection are written with eaſe and a beautiful ſimplicity. Thoſe of Dr. Arbuthnot deſerve this commendation. Dean Swift's are unaffected. Several of lord Bolingbroke's and of biſhop Atterbury's letters are maſterly. Mr. Pope's are too artificial. Among the French in the laſt age, Balzac and Voiture were the two moſt celebrated epiſtolary writers. Balzac's periods are ſwelling, and his ſtyle pompous; ſo that his reputation ſoon declined. Voiture continued for a long time a favourite author. His compoſition is extremely ſparkling; he manifeſts much wit, and trifles agreeably. His only fault is, that he is too open and profeſſed a wit, to be thoroughly agreeable as a letter-writer. The letters of Madam de Sevigné are now eſteemed the moſt accompliſhed model of a familiar correſpondence. Trifling as are their ſubjects, and overloaded as they are with compliments, they ſhew ſuch perpetual ſprightlineſs, they contain ſuch eaſy and varied narration, and ſo many ſtrokes of the moſt lively and beautiful painting, perfectly free from any affectation, that they are juſtly entitled to high praiſe. The letters of lady Mary Wortley Montague poſſeſs much of the French eaſe and vivacity, and retain more the character of agreeable epiſtolary ſtyle, than perhaps any letters which have appeared in the Engliſh language. Ward's Orat. vol. ii. p. 213, &c. Blair's Lect. vol. iii. Lect. 37. See STYLE.

EPISTOLARY is ſometimes alſo applied to authors who have wrote epiſtles or letters. The principal epiſtolary authors are Sidonius Apollinaris, Tully, the younger Pliny, Seneca the philoſopher, Petrarch, Politian, Buſbequius, Eraſmus, Lipſius, Muretus, Aſcham, Milton, Petau, Launci, Sarau, Balzac, Voiture, ſir W. Temple, Lyttelton, &c. &c. See the preceding Article.

EPISTOMIA, in *Anatomy*, are the utmoſt gapings and meetings of veſſels.

EPISTOMIUM, Επιςομιον, from επι, *upon*, and ςομα, *mouth*, in *Hydraulics*, a plug or inſtrument, by the application whereof the orifice of a veſſel may be opened and ſhut again at pleaſure.

EPISTROPHE, Επιϛροφη, in *Rhetoric*, a figure wherein that which is ſuppoſed of one thing is ſtrongly affirmed of another, and the repetition of the ſame word occurs at the end of each member or ſentence:

"Since concord was loſt, friendſhip was loſt, fidelity was loſt, liberty was loſt, all was loſt." Auct. ad Herenn. lib. iv. cap. 13. See alſo 2 Cor. xi. 22.

EPISTROPHEUS, in *Anatomy*, from επι, *upon*, and ϛρεφω, *I turn*, a name given to the ſecond vertebra of the neck, round a particular proceſs of which the firſt vertebra turns. See SPINE.

EPISTYLE, Επιϛυλιον, from επι, *upon*, and ϛυλος, *column*, in the *Ancient Architecture*, a term uſed by the Greeks for what we call architrave, *viz.* a maſſive ſtone, or a piece of wood, laid immediately over the capital of a column.

The epiſtyle is the firſt or loweſt member of the entablature.

EPITAPH, Επιταφιον, from επι, *upon*, and ταφος, *ſepulchre*; a monumental inſcription, in honour or memory of a perſon defunct; or an inſcription engraven or cut on a tomb, to mark the time of a perſon's deceaſe, his name, family, and uſually ſome eloge of his virtues or good qualities.

At Sparta, epitaphs were only allowed to people who died in battle. Boxhornius has made a collection of epitaphs, not very ample, but exceedingly well choſen. F. Labbe has likewiſe given a collection of the like kind in French, intitled, "Treſor des Epitaphes." Camden, Weaver, and Toldervy, have done ſomething in the ſame way with our Engliſh epitaphs.

In epitaphs, the dead perſon is ſometimes introduced by way of proſopopœia, ſpeaking to the living; of which we have a fine inſtance, worthy the Auguſtan age, wherein the dead wife thus beſpeaks her ſurviving huſband.

"Immatura peri: ſed tu, felicior, annos
Vive tuos, conjux optime, vive meos."

The French have a proverb, "Menteur comme une epitaphe: He lies like an epitaph;" an alluſion to the eloges ordinarily contained therein, which are not always over-juſt.

EPITAPH, is alſo applied to certain eloges, either in proſe or in verſe, compoſed without any intent to be engraven on tombs.

The elegance of an epitaph conſiſts in a nervous and expreſſive brevity, and it is ſometimes cloſed with an epigrammatic point. It is obſerved by Dr. Johnſon, in his life of Pope, that the difficulty of writing an epitaph conſiſts, in giving a particular and appropriate praiſe. This, he ſays, is not always to be performed, whatever be the diligence or ability of the writer; for the greater part of mankind have no character at all, or little that diſtinguiſhes them from others equally good or bad; and, therefore, nothing can be ſaid of them, which may not with equal propriety be applied to a thouſand more.

In the Anthologies, or collections of epigrams, we have abundance of epitaphs, ſome of them ludicrous and ſatirical, others grave. For a ſpecimen, we ſhall here add a very beautiful one, compoſed by Mr. Cowley, on himſelf, to be put in a little country-houſe, whither he retreated from the court and town to ſpend his laſt days.

"Hic, O viator, ſub lare parvulo,
Couleius hic eſt conditus, hic jacet
Defunctus humani laboris
Sorte, ſupervacuaque vita;
Non indecora pauperie nitens,
Et non inerti nobilis otio,
Vanoque dilectis popello,
Divitiis, animoſus hoſtis.
Poſſis ut illum dicere mortuum,
En terra jam nunc quantula ſufficit
Exempta ſit curis, viator,
Terra ſit illa levis, precare.
Hinc ſparge flores, ſparge breves roſas;
Nam vita gaudet mortua floribus;
Herbiſque odoratis corona
Vatis adhuc cinerem calentem."

The following epitaphs, beſides many others, are worth recording. That of Alexander:

"Sufficit huic tumulus, cui non ſufficeret orbis."

That of Newton:

"Iſaacum Newton
Quem immortalem
Teſtantur Tempus, Natura, Cœlum,
Mortalem hoc marmor
Fatetur."

That of Dryden:

"Dryden."

Similar to which is that which the Italians have annexed to the tomb of Taſſo:

"Les os du Taſſe."

The following epitaph on the ſiſter of ſir Philip Sidney, the counteſs of Pembroke, and ſaid to be written by the famous Ben Jonſon, is diſtinguiſhed by its admirable concluſion:

"Underneath this noble marble hearſe
Lies the ſubject of all verſe,
Sidney's ſiſter, Pembroke's mother:
Death, ere thou haſt kill'd another
Fair, and learn'd, and good as ſhe,
Time ſhall throw a dart at thee."

The following alſo by the ſame author is well known, and has been much admired:

"Underneath this ſtone doth lie
As much virtue as could die;
Which, when alive, did vigour give
To as much beauty as could live."

Another epitaph, by Dr. Samuel Johnſon, on a celebrated muſician, deſerves to be recorded, as it is equalled by few, and ſurpaſſed by none.

"Philips! whoſe touch harmonious could remove
The pangs of guilty pow'r and hapleſs love,
Reſt here, diſtreſt by poverty no more;
Find here that calm thou gav'ſt ſo oft before;
Sleep undiſturb'd within this peaceful ſhrine,
Till angels wake thee with a note like thine."

The following epitaphs are ſpecimens of the ſatirical or ludicrous kind:

Prior on himſelf, ridiculing the folly of thoſe who value themſelves on their pedigree.

"Nobles and heralds, by your leave,
Here lie the bones of Matthew Prior,
The ſon of Adam and of Eve;
Let Bourbon or Naſſau go higher."

On a Miſer.

" Reader, beware of immod'rate love of pelf;
Here lies the worſt of thieves, who robb'd himſelf."

A ſimilar epitaph by Dr. Swift.

" Beneath this verdant hillock lies
Damer, the wealthy and the wiſe.
His heirs, that he might ſafely reſt,
Have put his carcaſe in a cheſt;
The very cheſt, in which, they ſay,
His other ſelf, his money, lay.
And if his heirs continue kind
To that dear ſelf he left behind,
I dare believe that four in five
Will think his better half alive."

We ſhall here ſubjoin the epitaph of the ingenious and laborious author of the Cyclopædia, from his tomb in the cloiſters of Weſtminſter Abbey, on the north ſide, written by himſelf:

" Multis pervulgatus,
Paucis notus;
Qui vitam inter lucem et umbram,
Nec eruditus, nec idiota,
Literis deditus tranſegit; ſed ut homo
Qui humana nihil a ſe alienum putat,
Vita ſimul et laboribus functus,
Hic requieſcere voluit
Ephraim Chambers,
R. S. S.
Obiit 15 Maij, 1740."

In Engliſh thus:

" Heard of by many,
Known to few;
Who led a life between fame and obſcurity;
Neither abounding nor deficient in learning;
Devoted to ſtudy; but as a man
Who thinks himſelf bound to all offices of humanity;
Having finiſhed his life and labour together,
Here deſires to reſt.
Ephraim Chambers."

We ſhall cloſe this article with ſome pertinent remarks on epitaphs, by an anonymous writer in the " Olla Podrida." The peruſal of epitaphs is not to be conſidered as a light and frivolous amuſement. If ſuch only be the object of attention, as have been noticed with our applauſe, it is unqueſtionably an introduction to pleaſing knowledge, and an incentive to moral improvement. What biography is to hiſtory, an epitaph is to biography. It is a ſketch which marks the great outlines of character, and excites curioſity to view the portraits as painted in the pages of hiſtory. It is likewiſe an epitome of a ſermon, which teaches the moſt uſeful truths in the moſt comprehenſive form. Monumental inſcriptions remind us, that time is on the wing, that every rank and age muſt fall a prey to his depredations; that the moments of life are too precious to be ſquandered away on trifles; that religion is the only ſupport againſt the horrors of death, and the only guide to the joys of eternity.

EPITASIS, formed of επιτεινω, *intendo*, *I heighten*, in the *Ancient Poetry*, denoted the ſecond part or diviſion of a dramatic poem, wherein the plot or action propoſed and entered upon in the firſt part or protaſis was carried on, heightened, warmed, and worked up, till it arrives at its ſtate or height called the cataſtaſis.

This diviſion is laid aſide in the modern drama; in lieu whereof our plays are divided into acts. See Act.

The epitaſis might ordinarily take up about our ſecond or third act.

Epitasis, in *Medicine*, denotes the increaſe or growth and heightening of a diſeaſe; or the beginning of a paroxyſm, particularly in a fever.

EPITHALAMIUM, Επιθαλαμιον, formed of επι, and θαλαμος, *bride-chamber*, in *Poetry*, a nuptial-ſong, or a compoſition, uſually in verſe, on occaſion of a marriage between two perſons of eminence.

The topics it chiefly inſiſts on are the praiſes of matrimony, and of the married couple, with the pomp and order of the marriage ſolemnity: it concludes with prayers to the gods for their proſperity, their happy offſpring, &c. This kind of poetry is very ancient: the 44th Pſalm, and the book of Canticles have been conſidered as ſpecimens of the epithalamium. Steſichorus, who flouriſhed in the forty-ſecond Olympiad, has been uſually eſteemed the inventor of the epithalamium among the Greeks, though it is known that Heſiod compoſed the epithalamium of Thetis and Peleus, a work now loſt; but a fragment of which is preſerved by an ancient ſcholiaſt. Catullus exceeded all antiquity in his epithalamiums, and the cavalier Marino all the moderns.

Among the Greeks, the epithalamium was ſung by young men and maids at the door of the bed-chamber of the married pair in the evening and morning. The former ſort were called επιθαλαμια κοιμητικα, and the latter εγερτικα.

EPITHEM, Epithema, from επι, *upon*, and τιθημι, *pono*, *I put*, in *Pharmacy*, a kind of fomentation or remedy, of a ſpirituous or aromatic kind, applied externally to the regions of the heart, liver, &c. to ſtrengthen and comfort the ſame, or to correct ſome intemperature thereof.

There are principally three kinds of theſe external applications, the liquid, the ſolid, and the ſoft or poultice kind. See Cataplasm and Fomentation.

Epithem, *Volatile*, *epithema volatile*, a form of medicine preſcribed in the late London Pharmacopœia, and ordered to be made of equal weights of common turpentine and ſpirit of ſal armoniac. The turpentine is to be kept continually ſtirring in a mortar, and the ſpirit gradually dropt in till the whole is reduced to a white maſs.

The ſpirit of ſal armoniac uſed in this mixture muſt not be that made in the common way, with the addition of quick-lime, but with the alkali ſalt. Pemberton's Lond. Diſp. p. 377.

EPITHE'SIS, from επι and τιθημι, *to lay upon*, an old term in *Surgery*, the meaning of which was the ſtraightening of deformed limbs by mechanical contrivances.

EPITHET, Επιθετον, a noun adjective, expreſſing ſome quality of a ſubſtantive to which it is joined.

The word is formed of επι, *upon*, and θεσις, *poſitio*, *putting*. As a fruitful vine, a ſtately pile, an echoing vault, &c.

Epithets are of great uſe and conveniency among poets and orators, who ſupply in epithets what they want in other requiſites. Card. Perron even blames Homer on the head of epithets, obſerving, that he frequently hooks in epithets without any ſenſe or ſignificancy at all, to help out his meaſures; and that he equips every hero with an epithet, not according to the exigence of the caſe, but the meaſure of the verſe.

Epithet, is alſo uſed for a ſurname, or a perſon's ſecond appellation.

Epithets were anciently beſtowed very frankly, either on account of excellencies or defects of the body or mind; kings themſelves were not exempted from them. Hence theſe thoſe epithets ſo frequent in hiſtory, as Edward Longſhanks, Richard Cœur de Leon, Edmund Iron-ſide, Richard Crook-back, John Lack-land, &c.

Nor have the French uſed their kings any better; witneſs their Charles the Simple, Louis the Lazy, faineant (Ludovicus nihil faciens) Pepin the Short, Louis the Stammerer, le begue.

EPITHRICADIA, in *Antiquity*, a feſtival in honour of Apollo.

EPITHYME. See Dodder, and Epitheos.

EPITOME, an abridgment, or a reduction of the principal matters of a larger book into a little compaſs. See Abridgment.

The word is Greek, επιτομη, formed of επιτεμνειν, *reſecare, to retrench, abridge,* or *cut off.*

The epitome of Baronius's Annals is done by De Sponde (Spondanus). Bernier has given an epitome of the philoſophy of Gaſſendus.

It is a popular objection againſt the epitomizing of authors, that it frequently occaſions the loſs of the originals. Thus the loſs of the hiſtorian Trogus Pompeius is attributed to his epitomizer Juſtin, and the loſs of a great part of Livy to Luc. Florus. See Livy.

"Epitomes," ſays the learned Bacon, "are the moths and corruptions of hiſtory, that have fretted and corroded the ſound bodies of many excellent hiſtories, and wrought them into baſe and unprofitable dregs."

EPITRITES, from επι, and τριτος, *third,* in *Proſody,* a foot conſiſting of four ſyllables, three long, and one ſhort.

Grammarians reckon four ſpecies of epitrites; the firſt, conſiſting of an iambus and ſpondee, as ſălūtāntēs; the ſecond, of a trochee and ſpondee, as cōncĭtātī; the third, of a ſpondee and an iambus, as cōmmūnĭcāns; and the fourth, of a ſpondee and trochee, as īncāntārĕ.

Epitrites, among the *Greek Muſicians,* denoted a ratio, called alſo the ſeſquitertial ratio, the ſame with that of three to four. See Fourth.

EPITROCHASMUS, in *Rhetoric,* a figure wherein we ſlightly paſs over ſeveral things of great moment, by only mentioning them in general. Such is the ſaying of Cæſar, *Veni, vidi, vici.*

EPITROPE. See Concession. This is one of the figures of ſentences, which grants one thing to obtain another more advantageous. It is either real or feigned; and either the whole of a thing, or only a part is granted. Nothing more confounds an adverſary, than to grant him his whole argument, and at the ſame time either to ſhew that it is nothing to the purpoſe, or to offer ſomething elſe, which may invalidate it. Of the uſe of this figure we have examples in Cicero's defence of Ligarius, who was accuſed by Tubero for having joined with Pompey in the civil war between him and Cæſar, (cap. 1.); and in the affair of Roſcius, where the proof depended upon circumſtances; and when Cicero, who defended him, inquires what reaſon could be alledged for his committing ſo black a crime, as to kill his father, (cap. 27.) Cicero has alſo given us an example of a feigned or ironical conceſſion in his defence of Flaccus (cap. 38.); when interceding for him on account of his former good ſervices, in the time of Catiline's conſpiracy, he ſays in the way of irony, if ſuch things are to be overlooked, "let us appeaſe the ghoſts of Lentulus and Cethegus; let us recall thoſe who are in exile, and let us be puniſhed for our too great affection and love for our country." To theſe feigned conceſſions we may refer ſuch modes of reaſoning, by which the orator both juſtifies a charge brought againſt him, upon the ſuppoſition of its being true; and alſo proves that the charge itſelf is falſe. Thus Cicero, in his defence of Milo, repreſents the taking off of Clodius, with which Milo was accuſed, as a glorious action; after he has ſhewn that Milo's ſervants did it without the knowledge of their maſter. (Cap. 10. and 27.)

EPITROPUS, a kind of judge, or rather an arbitrator, which the Greek Chriſtians under the dominion of the Turks elect in the ſeveral cities, to terminate the differences that ariſe among them, and avoid carrying them before the Turkiſh magiſtrates. See Arbitrator.

There are ſeveral epitropi in each city. M. Spon, in his Travels, obſerves, that at Athens there are eight taken out of the ſeveral pariſhes, and called vecchiardi, *i. e.* old men. But Athens is not the only place where there are epitropi; they are in all the iſlands of the Archipelago.

Some Latin authors of the ſixth century call epitropi thoſe who more anciently were called villici, and ſince vidames.

In times ſtill earlier, the Greeks uſed the term επιτροπος, in the ſame ſenſe as the Latins did *procurator, viz.* for a commiſſioner or intendant.

Thus the commiſſioners of proviſions in the Perſian army are called by Herodotus and Xenophon epitropi. In the New Teſtament, επιτροπος denotes the ſteward of a houſehold, rendered in the vulgate procurator.

EPIZEUXIS, in *Rhetoric,* a figure where the ſame word is repeated with vehemence in the ſame ſenſe, without any others intervening, and ſuited to expreſs anger, ſurpriſe, ſorrow, and ſeveral other paſſions: thus *age, age; adeſte, adeſte;* and that of Virgil, *nunc, nunc inſurgite remis,* are inſtances of it. Thus alſo, when Cicero would expreſs his indignation againſt Antony for having been the chief inſtrument in bringing on the civil war, he ſays to him: "You, you, Antony, puſhed Cæſar upon the civil war." (Philip. ii. c. 22.) Thus he tells Catiline in his firſt invective againſt him; "You live, and live, not to lay aſide, but to purſue your wicked deſign." (Ibid. cap. 2.) See Matthew xxiii. 37. The uſe of this figure ſhews the earneſtneſs of the ſpeaker and the great concern of his mind about what he ſays, and has a natural tendency to excite the attention of the audience.

EPIZOOTIC Strata, or *Mountains,* in *Geology,* are ſuch as contain remains of animals, which a very large portion of all thoſe upon the ſurface of the earth ſeem to do, although their reliquiæ are by no means equally numerous in all ſtrata, probably owing to their not being preſerved in every inſtance, ſo that their remains or impreſſions can be now traced.

EPIZOOTY, a denomination given to an epidemical or contagious diſtemper among horned cattle. M. de Saive, apothecary to the prince biſhop of Liege, has given the following inſtructions for the prevention and cure of this diſorder. As ſoon as any ſymptoms of the diſtemper are perceived, about $1\frac{1}{2}$ pint of blood ſhould be taken from the beaſt, unleſs he has been ill a day or two, in which caſe he ſhould not be blooded; but in both caſes the following draught ſhould be given, *viz.* N° 1. an ounce of the beſt Venice treacle diſſolved in a pint of vinegar, after which the back-bone and the whole hide muſt be well rubbed with a dry hair cloth, to heat the hide and promote perſpiration. No drink ſhould be given him but a white drink compoſed of (N°. 2.) a handful or two of rye-meal in a pailful of clean water; and if the beaſt ſhould want food, mix up ſome crumbs of rye bread with ſome of this white drink, and give it him. The animal's mouth muſt be waſhed twice a day with a cloth dipped in a mixture of (N°. 3.) equal quantity of vinegar and water, with a ſpoonful of honey to a pint of it. If on the ſecond day the beaſt has not dunged, a clyſter compoſed of (N°. 4.) a pint of water in which bran has been boiled, two ſpoonfuls of ſalt, and a ſmall glaſs of vinegar muſt be given and repeated every day till the evacuations are natural and regular. Beſides the above remedies, the following cordial mixture (N°. 5.) *viz.* a pint of clear water, the ſame quantity of vinegar, four ſpoonfuls of honey or ſyrup, and two glaſſes of brandy, muſt be given four times a day to facilitate and keep up perſpiration; taking particular care to repeat the friction as above directed. If the beaſt ſhould ſtill continue low and heavy, the draught (N°. 1.) muſt be repeated, unleſs he ſhould be found to be hot and thirſty, in which caſe only the drink (N°. 2.) ſhould be uſed. On the fourth day, if he ſeems more lively and free from heat, purge him with (N°. 6.); two ounces of ſalts and one ounce of common ſalt, diſſolved in a pint of lukewarm water, with two ſpoonfuls of honey. If this does not procure four or five evacuations, repeat the clyſter the ſame day.

This mode of treatment muſt be continued without intermiſſion till the beaſt begins to eat; then he muſt have only the white drink (N° 2) and a little good fodder, or ſome rye-bread dipped in ſtale-beer, moderately ſweetened with honey or ſyrup. The exterior treatment conſiſts in the application of ſetons in the beginning of the diſtemper, at the bottom of the dewlap, and of cauteries towards the horns, between which ſome weight, *e.g.* a ſtone of a pound weight or more, wrapped up in a cloth, muſt be fixed in order to keep it ſteady. This is neceſſary to keep the head warm. But above all, the friction muſt be carefully attended to, for determining the critical efforts of nature. It would be proper alſo to evaporate vinegar in the cow-houſe, &c. and if it could be done without riſk, blowing of a few grains of gunpowder in them twice a day would be a very uſeful fumigation. If, notwithſtanding theſe aids, the beaſt be not perfectly cured in ten or twelve days, they muſt be continued without bleeding, unleſs the inflammation be very conſiderable; but if, after all, the diſtemper does not give way, the beaſt muſt be killed, buried very deep, and well covered with earth and turf, for the purpoſe of preventing the exhalation of the putrid vapours and the ſpread of the infection. The principal preſervatives from infection conſiſt in waſhing the racks, troughs, &c. and the hide of the beaſt every day, with plenty of water; and inſtead of expenſive aromatic fumigations ſometimes recommended, the uſe of fires made with the branches of green wood, with pitch thrown on it to quicken the flames and perfume the air. Common ſalt given in ſmall quantities every day to horned cattle, is reckoned an excellent preſervative, particularly in a learned diſſertation on the contagious diſtempers among horned cattle, by M. de Limborg, M.D. F.R.S. Letters, &c. on Agriculture of the Bath, &c. Society, vol. i.

EPLOYE', in *Heraldry*. An eagle eployé is what in Engliſh we more uſually call an eagle diſplayed, or a ſpread eagle. See Displayed.

EPNEUMATOSIS, from πνευματοω, *I breathe*, in *Medicine*, the ſame with expiration.

EPOBOLIA, in *Antiquity*, a fine laid upon thoſe that could not prove the indictment they had brought againſt their adverſaries.

It was ſo called, becauſe they were obliged to pay the ſixth part of the value of the thing they contended for, *viz.* an obolus out of every drachm. Some of theſe ſums were depoſited in all law-ſuits, a very few excepted, before the trial could proceed. Potter. Archæol. Græc. lib. i. cap. 21. tom. i. p. 117.

EPOCH, in *Aſtronomy*, is the mean longitude of a planet for the commencement of a given year. It is one of the principal elements of the elliptic motion. (See Element and Elliptic *Motion.*) When two obſervations of a planet are made in the mean diſtances, that is, at three and nine ſigns of mean anomaly, it is then practicable to correct, by two ſuch obſervations, both the epoch and equation of the centre. If the latter is exact, there will be no other difference between the calculation and obſervation than the epoch of the mean motion, ſince the place of the aphelion does not influence the longitudes taken at the mean diſtances; the error will, therefore, be equal in the two obſervations, for we ſuppoſe the mean motion known exactly. Thus, if the errors of the tables are found equal at three and nine ſigns of anomaly, it is a proof that the equation of the centre is exact, and that the error lies wholly in the epoch being improperly aſſumed.

EPOCHA, in *Chronology*, a term or fixed point of time, whence the ſucceeding years are numbered or accounted.

The word is εποχη, q. d. *inhibitio, repreſſio*, formed of επεχειν, *to ſuſtain, ſtop*, becauſe the epocha defines or limits a certain ſpace of time. For the difference between epocha and era; ſee Æra.

Different epochas obtain in different nations; and no wonder; for there being no aſtronomical conſideration to render one preferable to another, their conſtitution is purely arbitrary. That principally regarded among Chriſtians is, the epocha of the Nativity or Incarnation of Jeſus Chriſt; that of the Mahometans, the Hegira; that of the Jews, &c. the Creation of the World; that of the ancient Greeks, the Olympiads: that of the Romans, the Building of the City; that of the ancient Perſians and Aſſyrians, the epocha of Nabonaſſar, &c.

The doctrine and uſe of epochas are of very great extent in chronology.

To reduce the years of one epocha to thoſe of another, *i. e.* to find what year of one correſponds to a given year of another; a period of years has been invented, which, commencing before all the known epochas, is, as it were, a common receptacle of them all, called the Julian period. To this period all the epochas are reduced, *i. e.* the year of this period whereon each epocha commences is determined. All that remains, therefore, is, to add the given year of one epocha to the year of the period correſponding with its riſe; and from the ſame to ſubtract the year of the ſame period correſponding to the other epocha; the remainder is the year of that other epocha.

Epocha *of Chriſt*, or *of our Lord*, is the vulgar epocha throughout Europe, commencing from the ſuppoſed time of our Saviour's nativity, December 25, or rather according to the uſual account, from his circumciſion, that is, from the firſt of January.

Now, the year of the Julian period, wherein Chriſt was born and circumciſed, is uſually computed to be the 4713th; conſequently, the firſt year of the era of Chriſt correſponds to the year 4714 of the Julian period.

Hence, 1. If to any given year of Chriſt you add 4713, the ſum will be the year of the Julian period correſponding thereto, *E. gr.* If to the year 1809 be added 4713, the ſum 6522 is that year of the Julian period.

2. On the contrary, ſubtracting 4713 from any given year of the Julian period, the remainder is the current year of Chriſt. *E. gr.* from the year of the Julian period 6522, ſubtracting 4713, the remainder is the year of Chriſt 1809.

In effect, the epocha of our Lord ſerves not only for the computation of the years elapſed ſince the epocha commenced, but even of thoſe before it.

Now, to find the year of the Julian period correſponding to a given year before Chriſt, ſubtract the given year from 4713, the remainder is the correſpondent year required. Thus, *e. gr.* the year before Chriſt 752, is the year 3961 of the Julian period. On the contrary, ſubtracting the year of the Julian period from 4713, the remainder is the year before Chriſt.

The author of the vulgar epocha, or way of computing from Chriſt, is an abbot of Rome, one DIONYSIUS *Exiguus*, (which ſee,) by nation a Scythian, who flouriſhed under Juſtinian about the year 507, or, according to others, 527, though this Dionyſius borrowed the hint from Panodorus, an Egyptian monk. Till his time, the generality of Chriſtians computed their years either from the building of Rome, or according to the order of the emperors and conſuls, and by other ways in uſe with the people among whom they lived.

This diverſity occaſioning a great diſtraction between the churches of the Eaſt and Weſt; Dionyſius, to compoſe the ſame, firſt propoſed a new form of the year, with a new general era, which in a few years time was generally admitted.

Dionyſius began his account from the conception or incarnation, by us popularly called Lady-day, or the Annunciation; which method obtained in the dominions of Great Britain till the year 1752, before which time the Dionyſian and Engliſh epocha was the ſame; but in that year the Gregorian calendar having been admitted by act of parliament, they now reckon from the firſt of January, as they do in the other countries of Europe, except in the court of Rome, where the epocha of the incarnation ſtill obtains for the date of their bulls.

It muſt be added, that this epocha of Dionyſius is charged with a miſtake: the common opinion is, that it places our Saviour's nativity a year too late; or that he was born the winter preceding the time preſcribed by Dionyſius for his conception.

But the truth is, the fault lies on Bede, who miſinterpreted Dionyſius, and whoſe interpretation we follow, as has been ſhewn by Petavius from Dionyſius's own epiſtles; for Dionyſius began his cycle from the year 4712, but his epocha from the year 4713, wherein the vulgar era ſuppoſes Chriſt to have been incarnate.

The year, therefore, which, according to the vulgar epocha, is the firſt year of Chriſt, according to Dionyſius's era is the ſecond; ſo that the year which we call 1809, ſhould, in juſtice, be 1810, though ſome chronologers, inſtead of one year, will have the error two.

Others ſuppoſe that the Dionyſian era is four years too late; which ſuppoſition is confirmed by conſidering that our Saviour was born before the death of Herod the Great; and during the reign of Auguſtus (Matth. ii. 1. 22. Luke, ii. 1.) and according to the teſtimony of Joſephus, (lib. xvii. cap. 18.) there was an eclipſe of the moon in the time of Herod's laſt illneſs; which eclipſe appears to have happened in the year of the Julian period 4710, March 13, at Jeruſalem. Now, as our Saviour muſt have been born ſome months before Herod's death, ſince in the interval he was carried into Egypt, the lateſt time in which we can fix the true era of his birth is about the end of the 4709th year of the Julian period.

In order to aſcertain the true year of our Saviour's birth, it is neceſſary to fix the preciſe time of Herod's death. The chief opinions concerning the time of this event are three. Some think he died a little before the paſſover of A. U. 750, Julian year 42; others on Nov. 25 in that year: and others, a ſhort time before the paſſover A. U. 751. We learn from Joſephus, (De Bell. lib. ii. c. 1. Antiq. l. xvii. c. 9.) whoſe authority we cannot reject in deciding this queſtion, that Herod died but a ſhort time before one of the Jewiſh paſſovers. That Herod died a ſhort time before the paſſover A. U. 750, Julian year 42, is argued in this manner. His diſtemper had made great progreſs before the pulling down of the golden eagle at the temple. The Jewiſh rabbies excited their ſcholars to this action. News being brought that Herod was *dying* (Joſ. de Bell. l. i. c. 33. § 1.) or *dead* (Joſ. Ant. l. xvii. c. 6. § 3.) theſe rabbies were taken up and carried to Jericho, where Herod was, in a very infirm ſtate, and where they were tried and burnt to death. On that very night there was an eclipſe of the moon, which, as we have already mentioned, happened March 13th A. U. 750. From this time Herod grew worſe and worſe; ſo that he could not live long. The paſſover of this year happened on the 11th of April; and the interval between the 13th of March and 11th of April would have been ſufficient for every thing that Joſephus has related concerning Herod's illneſs; the ſettling of his affairs, the execution of Antipater, Herod's death and funeral, which are the occurrences between the eclipſe and Archelaus's coming to Jeruſalem at the paſſover.

Beſides, from circumſtances related by Joſephus concerning Archelaus, one would be apt to conclude, that he reigned nine years complete, and that the 10th year was current when he was baniſhed. Dio (l. lv. p. 567.) places Archelaus's baniſhment in the 759th year of Rome. If Herod did not die, as ſome imagine, till the beginning of A. U. 751, the 9th year of Archelaus's reign could not be completed in the 759th year of Rome. But if Herod be ſuppoſed to have died in the beginning of A. U. 760, Joſephus and Dio agree. Moreover, Joſephus ſays, that Cyrenius ſeized Archelaus's eſtate, and finiſhed the aſſeſſment in Judea in the 37th year after the defeat of Antony at Actium by Cæſar Auguſtus. The victory at Actium was obtained Sept. 2, A. U. 723; therefore the 37th year from it begins Sept. 2, A. U. 759, and ends Sept. 2, 760. Suppoſing then that Herod died in the beginning of A. U. 750, there is in this particular alſo a very good harmony between Joſephus and Dio. Beſides, Joſephus informs us (Ant. l. xiv. c. 29.) that Herod was appointed king by the Roman ſenate A. U. 714. *i. e.* 40 years before the vulgar era. The ſame hiſtorian obſerves, that he died in the 37th year of this reign, and 34th after the death of Antigonus, *viz.* in the 42d Julian year (Antiq. l. xvii. 10.) If to 713 we add 37, the ſum will be 750, the year of Rome in which this prince died.

The opinion, adopted by other learned men, that Herod died a ſhort time before the paſſover A. U. 751, labours under ſeveral great difficulties, which are pointed out by Dr. Lardner (ubi infra). Upon the whole it appears, that Herod did not die before the year 750, nor ſurvive the year 751, and that he died a ſhort time before the Jewiſh paſſover of one of theſe years. It follows, that if Herod died in 750, he died three years and nine months before the vulgar Chriſtian era, which commences January 1, A. U. 754; if at the time above-mentioned, in the year 751, then he died about two years and nine months before the ſaid era. "Which is the truth," ſays Dr. Lardner, with his uſual diffidence and modeſty, "I am not able to determine." Accordingly he ſays, that "if Herod died in March A. U. 750, I ſhould be inclined to place the nativity of Jeſus in September or October, A. U. 748; if Herod died in March 751, then the nativity of Jeſus might very well be placed in September or October 749." The birth of Jeſus muſt be dated about a year and five or ſix months before the death of Herod, *i. e.* before the latter end of the year of Rome 748 or 749, *i. e.* 4708 or 4709 of the Julian period; but for reaſons already aſſigned, the latter date is the moſt probable.

We ſhall here add, that an objection has been urged againſt the 15th year of the reign of Tiberius, compared with the age of Jeſus at his baptiſm. (Luke, iii. 1, 2. 23.) If Jeſus, it is ſaid, was born above a year, much more, if above two years before Herod's death, then the age of 30 years, here aſcribed to him at his baptiſm, is abſolutely inconſiſtent with the notes of time mentioned at the commencement of John the Baptiſt's miniſtry; even allowing, that *the word of God came to John* in the very beginning of the *15th year of Tiberius*, and that Jeſus was baptized a few months after. Dr. Lardner obſerves, that the true meaning of theſe words, *Jeſus himſelf began to be about 30 years of age*, is not that he then *entered* the 30th year of his age, but that Jeſus was about 30 years of age when he began his miniſtry. This, he ſays, is now the general opinion of learned men; ſo the Greek word of this text is uſed by St. Luke in other places. The objection is thus ſtated: Auguſtus died, and Tiberius ſucceeded him the 19th of Auguſt, A. U. 767, Julian year 59, A. D. 14. Therefore the 15th of Tiberius began the 19th Aug. A. U. 781, A. D. 28. Herod died before the paſſover, in A. U. 751, Jul. year 43. If then John the Baptiſt began to preach in the beginning of the 15th of Tiberius, in the latter end of A. U. 781, and Jeſus be ſuppoſed to have been baptized by John a few months after, on the 6th of January of the year following, *viz.* A. U. 782, Jeſus muſt have been in the 32d year of his life, if Herod died in the ſpring, *viz.* A. U. 751, and if Jeſus was born the 25th of December preceding, *viz.* A. U. 750. But if Herod died A. U. 750, and Jeſus was born the 25th December before, *viz.* A. U. 749, then he would be at his baptiſm in the 33d year of his age. But it may be made to appear in ſeveral ways, that Jeſus was born above a year, probably above two years before Herod died. Dr. Lardner has ſtated this objection in its full force; and detailed ſeveral circumſtances that tend to obviate it. From ſome of them he infers, that there is no neceſſity of placing the birth of Jeſus above a year and ſix months before the death of Herod, as we have already ſtated. As it is moſt probable that Herod died A. U. 750, we may be diſpoſed, from other circumſtances alleged by this accurate and impartial writer, to place the nativity of Jeſus in September or October A. U. 748. The latter part of the ſummer, or the autumn ſeaſon, ſeems to be the moſt likely time of the year for the birth of Jeſus; nor is there any particular reaſon that ſhould determine us to the 25th of December. The very depth of winter was not a very proper ſeaſon for a ſurvey and aſſeſſment, when people are to enter themſelves according to their tribes or families; the autumn, when harveſt and vintage are over, would be a time of general leiſure. When Jeſus was born in Bethlehem, *there were in the ſame country ſhepherds abiding in the field, keeping watch over their flocks by night*, (Luke, ii. 8.) This circumſtance is not very favourable to the ſuppoſition, that Jeſus was born the 25th of December; and we are at liberty to place it in autumn, a more likely ſeaſon. (See CHRISTMAS.) It is not improbable then, that Jeſus might be born ſome time between the middle of Auguſt and the middle of November. Cyrenius, we may ſuppoſe, came into Judea at the time, or ſoon after the time, that Varus became governor of Syria (before Sept. A. U. 748), and publiſhed the decree of Auguſtus, requiring all people to enter themſelves, their dependents, and eſtates. This aſſeſſment could well be made in a country of ſuch ſmall extent as Judea in two or three months; and the ſhort time appointed for this work may be inferred from the peculiar circumſtances of Cyrenius, who wiſhed to haſten back to Rome, and alſo from St. Luke's hiſtory of it. Upon the whole, we may conclude, that about a year and ſix or ſeven months before the death of Herod, ſoon after the arrival of Varus in the province of Syria, in Auguſt or September A. U. 748 or 749, Julian year 40 or 41, Cyrenius (or ſome other perſon of eminence) came into Judea, an aſſeſſment was made there, and in the time of it, Jeſus was born at Bethlehem, in the month of September or October. In order, however, to ſettle ſatisfactorily the *15th year of the reign of Tiberius*, we ſhould conſider that the commencement of his reign may be computed from a different period than that of his ſole empire, after the death of Auguſtus. In fact, it appears, that there were two different dates of the beginning of Tiberius's reign; one from the time of his being made colleague with Auguſtus, and the other from his ſole empire, after the death of Auguſtus. Many learned writers are of opinion, that St. Luke intends the former of theſe two computations, referring to a period two years before the death of Auguſtus, *viz.* in A. U. 765, when Piſo was præfect of Rome, Tiberius being prince. Archbiſhop Uſher and Prideaux place the beginning of this government of Tiberius in this year. This epoch of Tiberius's empire was followed for ſome time by ſome perſons, in the provinces at leaſt; but it is not ſo certain, when this pro-conſular empire began, whether about two years, or about three years before Auguſtus died. If Tiberius's proconſular empire began about three years before Auguſtus died, on the 28th of Auguſt A. U. 764, A. D. 11, then this 15th of Tiberius's reign (according to this computation of it) began Auguſt 28th, A. U. 778, A. D. 25. Suppoſing that John the Baptiſt began his miniſtry November following, in the ſame year, and that Jeſus was baptized by him the 6th of Jan. following, in A. U. 779, A. D. 26; then upon the ſuppoſition that Jeſus was born in Sept. A. U. 748, he would be at his baptiſm 30 years of age, and ſome months more. If Tiberius's proconſular empire commenced about two years before the death of Auguſtus, in A. U. 765, A. D. 12, then the 15th year of the reign of Tiberius began in A. U. 779, A. D. 26. And ſuppoſing that John the Baptiſt began his miniſtry in November of that year, and that Jeſus was baptized by him the 6th of January following, A. U. 780, A. D. 27, then, upon the ſuppoſition that Jeſus was born in September, A. U. 749, he would be at the time of his baptiſm 30 years of age, and ſome months more; or, if born A. U. 748, he would be ſomewhat more than 31 years of age. Again, if John the Baptiſt began his miniſtry in the 15th of Tiberius, A. U. 778, A. D. 25, according to the firſt ſtatement, but did not baptize Jeſus till the 6th of January, A. U. 780, A. D. 27, after he had preached ſomewhat above a year, then Jeſus would be at his baptiſm 30 years of age and odd months, if he was born A. U. 749; 31 years of age and ſome odd months, if born the latter end of the year 748. Such will be the reſult, if we take thoſe dates of theſe events, which appear moſt favourable to St. Luke; ſince it is not abſolutely certain when Herod died, or when Tiberius's proconſular empire began. But if we allow on each hand the dates leaſt favourable to St. Luke's numbers, *viz.* that Jeſus was born A. U. 748, and that he was not baptized till January A. U. 780, A. D. 27; yet even then Jeſus would be little more than 31 years of age; at which time a perſon may be ſaid very properly to be ABOUT *thirty years of age.*

The queſtion of our Lord's nativity and age at his baptiſm is amply diſcuſſed, and the difficulties which it involves accurately and impartially examined, by Dr. Lardner in his "Credibility, &c." See his Works, vol. i. See alſo Playfair's Syſtem of Chronology, p. 49, &c.

Learned men have differed in opinion concerning the preciſe time of the death of Chriſt. Some have referred this event to the 29th year of the vulgar era; others to the 31ſt; and not a few to the 33d. Playfair (with whom Blair agrees) inclines to adopt the laſt of theſe dates, for the following reaſons. 1. There is no other year beſides the 33d of the vulgar era, 78th Julian year, 4746th of the Julian period, A. U. 786, to which this event can be properly referred; for Jeſus Chriſt went to eat the paſſover with his diſciples on the evening of the 14th of the firſt month, and was crucified on the day following, *viz.* on Friday, April 3d, the 16th day of the paſchal moon, according to the true, and the 15th, according to the Jewiſh computation. 2. The 70 weeks of Daniel, which began in the 20th year of Artaxerxes Longimanus, and ended in J. P. 4746, when Meſſiah was cut off. 3. Phlegon, the freedman of Adrian, and eſteemed as an exact computer of the Olympiads, obſerved "that in the 4th year of the 202d Olympiad, there was a miraculous darkneſs; for at the ſixth hour of the day came on night, inſomuch that the ſtars of heaven were ſeen. At the ſame time, there was alſo a great earthquake in Bithynia, which threw down part of the city of Nice." (Compare this account with Matth. xxvii. 45. and Luke, xxiii. 45.) The 4th year of the 202d Olympiad anſwers to the firſt ſix months of the 33d year of our vulgar era, and to the 19th of the reign of Tiberius. Concerning the teſtimony of Phlegon; ſee PHLEGON. 4. When Chriſt ſuffered, Pontius Pilate was governor of Paleſtine (Tacit. l. xv. Joſeph. Antiq. l. xviii. c. 5.); Herod Antipas was tetrarch of Galilee (Luke, xxiii. 6. Joſeph. Antiq. l. xix. c. 7.); and Caiaphas was high-prieſt among the Jews (John, xi. 49. Luke, iii. 2. and Acts, iv. 6.) (See CAIAPHAS.) From theſe and other characters it appears, ſays Playfair, that Jeſus Chriſt lived about 36 years, 3 months, 9 days, and 15 hours, if we reckon (according to the generally received opinion concerning the month and day of his nativity) from midnight of December 25th, of the 42d Julian year commencing, to April 3d and 3 in the afternoon, of the 78th Julian year. His reſurrection took place on Sunday April 5th, and his aſcenſion on Thurſday May 14th.

To the vulgar era of our Lord's nativity, as a ſure fixed point, chronologers have been accuſtomed to reduce all the other epochas, though there is not one of them but what is controverted; ſo much uncertainty there is in the doctrine of time. We ſhall exhibit them as reduced to the Julian period.

EPOCHA *of the Creation, Orbis Conditi,* according to the computation of the Jews, called alſo the Jewiſh epocha, is the year of the Julian period 953, anſwering to the year before Chriſt 3761, and commencing on the ſeventh day of October. Hence ſubtracting 952 years from any given year of the Julian period, the remainder is the year of the Jewiſh epocha correſponding to it. Thus, *e. gr.* the year 1809 being the 6522d year of the Julian period, it is the 5570th year of the Jewiſh epocha, or ſince the creation of the world.

This epocha is ſtill in uſe among the Jews.

The EPOCHA *of the Creation,* uſed by the Greek hiſtorians, is the year before the Julian period, 787, anſwering to the year before Chriſt 5500.

Hence, to any given year of the Julian period, adding 787, the ſum gives the year of this epocha. *E. gr.* 1809 being the 6522d year of the Julian period, 7309 is that year of this epocha, or the year of the world, according to this computation.

The author of this epocha is Julius Africanus, who collected it from the hiſtorians: but when it came to be admitted into civil uſe, 8 years were added to it, that ſo every year thereof divided by 15 might exhibit the indiction, which the eaſtern emperors uſed in their charters and diplomas.

The epocha of the creation uſed by the latter Greeks and Ruſſians is the year 795 before the Julian period, or the year 5508 before Chriſt, commencing from the firſt day of September. Though the Ruſſians, having lately admitted the Julian calendar, begin their year from the firſt of January.

Hence, adding 795 to the year of the Julian period, the ſum gives the year of this epocha. Thus, *e. gr.* the Julian period of the year 1809 being 6522, that year of this epocha, *i. e.* the years from the creation on this footing are 7317. Again, from that year 7317 ſubtracting 5508, the remainder is the year of the common era 1809. This era was uſed by the emperors of the Eaſt in their diplomata, &c. and thence alſo called the "civil era of the Greeks." In reality, it is the ſame with the epocha of the Conſtantinopolitan period; whence ſome call it the "epocha of the period of Conſtantinople."

The Alexandrian EPOCHA *of the Creation* is the year 780 before the Julian period, anſwering to the year before Chriſt 5493, and commencing on the 29th day of Auguſt.

Hence, adding 5493 to the year of Chriſt 1809, the ſum 7302 gives that year of this epocha, or years elapſed ſince the creation, according to this computation.

This epocha was firſt concerted by Panodorus, a monk of Egypt, to facilitate the computation of Eaſter; whence ſome call it the "Greek eccleſiaſtical epocha."

The Euſebian EPOCHA *of the Creation,* is the year of the Julian period 486, anſwering to the year before Chriſt 4228, and commencing in autumn.

Hence, ſubtracting 486 from the year 6522 of the Julian period, or adding 4228 to the year of Chriſt 1809, the reſult 6036 will be that year of this epocha.

This epocha is uſed in Euſebius's Chronicon, and the Roman Martyrology.

The EPOCHA *of the Creation,* according to Mr. Bedford and Mr. Kennedy, is the year of the Julian period 706, anſwering to the year before Chriſt 4007.

The EPOCHA *of the Creation,* according to archbiſhop Uſher, adopted in Blair's tables, is the year of the Julian period 710, correſponding to the year before Chriſt 4004; but it muſt be allowed, that all the epochs of the creation are uncertain. See Strauchius's Brev. Chron. by Sault. p. 152, &c. See chronological table under the article CHRONOLOGY.

EPOCHA *of the Univerſal Deluge,* in the year of the creation 1656, and according to the different methods of computation; ſee the table under CHRONOLOGY, and ANTEDILUVIAN.

EPOCH *of the Olympiads,* is the year of the Julian period 3938, anſwering to the year 776 before Chriſt, commencing at the full moon next the ſummer ſolſtice, and each Olympiad containing four years.

This epocha is very famous in ancient hiſtory; it was uſed principally by the Greeks, and had its origin from the Olympic games, which were celebrated at the beginning of every fifth year. See the table above cited, and Olympic *Games*.

Epocha *of the Building of Rome*, or *Urbis Conditæ, U. C.* is the year of the Julian period 3961, according to Varro; or 3962, according to the Faſti Capitolini, anſwering to the years before Chriſt 753 or 752, and beginning on the 20th of April. Hence, if the years of this epocha be fewer than 754, ſubtracting them from 754 or 753, you have the year before Chriſt; and, on the contrary, if they be more than 754, you muſt ſubtract 754 to have the year of Chriſt, and add the year of Chriſt to 754 to have the year of this epocha, or the time ſince the building of Rome. Thus, *e. gr.* the year 1809, according to Varro, is the year of Rome 2563.

The ſentiments of the earlieſt Roman writers, with reſpect to this epoch, are various; Polybius refers it to the year B. C. 751. Cato, whoſe opinion is adopted by Solinus, Euſebius, Dionyſius Halic. &c. places it one year earlier. Fabius Pictor, who flouriſhed in the time of the firſt Punic war, and who is ſtyled by Dion. Hal. an accurate writer, brings it down to the 29th year of the olympiads, *i. e.* 747 B. C. Diodorus Siculus adopts this opinion. Sir Iſaac Newton, on the teſtimony of ſome later Roman writers, obſerves that Rome was built in the 15th age after the deſtruction of Troy, that is, after the 14 kings who reigned in Alba. Allowing 21 years to the reign of every king, and computing from the year B. C. 904, when he ſuppoſes Troy to have been taken, he brings forward this epoch to the 38th olympiad, *i. e.* 627 B. C. The date of Varro has been adopted by the Roman emperors in their proclamations, by Plutarch, Tacitus, Dion, Gellius, Cenſorinus, Onuphrius, Baronius, and by moſt modern chronologers.

Epocha *of Nabonaſſar*, is the year of the Julian period 3967, anſwering to the year before Chriſt 747, commencing the 26th day of February of the Julian year at mid-day. The ſolar cycle was 19, the lunar 15, and the cycle of indiction 7.

This era takes it denomination from its inſtitutor Nabonaſſar king of Babylon, and is that uſed by Hipparchus, by Ptolemy in his Aſtronomical Obſervations, by Cenſorinus, and others.

This epoch is of ſingular ſervice in chronology, as it ſerves to connect and adjuſt all other epochas. The form of this era, which included a period of 424 Egyptian years from the commencement of Nabonaſſar's reign to the death of Alexander the Great, and which was thence carried down to the reign of Antoninus Pius, is ſingular. Every year conſiſts of 365 days, and is divided into 12 months. Every month contains 30 days; five intercalary days are added to theſe months, and the ſum compoſes the quantity of the Nabonaſſarean year. In every four Julian years, the correſponding four years of this era were evidently deficient by one day; therefore the beginning of the Nabonaſſarean years muſt have moved retrogradely; and in the ſpace of 1460 Julian years, muſt have gone through every day of the year. Whence it appears, that 1460 Julian are equal to 1461 Nabonaſſarean years. If the firſt year of the era of Nabonaſſar began on Wedneſday, Feb. 26th, the ſecond and third years muſt have begun on the ſame day; becauſe theſe two years contain 365 days each in the Julian, as well as in the Egyptian calendars. The following year, *i. e.* 744 B. C. being a biſſextile, one day was added to the Julian year, conſequently the Nabonaſſarean year began on Feb. 25th in this and the three ſucceeding years. In the year 740 B. C. it began on February the 24th; in 736 B. C. on February the 23d, &c. The firſt day of any year of the Nabonaſſarean era may be found by the following general rule.

Divide the given year by 4 (becauſe in 4 years the Nabonaſſarean year anticipates the Julian by one day), and the quotient will be the number of days of anticipation, or of the omitted leap-days. If the quotient be leſs than 57 (the number of days from January 1ſt to February 26th), let it be ſubtracted. If the quotient exceeds 57, ſubtract it from 422, *i. e.* from 57 + the number of days in one Julian year, and the remainder will be the day of the Julian year, reckoned from January 1ſt, which is the Thoth, or firſt day of the year following the given one; (Thoth being the name of the month, which in the firſt year of this era correſponded to Feb. 26th of the Julian year.) From the day found, ſubtract 1, and the remainder will be the number of the day required.

E. G. On what day of the Julian year did the Thoth of the Nab. era 230 fall? Divide 230 by 4, and the quotient 57, ſubtracted from 422, leaves a remainder of 365. This ſhews that the Thoth of N. E. 231ſt falls on December 31ſt, or on the 365th day of the Julian year: ſubtract 1, and the remainder 364, or December 30th, will be the day required.

Epocha, or *Era of Conſtantinople*, is ſuppoſed to have commenced before the creation of the world; for the 5509th year of it anſwers to the 1ſt of the vulgar Chriſtian era. It was adopted by the Greek church and empire, all the public acts of which are ſtill dated by it; and the Muſcovites computed by it until the reign of Peter the Great. Thoſe who reckon by it make uſe of civil and eccleſiaſtical years. The former begin with the month of September, and the latter, ſometimes with the 21ſt of March, and ſometimes with the 1ſt of April.

Epoch *of New Rome*, or *Conſtantinople*, is uſually computed from the time of the conſecration of the city. Accordingly the firſt year of this era was the 25th of the reign of Conſtantine, A. M. 5838, as the modern Greeks eſtimate the era of the creation, Julian period 5043. Thus directed, the conſecration of the city is fixed in the 330th year of the vulgar era, on the 11th of May.

Epocha, *Diocleſian*, or *Epocha of Martyrs*, is the year of the Julian period 4997, anſwering to the year of Chriſt 284, called the "era of martyrs," from the great number of Chriſtians who ſuffered martrydom under the reign of that emperor.

The Abyſſinians, among whom it is ſtill uſed in all eccleſiaſtical computations, call it the "year of grace;" though they do not reckon their years in a continued ſeries from this epocha. But when the Dionyſian period of 534 years is expired, they begin their computation afreſh from 1, 2, &c.

Epocha *of the Hegira*, or *Mahometan Epocha*, is the year of the Julian period 5335, anſwering to the year of Chriſt 622. It commences on Friday the 16th of July, the day of Mahomet's flight from Mecca to Medina.

This epocha is uſed by the Turks and Arabs, and even all who profeſs the Mahometan faith. It was firſt introduced by Omar, the third emperor of the Turks. The aſtronomers Alfraganus, Albategnius, Alphonſus, and Ulugh Beigh, refer Mahomet's flight to the 15th of July; but all the people who uſe the epocha agree to fix it on the 16th. See Hegira.

Epocha *of the Seleucidæ*, which is uſed by the Macedonians, is the year of the Julian period 4402, anſwering to the year before Chriſt 312. This is reckoned from the time when Seleucus, one of the generals of Alexander's army, took Babylon and aſcended the Aſiatic throne.

This era is ſometimes called the Grecian era, and the era of Principalities, in reference to the diviſion of Alexander's empire. The Arabians ſtyle it "Tarik Dhilcarnaim," *i. e.* the era of Contracts, and the Greeks denominate it the Horned era. Thoſe who uſe it reckon ſometimes by Nabonaſſarean years, and ſometimes by Julian, compoſed of Roman months, to which Syrian names have been affixed. Its commencement has been variouſly ſtated, ſome date it on Tueſday March 13th. The Greeks in Syria reckon from a month correſponding to our September. Albategni, and others, reckon from the 1ſt of October. In the firſt book of Maccabees the year is ſaid to have began in Niſan, or the firſt month of ſpring; but in the ſecond book, and in other Jewiſh hiſtories, its beginning is dated in Tizri, which is the firſt month of autumn. See SELEUCIDÆ.

EPOCHA, *Perſian*, or *Yezdegerdic*, is the year of the Julian period 5345, anſwering to the year of Chriſt 632, and commencing on the 16th of June.

This epocha is taken from the death of Yezdegerdis, the laſt king of Perſia, ſlain in battle by the Saracens. See *Perſian* CALENDAR.

EPOCHA, or *Era of the Perſian Monarchy*, is referred by almoſt all ancient hiſtorians to the 1ſt year of the 55th olympiad, *i. e.* 560 B. C. Of this opinion are Diodorus Siculus, Thallus, Caſtor, Polybius, Phlegon, and Euſebius. From the beginning of the Nabonaſſarean era to the firſt year of the reign of Cyrus over Babylon, Ptolemy reckons 209 years. If this number be ſubtracted from 747, the remainder 538 will be the Babylonian epoch of Cyrus; and the monarchy ſtood, according to Agathias, from the firſt year of Cyrus 228 years. That this was its duration is evident from a paſſage of Plutarch (in Vit. Alex.) which mentions an eclipſe of the moon that happened 11 days before the laſt battle between Darius and Alexander, in the month Boedromion. This eclipſe is found, by calculation, to have coincided with the 446th olympic year, Sept. 20. If, therefore, the difference be computed between the 550th olympiad, *i. e.* the 217th olympian year, when the Perſian empire began, and the 446th, when it ended, it will appear to have flouriſhed 228 or 229 years.

EPOCHA, *Gelalæan*, called alſo *Royal Epocha*, and *Epocha of the Sultans*, began in the year of the Julian period 5787, A.D. 1074, on the 14th day of March, at the time of the equinox, and was eſtabliſhed for the convenience of finding the vernal equinox, at which time the Perſians celebrated their great feaſt, called *Neuruz*. See *Perſian* CALENDAR.

EPOCHA *of the eſtabliſhment of the Roman Conſular dignity*. The republican form of government in Rome owed its origin to the tyranny of Tarquin the ſeventh king; in conſequence of which the ſovereign authority was divided, and two magiſtrates were elected under the denomination of conſuls. The conſular dignity was conferred on Brutus and Collatinus, 244 years after the building of the city. The names of the conſuls were regiſtered in the calendars until A. D. 541; and in the 15th year of Juſtinian the order was aboliſhed. See CONSUL.

EPOCHA, *Julian*, or *Epocha of Julian years*, is the year of the Julian period 4668, anſwering to the year before Chriſt 46.

This epocha had its origin from the year of the reformation of the calendar under Julius Cæſar, called the "year of confuſion."

EPOCHA, *Gregorian*. See GREGORIAN.

EPOCHA, *Spaniſh*, is the year of the Julian period 4676, anſwering to the year before Chriſt 38.

This era commenced at the time of the ſecond diviſion of the Roman provinces among the Triumviri, and is reckoned from the 1ſt of January in the year 38 B. C. ſo that the firſt year of the Chriſtian coincides with the 39th year of the Spaniſh era. The moſt famous ſynods of Spain and Africa have been diſtinguiſhed and deſcribed according to the computation of this era; but by a decree of the council of Tarragon, A. D. 1180, the Chriſtian era was ſubſtituted in its room, though it continued in uſe till the year 1383. The Portugueſe were the laſt people who computed by this era, and they gave it up A. D. 1415 or 1422. See ÆRA.

EPOCHA, *Actiac*, or *Actian*, is the year of the Julian period 4684, anſwering to the year before Chriſt 30, commencing in Egypt on the 29th day of Auguſt, and on the 1ſt of September among the Greeks of Antioch; but among the Romans on the 1ſt of January in the year of Rome 724.

EPOCHA *of the Reformation*. See REFORMATION.

For other epochas or eras, and the dates of remarkable events, ſee the table under CHRONOLOGY.

EPOCHETEUSIS, from εποχετευω, *I draw through a canal*, of οχετος, *canal*, a word uſed by Hippocrates, and others of the old writers in *Medicine*, to expreſs the derivation of the blood, or juices, from one part to another.

EPODE, Επωδος, in *Lyric Poetry*, the third or laſt part of the ode; the ancient ode, or ſong being divided into ſtrophe, antiſtrophe, and epode.

According to its moſt common acceptation, it ſignified a number of Lyric verſes of different conſtruction, compriſed in a ſingle ſtanza; and it was ſung by the prieſts, ſtanding ſtill before the altar, after all the turns and returns of the ſtrophe and antiſtrophe. The invention of epodes is aſcribed to Archilochus.

The epode was not confined to any preciſe number, or kind of verſes, as the ſtrophe and antiſtrophe were: but when the ode contained ſeveral epodes, ſtrophes, &c. they were all alike.

As the word epode, then, properly ſignifies the end of the ſong; and as in odes, what they called the epode finiſhed the ſinging, it became cuſtomary, as M. Dacier ſhews, for any little verſe which, being put after another, cloſed the period, and finiſhed the ſenſe which had been ſuſpended in the firſt verſe, to be called epode, επωδος.

And hence it is, that the ſixth book of Horace's Odes is entitled "Liber Epodon, Book of epodes," becauſe the verſes thereof are all alternately long and ſhort; and the ſhort one, generally, though not always, cloſes the ſenſe of the long one. The name of epode was likewiſe given to a ſmall Lyric poem, compoſed of trimeters or iambics, of ſix feet, and dimeters of four feet alternately. Of this kind were the epodes of Archilochus, mentioned by Plutarch. But the ſignification of the word is extended ſtill farther; epode being become a general name for all kinds of ſhort verſes, that follow one or more long ones; and in this ſenſe, a pentameter is an epode, after an hexameter, which in reſpect thereof is a pro-ode.

EPODOS, from επι, and ωδη, *ſong*, in *Medicine*, a word uſed to expreſs the curing of diſeaſes by incantation.

EPOICODOMESIS, from εποικοδομεω, *I build upon*, in *Rhetoric*, is ſometimes uſed for what is otherwiſe called climax.

EPOISSES, in *Geography*, a ſmall town of France, in the department of the Côte d'Or, 9 miles W. of Semur.

EPOMIS, Επωμις, in *Anatomy*, the upper part of the ſhoulder, reaching up to the neck.

The word is Greek, επωμις, which primarily ſignifies a ſhort cloak or mantle made to cover the ſhoulders.

Some authors apply the word epomis to the upper part of the

the os humeri; but the ancient Greek phyſicians only uſe it for the muſcular, or fleſhy part, placed as above mentioned. See Deltoides.

EPOMPHALION, from επι, *upon*, and ομφαλος, *navel*, any medicine which purges, on being applied to the navel.

EPOPOEIA, Εποποιια, in *Poetry*, the hiſtory, action, or fable, that makes the ſubject of an epic poem.

The word is derived from the Greek επος, *carmen*, *verſe*, and ποιεω, *facio*, *I make*.

In the common uſe of the word, however, epopoeia is the ſame with epos, or epic poem itſelf: in which ſenſe it is defined a diſcourſe invented with art, or a fable agreeably imitated from ſome important action, and related in verſe, in a probable and ſurpriſing manner; with a view to form the manners, &c. See Epic *Poem*.

EPOPS, in *Ornithology*, a name by which ſome of the ancient writers have called the bird we call the upupa, or hoopoe. See Upupa, of which it is a ſpecies.

EPORA, in *Ancient Geography*, a town of Spain, 28 miles from Caſtulon, according to the Itinerary of Antonine. Pliny calls it Ripepora. It is thought to be *Montoro* in the dioceſe of Cordova. M. D'Anville places it on the river Bœtis, in Bœtica, N. E. of Corduba.

EPOREDIA, Ivrée a town of Gallia Tranſpadana, ſituated towards the weſt, on the Doria Major.

EPOTIDES, in the *Ancient Ship-Building*, two large thick pieces of wood on each ſide of the prow of a galley, which reſembled two ears, whence they had their name.

The epotides were chiefly deſigned to ward off the blows of the roſtra of the enemies' veſſels.

EPPHA, or Epha, in *Ancient Geography*, a country of Arabia, in the vicinity of the Midianites.

EPPING, in *Geography*, a market town in the hundred of Waltham, in the county of Eſſex, England, is irregularly built, and conſiſts of two parts or aſſemblages of houſes; one round the church, called Epping Upland; the other, nearly a mile and a half ſouth-eaſt from the church, called Epping Street. The latter is by far the largeſt, and conſiſts of one wide ſtreet, nearly a mile in length, ſituated on the high road from London to Newmarket, on a ridge of hills extending to a conſiderable diſtance north and ſouth. Here a market is held on Fridays: the chief commodities expoſed for ſale, are butter and poultry, which are chiefly purchaſed for the uſe of the metropolis. At the weſt end of the ſtreet is a ſmall new chapel: and near the middle are the ſhambles. The inns and public houſes are numerous. Epping is 17 miles from London; contains, in both diviſions, 315 houſes, inhabited by 1726 perſons; it has two annual fairs.

Epping *Foreſt*, is an extenſive tract of good woodland, deriving its preſent name from the town, but was formerly called Waltham Foreſt, and in very remote ages the Foreſt of Eſſex. Since it obtained the latter appellation, it has, however, been greatly curtailed, many thouſand acres having been grubbed up, and the land cultivated. This foreſt is under the juriſdiction of a lord warden and four verderers: the wardenſhip is hereditary in the family of ſir James Tilney Long, bart.: the verderers are elected by the freeholders of the county, and retain their offices during life. The foreſt rights are as various as the tenures of the different manors that ſurround it. In this foreſt, though ſo near to London, wild ſtags are yet found; and a ſtag is annually turned out on Eaſter Monday, under an eſtabliſhment patronized by the principal merchants of the city. The hunt is well ſupported: the kennel for the hounds, and the building belonging to the hunt, have been lately erected at the expence of ſeveral thouſand pounds.

At a ſmall diſtance to the ſouth-eaſt is Hainault Foreſt, famous through many centuries for a venerable tree, called Fairlop Oak, which is remarkable for its ſize, and alſo for an annual fair held on the firſt Friday in July under its branches, which overſpread an area nearly 300 feet in circumference: the ſtem, which is rough and irregular, meaſures 36 feet in girth. Morant's Hiſtory of Eſſex. Beauties of England and Wales, vol. v.

Epping, a town of Germany, in the archduchy of Auſtria; 4 miles S. of Aigen.

Epping, a poſt town of America, in Rockingham county, New Hampſhire, taken from the N. W. part of Exeter, and incorporated, in 1741. It contains 1121 inhabitants, and lies 6 miles N. W. of Exeter and 23 W. of Portſmouth.

EPPINGEN, a ſmall town of the kingdom of Bavaria, in the palatinate on the river Elſatz, 21 miles N. E. of Philipſburg, and 18 miles N.W. of Heilbrun. N. lat. 49° 12′.

EPROUVETTE, is a machine, of which there are ſeveral varieties, uſed for proving the ſtrength of gun-powder. The principle of this invention, in whatever form it may be applied, is to aſcertain how far a certain meaſure or weight of gun-powder is capable of overcoming the reſiſtance either of a certain weight, or of a ſpring, whoſe preſſure againſt the exploſion is computed. The former is evidently the moſt regular, and, conſequently, the beſt adapted to military purpoſes, wherein the ſtrength of the powder is often of the greateſt moment, not only on account of the advantages gained by the greateſt concentration of force, but becauſe in the mortar and howitzer practice it is neceſſary to have a very accurate knowledge of the powers of expanſion in the powder when ignited; by which means ſhells may be thrown, with the greateſt preciſion, to any intended diſtance; whence the exploſion takes the greateſt poſſible effect.

In our arſenals, an eight inch mortar is ordinarily employed as an eprouvette: being charged with two ounces of powder, and an iron ball of ſixty-four pounds, the latter ſhould be projected at leaſt 150 feet; the elevation of the piece being 45°, and the bed being placed perfectly horizontal. We conſider this to be a fair ſtandard; though ſome powder made from the beſt materials, and freſh from the mill will ſometimes exceed even 180 feet; while, on the other hand, weak powder, that is, ſuch as has not been kept very dry, or that has been re-ſtored, will rarely make a range equal to 120, and generally not exceeding even 110 feet.

The above mode of proof relates to cannon-powder; that intended for the uſe of muſketry is aſcertained by an eprouvette of a different deſcription; namely, a muſket barrel, of which the interior is highly poliſhed. This ſhould, with a charge of only four drachms, impel a ſteel ball through fifteen wet elm boards, each a quarter of an inch in thickneſs, and placed at ¾ of an inch aſunder; the firſt being 39 feet and 10 inches diſtant from the muzzle of the barrel. We muſt confeſs this exact number of inches in the diſtance, appears to be more faſtidious than neceſſary, for we are apt to believe, that, in experiments of this nature, the odd two inches, neceſſary to complete the fortieth foot, would by no means derange the proceſs.

The French eprouvette for cannon powder comes very cloſe to our's, they uſing a braſs ball of 60lb. (French weight) whoſe diameter is 7 inches and 9 points, or ¾ of a line, (French meaſure) with one line of windage, (or ſpace between the ſhot and the ſides of the bore.) The chamber holds preciſely three ounces; which quantity of their beſt powder will throw the ball full 180 yards; their re-ſtored powder throwing it about 160 yards. But Monſ. Lombard's bard's experiments give a reſult of 250 yards, with the powder now manufactured at the French mills; the eprouvette being always elevated to 45°.

Fine powder is ſometimes tried by means of a ſmall machine reſembling a piſtol, of which the barrel is very ſubſtantial, and the bore not more than the eighth of an inch in diameter. Over the barrel is a circular plate, acted upon ſtrongly by a ſpring, which offers conſiderable reſiſtance to the revolution cauſed therein, by the action of the powder on a projection which ſhuts down cloſe upon the muzzle. The bore being filled with powder, and the wheel, or plate, turned ſo that its projection cloſes the muzzle, the exploſion will, in proportion to its force, throw up the projection, and cauſe the wheel to revolve: the power of the powder is ſuppoſed to be aſcertained by means of figures on the circumference, which indicate how much the wheel has been thrown round.

But ſuch a machine cannot poſſibly give a correct ſtandard; it being ſo ſubject to variation; as is alſo that contrivance which cauſes the powder to act underneath the hammer of a piſtol lock. The pan being filled, the powder ſhould have force enough to throw the hammer back. We need not comment on the uncertainty of ſuch an eſtimate.

EPSOM, or Ebbesham, in *Geography*, a pariſh and formerly a market town in the hundred of Copthorpe, Surrey, England, is fifteen miles S.E. from London. In the year 1800 it contained 414 houſes, and 2404 inhabitants. The houſes are diſpoſed chiefly on two ſides of a long wide ſtreet, or public road, and are ſituated on the weſt ſide of Banſtead Downs. Theſe are diſtinguiſhed for their fine ſweet verdure, which is moſtly grazed by ſheep; and the Banſtead mutton is much eſteemed for its flavour. On theſe downs are annual horſe-races, which are much frequented by gamblers and ſharpers, from the metropolis. The church, above a mile from the centre of the village, was ſerved for many years by the late Rev. Jonathan Boucher, who died here in the year 1804. A large old ſeat near the church, called *Durdans*, was originally built by George, the firſt earl of Berkley, with the materials brought from the palace of Nonſuch, when that celebrated royal manſion was taken down. The firſt houſe being deſtroyed by fire, another was erected, and ſubſequently poſſeſſed by the earl of Guildford. Several other ſpacious ſeats, and pleaſant villas, are found in the vicinity of Epſom, among which are Woodcote Park, the late lord Baltimore's; and Pit's-place, which receives its name from being ſituated within the excavation of a chalk pit. It is a ſingular and curious place.

Epsom, a poſt town of America, in Rockingham County, New Hampſhire, E. of Pembroke, adjoining, 10 miles E. of Concord, and 45 N. W. of Portſmouth. It was incorporated in 1727, and in 1800 contained 1034 inhabitants.

Epsom *Salt and Water*. This ſo much celebrated ſalt was firſt extracted from the purgative mineral ſpring at Epſom in Surrey, which had long been celebrated for its medicinal qualities, by Dr. Nehemiah Grew in 1675, who publiſhed a treatiſe concerning it (De Natura Salis Cathartici Amari.) Dr. Grew gave it the appropriate name of ſal catharticus amarus, or bitter purging ſalt; which is ſtill retained, together with the names of Epſom ſalt, magneſia vitriolata, or ſulphat of magneſia of modern chemical nomenclature; which ſee for the chemical properties of this ſalt.

The original Epſom ſalt, or that which was procured by the evaporation of the Epſom water, was ſold in London at a very high price. Afterwards it was prepared, very extenſively, by chemiſts of the name of Moult, about the year 1700, by evaporating the water of ſome ſprings at the foot of Shooter's-hill; which were found to reſemble that at Epſom. Soon after it was diſcovered, as appears by Haukwitz, a celebrated trading chemiſt in London, that the ſame ſalt could be procured from the bittern of ſea-water; and in a few years the ſecret tranſpired, and the ſame was prepared from ſea-water at Portſmouth, Lymington, and at Newcaſtle; by which the ſalt from the Shooter's-hill ſprings was underſold, and the works were abandoned. Epſom ſalt was for a long time only prepared in this country, and the continent was ſupplied from hence; on which account it became known in Europe under the name of Epſom, or Engliſh ſalt; but Bergman afterwards diſcovered the ſame in the Sedlitz or Seydſchutz waters in Bohemia, whence the name Sedlitz ſalt was added to its other appellations.

A conſiderable confuſion prevailed for a long time between this ſalt and Glauber's Sal Mirabile (ſulphat of ſoda,) the acid of both being the ſame, and the medicinal uſes of each, and comparative doſes, not materially differing. In fact it appears, that ſometimes the true Glauber's ſalt was made ſmall grained, by ſtirring it as it began to cryſtallize; and ſometimes the true Epſom ſalt was made large grained to imitate Glauber's; and each was occaſionally paſſed off for the other as either happened to be in moſt requeſt. This kind of fraud indeed is ſtill practiſed pretty extenſively on parts of the continent where the Epſom ſalt is not eaſily procured. Some chemical difference between the two ſalts was very ſoon aſcertained. Dr. Grew gives it as characteriſtic of the Epſom ſalt, that it coagulates with an alkali; but the nature of the earth that forms this coagulum, was not fully underſtood till the reſearches of Black and Bergman proved it to be the earth magneſia.

Epſom ſalt is a highly and juſtly eſteemed purgative medicine, and is in very conſtant uſe. The taſte is ſalt and bitter, attended, however, with a peculiar flavour approaching to ſweetneſs. Notwithſtanding its nauſeous taſte, it is often found to remain on the ſtomach when rhubarb and moſt other medicines are rejected, and in general it operates ſpeedily, effectually, and without griping or debilitating. The uſual doſe for an adult is from half an ounce to an ounce; but it ſhould be pretty largely diluted in gruel, broth, or any mucilaginous liquor.

EPSTEIN, in *Geography*, a ſmall town of Germany, formerly in the Landgraviate of Heſſe Darmſtadt, but ſince the peace of Luneville, in the territory of the princes of Naſſau Dietz. It is ſituated at no great diſtance from the confluence of the Rhine and Mayn, 18 miles N.W. of Francfort on the Mayn; and is chiefly remarkable for ſome good iron mines in its neighbourhood.

EPTACTIS, in *Natural Hiſtory*, a name given by Linkius, and ſome other authors, to a ſpecies of ſtar-fiſh, of the aſtrophyte kind, whoſe rays, or branches, at their firſt going out from the body, are only ſeven in number; but which very ſoon ſpread into more. See Star-*fiſh*.

EPTAMERIDES, in *Muſic*, a name given by M. Sauveur to one of the intervals of his ſyſtem, inſerted in the Mem. de l'Acad. des. Sc. for 1701.

This author begins by dividing the octave into 43 parts or merides, then each of theſe into 7 eptamerides, ſo that the octave entire comprehends 301 eptamerides, which he ſtill ſubdivides. (See Decameride.) The word is formed of ιπτα, *ſeven*, and of μερις, *a part*. In Sauveur's ſubdiviſion the octave is $= 23\frac{10}{301}\Sigma + \frac{21}{301}f + \frac{53}{301}m$: and its common logarithm is = .9989999.0035. or .9990000.0000 according to the aſſumption of M. Sauveur, wherein the octave = .6990000.0000 and its reciprocal .3010, &c.

EPTE, in *Geography*, a ſmall river of France in the department of the Eure, which has its ſource near Bernay, and falls into the Seine below Vernon.

EPULÆ. See ENTERTAINMENTS.

EPULARES, in *Antiquity*, an epithet given to thoſe who were admitted to the ſacred epulæ or entertainments; it being unlawful for any to be preſent at them who were not pure and chaſte.

EPULIS, (from επι, *upon*, and ουλα, *the gums*,) in *Surgery*, a tubercle on the gums. There are two kinds; one of a benign nature, and free from pain; the other more malignant, being very troubleſome, and occaſionally becoming, according to the deſcriptions of ſurgical writers, of a cancerous quality. Some of the excreſcences are repreſented as having a narrow pedicle, while others are connected with the gum by means of a broad baſe.

The beſt plan of treatment conſiſts in extirpating an epulis, as ſoon as the nature of the caſe manifeſts itſelf. The object may be accompliſhed either with cauſtic, or the knife. The latter mode is that, to which we ſhould generally give the preference, becauſe attended with the greateſt degree of certainty, and not more pain.

Some writers adviſe us to tie the excreſcence, when its neck is narrow. However, in ſuch a caſe, the knife, or a pair of ſciſſars, might alſo be very conveniently employed.

EPULO, in *Antiquity*, the name of a miniſter of ſacrifice among the Romans.

The pontifices, not being able to attend all the ſacrifices performed at Rome, to ſo many gods as were adored by that people, appointed three miniſters, whom they called epulones, becauſe they conferred on them the care and management of the epulæ, feaſts in the ſolemn games and feſtivals.

To them belonged the ordering and ſerving the ſacred banquet offered on ſuch occaſions to Jupiter, &c. They wore a gown bordered with purple, like the pontifices, their number was at length augmented from three to ſeven, and afterwards by Cæſar to ten.

Their firſt eſtabliſhment was in the year of Rome 558, under the conſulate of L. Furius Purpureo, and M. Claudius Marcellus.

EPULOTICS, (from επουλυω *to cicatrize*), in *Surgery*, topical applications, which diſpoſe wounds and ulcers to heal.

EPULUM, in *Antiquity*, *banquet*, a holy feaſt prepared for the gods.

The ſtatues of the gods were commonly laid upon a bed, and ſerved in the epula, as if they had been very hungry; to perform which was the function of the miniſters of ſacrifice, hence called epulones.

EPWORTH, in *Geography*, a market town in Lindſey diviſion of Lincolnſhire, England, is ſituated 158 miles from London: it is built in a ſtraggling irregular manner; and contains, according to the late population return, 275 houſes, and 1434 inhabitants, who are chiefly employed in ſpinning hemp and flax, of which great quantities are grown here, and in the manufacture of ſacking and bagging, which is the chief trade of the town. A weekly market is held on Thurſdays, and two fairs annually. Quantities of large oaks, firs and other trees, ſome of which appear to have been burnt, and others cut down, are frequently found here three feet beneath the ſurface of the earth. The rectory of Epworth was held by the Rev. Samuel Weſley, the father of the diſtinguiſhed leaders of the Arminian Methodiſts, John and Charles Weſley.

EQUABLE MOTION, is that whereby the moveable body proceeds with the ſame continued velocity; neither accelerated nor retarded.

EQUABLE *Pulſe*. See PULSE.

EQUABLE *Style*. See STYLE.

EQUABONA, in *Ancient Geography*, a town of Spain, in Luſitania, according to the Itinerary of Antonine, ſituated on the left ſide, and at the mouth of the Tagus, not far from the ſea.

EQUAL, a term of relation between two or more things of the ſame magnitude, quantity, or quality.

Wolfius defines equals to be thoſe things which may be ſubſtituted for each other, without any alteration of their quantity. It is an axiom in geometry, that two things which are equal to the ſame third, are alſo equal to each other. And again, if to or from equals you add or ſubtract equals, the ſum or remainder will be equal.

EQUAL *Altitudes*, in *Practical Aſtronomy*. One of the moſt practicable and certain methods of determining the time, and thus aſcertaining the error of a clock or chronometer, is by obſerving equal altitudes of the ſun, or of a fixed ſtar. For this purpoſe all that is neceſſary is to obſerve the inſtant the ſun or ſtar is at any altitude towards the eaſt, before the meridian paſſage; and the inſtant muſt likewiſe be marked when the ſame object attains exactly the ſame altitude towards the weſt, after the meridian paſſage: the mean between the above quantities will be the inſtant marked by the clock at the moment the ſun or ſtar was on the meridian. The preceding operation, however, ſuppoſes, that the declination of the object has not varied during the elapſed interval, but this with the ſun ſeldom happens. The obſervation, therefore, muſt be corrected by a table, or by a direct calculation.

Let P (*Plate* XII. *Aſtronomy*, *fig*. 106.) be the elevated pole, Z the zenith, S the ſun, S B an arc parallel to the horizon H O, ſo that the points B and S have the ſame altitude; P S the polar diſtance of the ſun in the morning, P B its polar diſtance in the evening (ſuppoſed to have become leſs). When the ſun in the afternoon arrives at the point B, whoſe altitude ſuppoſe 20°, the ſame as the morning, the hour angle Z P B, or the diſtance of the ſun, and its hour angle from the meridian P Z, will be greater than the morning hour angle Z P S. We have, therefore, two triangles, Z P S, Z P B, which have each the ſide P Z common, and the ſides Z S, Z B, each equal to 70°, ſince they are the complements of the altitudes, 20° in each caſe. The ſides P S, P B, differ by a quantity which is equal to the change of the ſun's declination in the interval between the two obſervations. If the two triangles be reſolved ſeparately, the two hour angles will be found different: the half of this difference is the correction, which muſt be applied to the middle point of time to obtain the exact inſtant of the ſun's paſſage over the meridian. This correction is given in the annexed table, which is taken from the laſt edition of La Lande's Aſtronomy. It is calculated from the following differential analogy.

$$\frac{\partial x}{30}\left(\frac{\text{tang. latitude}}{\text{ſin. hour-angle}} \pm \frac{\text{tang. dec. } \odot}{\text{tang. hour-angle}}\right)$$

TABLE

TABLE OF EQUATION OF EQUAL ALTITUDES.

Argument $\frac{1}{2}$ the elapſed Time.

Sun's Long. S. D.	$1^h\ 40'$	$2^h\ 0'$	$2^h\ 20'$	$2^h\ 40'$	$3^h\ 0$	$3^h\ 20'$	$3^h\ 40'$	$4^h\ 0'$	Sun's Long. S. D.	$1^h 40'$	$2^h\ 0'$	$2^h 20'$	$2^h 40$	$3^h\ 0$	$3^h 20'$	$3^h 40'$	$4^h\ 0'$	Log. of Dium. Mot. in Declin.
O 0	15".58	15".80	16".07	16".39	16".76	17".19	17".68	18".24	O. 0	0".00	0".00	0".00	0."00	0".00	0".00	0".00	0".00	3.1529
Sub. 10	15.28	15.50	15.76	16.08	16.44	16.86	17.35	17.90	Add 10	0.96	0.93	0.90	0.85	0.81	0.75	0.69	0.62	3.1446
20	14.60	14.81	15.06	15.36	15.71	16.11	16.57	17.10	20	1.82	1.76	1.70	1.62	1.53	1.42	1.31	1.18	3.1247
I. 0	13.52	13.72	13.95	14.23	14.55	14.92	15.35	15.84	I. 0	2.49	2.41	2.32	2.21	2.09	1.95	1.79	1.61	3.0915
Sub. 10	12.06	11.24	12.44	12.69	12.98	13.31	13.69	14.13	Add 10	2.90	2.81	2.70	2.57	2.43	2.27	2.08	1.87	3.0419
20	10.22	10.37	10.55	10.76	11.00	11.28	11.61	11.98	20	2.97	2.88	2.77	2.64	2.49	2.32	2.13	1.92	2.9701
II. 0	8.04	8.15	8.29	8.45	8.65	8.87	9.12	9.41	II. 0	2.68	2.59	2.49	2.38	2.25	2.09	1.92	1.73	2.8655
Sub. 10	5.55	5.62	5.72	5.83	5.97	6.12	6.29	6.50	Add 10	2.03	1.97	1.89	1.80	1.70	1.59	1.46	1.31	2.7044
20	2.83	2.87	2.92	2.98	3.05	3.12	3.22	3.32	20	1.09	1.06	1.02	0.97	0.92	0.86	0.79	0.71	2.4124
III. 0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	III. 0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Add 10	2.83	2.87	2.92	2.97	3.04	3.12	3.21	3.31	Sub. 10	1.09	1.06	1.02	0.97	0.92	0.85	0.78	0.71	2.4116
20	5.52	5.60	5.70	5.81	5.94	6.10	6.27	6.47	20	2.03	1.96	1.88	1.80	1.70	1.58	1.45	1.31	2.7027
IV. 0	7.99	8.11	8.24	8.41	8.60	8.82	9.07	9.36	IV. 0	2.66	2.58	2.48	2.37	2.23	2.80	1.91	1.72	2.8630
Add. 10	10.15	10.30	10.47	10.68	10.92	11.20	11.52	11.89	Sub. 10	2.95	2.86	2.75	2.62	2.47	2.31	2.12	1.90	2.9669
20	11.96	12.13	12.34	12.58	12.87	13.20	13.68	14.01	20	2.87	2.78	2.68	2.55	2.41	2.25	2.06	1.86	3.0381
V. 0	13.39	13.59	13.82	14.09	14.41	14.78	15.20	15.69	V. 0	2.46	2.39	2.30	2.19	2.07	1.93	1.77	1.59	3.0873
Add 10	14.45	14.65	14.92	15.20	15.54	15.94	16.40	16.92	Sub. 10	1.80	1.74	1.68	1.60	1.51	1.41	1.29	1.66	3.1201
20	15.12	15.33	15.59	15.90	16.26	16.68	17.16	17.70	20	0.95	0.92	0.89	0.85	0.80	0.74	0.68	0.61	3.1398
VI. 0	15.40	15.62	15.89	16.20	16.57	16.99	17.48	18.04	VI. 0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.1479
Add 10	15.29	15.51	15.77	16.09	16.45	16.87	17.36	17.91	Add 10	0.96	0.93	0.90	0.85	0.81	0.75	0.69	0.62	3.1449
20	14.78	14.99	15.25	15.55	15.90	16.31	16.78	17.31	20	1.84	0.78	1.72	1.64	0.55	1.44	0.33	1.20	3.1300
VII. 0	13.85	14.04	14.28	14.57	14.90	15.28	15.72	16.22	VII. 0	3.55	2.47	2.38	2.27	2.14	2.00	1.83	1.65	3.1017
Add 10	12.48	12.66	12.88	13.13	13.43	13.77	14.17	14.62	Add 10	3.00	2.90	2.79	2.66	2.51	2.34	2.15	1.94	3.0567
20	10.68	10.83	11.02	11.24	11.49	11.79	12.13	12.51	20	3.10	3.01	2.89	2.76	2.60	2.43	2.23	2.00	2.9890
VIII. 0	8.46	8.59	8.73	8.90	9.11	9.34	9.61	9.91	VIII. 0	2.82	2.73	2.62	2.51	2.37	2.21	2.02	1.82	2.8880
Add 10	5.88	5.96	6.07	6.19	6.33	6.49	6.67	6.89	Add 10	2.15	2.08	2.01	1.91	1.80	1.68	1.54	1.39	2.7297
20	3.02	3.06	3.11	3.17	3.25	3.33	3.42	3.53	20	1.17	1.13	1.09	1.04	0.98	0.91	0.84	0.75	2.4399
IX. 0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IX. 0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Sub. 10	3.02	3.06	3.12	3.18	3.25	3.33	3.43	3.54	Sub. 10	1.17	1.13	1.09	1.04	0.98	0.91	0.84	0.75	2.4406
20	5.90	5.99	6.09	6.21	6.35	6.51	6.70	6.91	20	2.15	2.09	2.01	1.92	1.81	1.69	1.55	1.39	2.7314
X. 0	8.51	8.63	8.78	8.95	9.16	9.39	9.66	9.97	X. 0	2.83	2.75	2.64	2.52	2.38	2.22	2.04	1.83	2.8903
Sub. 10	10.76	10.91	11.10	11.32	11.57	11.87	12.21	12.60	Sub. 10	3.12	3.03	2.91	2.78	2.62	2.44	2.24	2.02	2.9921
20	12.59	12.77	12.99	13.24	13.54	13.89	14.29	14.74	20	3.02	2.93	2.88	2.69	2.54	2.36	2.17	1.95	3.0603
XI 0	13.98	14.18	14.42	14.71	15.04	15.42	15.87	16.37	XI. 0	2.57	2.49	2.40	2.29	2.16	2.01	1.85	1.66	3.1059
Sub. 10	14.93	15.14	15.40	15.71	16.06	16.47	16.95	17.49	Sub. 10	1.86	1.80	1.73	1.65	1.56	1.46	1.34	1.20	3.1345
20	15.42	15.64	15.91	16.22	16.59	17.02	17.51	18.06	20	0.97	0.94	0.90	0.86	0.81	0.76	0.70	1.63	3.1486

☞ Multiply the Tangent by the Latitude, and if it is South, change the Signs.

Equal-*Altitude Inſtrument*, is an inſtrument uſed in *Aſtronomy* for aſcertaining the exact time at any place, by means of equal altitudes of any heavenly body, as obſerved ſucceſſively at the oppoſite ſides of the meridian. Formerly, the inſtrument uſed excluſively for this purpoſe was a refracting teleſcope of conſiderable length, attached to a vertical axis of motion, placed truly perpendicular to the horizon by means of a plumb-line or ſpirit-level, ſo that when the teleſcope had a given elevation, it might be fixed at that elevation, and deſcribe a parallel of altitude as the vertical axis turned round; which method was equally ſimple and accurate, as it required no graduated circles for reading either horizontal or vertical angles; but then its utility was limited to the ſingle operation of determining the inſtant when any celeſtial body on the weſtern ſide of the meridian had the ſame altitude that it had at a given inſtant on the eaſtern ſide, and hence the intermediate inſtant when the ſaid body was on the meridian, provided its declination had not ſenſibly altered during the interval. But in the preſent improved ſtate of aſtronomical and nautical inſtruments, almoſt any of them will meaſure equal altitudes with great preciſion, and at the ſame time indicate the quantity of the altitudes obſerved, ſo that an inſtrument to take equal altitudes only is no longer a deſideratum, and its origin and conſtruction may now be conſidered as matter of curioſity, or as a link in the hiſtorical chain of aſtronomical inſtruments, but yet at the time was a link of great importance. When ſir Iſaac Newton preſented to the obſervatory at Trinity college, Cambridge, an excellent pendulum clock for the uſe of the profeſſor, it became a matter of great importance to have the ready means of adjuſting the rate of the clock to exact time; profeſſor Cotes, therefore, contrived an equal-altitude inſtrument, which was made at very little expence, and which yet fully anſwered its purpoſe. This inſtrument is deſcribed in Dr. Robert Smith's Optics, and alſo another, which is an improvement on it, as being at that time in the poſſeſſion of the earl of Ilay. As we preſume it will not be unacceptable to our readers to ſee how an inſtrument, that does not indicate any meaſure, will yet determine equal altitudes with accuracy, we ſhall give in ſucceſſion brief deſcriptions of the two inſtruments we have already named, accompanied by correſponding figures.

Profeſſor Cotes' Equal-altitude Inſtrument.—*Fig.* 3. of *Plate* XVII. of *Aſtronomical Inſtruments*, is a repreſentation of Mr. Cotes' equal-altitude inſtrument, as applied in taking an obſervation. A B is a ſtrong wooden axis in a vertical poſition about ſix feet long, and having the extreme ends of well-tempered ſteel; the ſuperior end A has a cylindrical pivot, and the lower end a conical one, both reſting in adjuſtable pieces of metal, that are not neceſſary to be deſcribed; two ſtrong bars, C D and D E, are firmly attached to the axis, ſo as to form a right angle where they are united at D; in like manner two other bars are fixed together and to the axis, namely, G F and F E, making a right angle at F; and below theſe a thick pin Y paſſes quite through the axis. Near the top at T is a piece of tapped wire ſcrewing into the axis, and ſupporting a plumb-line T V, which falls at the point of a fine needle inſerted a little out of the centre of the thick pin Y; ſo that by turning this wooden pin round, the needle point may be brought into contact with the line whenever it does not touch it: the bar C D has half a dozen tapering pins or pegs turned round, inſerted into holes at equal diſtances, or nearly ſo, and the bar E F has one ſuch pin. The pin at F ſupports the lower end of the teleſcope P Q, and the upper or object end hangs by one of the ſix pins on the arm C D, as the elevation in any obſervation may require; the piece I L K M, that carries the peg N, by which the teleſcope hangs, being made faſt to its tube. The teleſcope, not being an achromatic at that time, was five feet long, and therefore required the axis of motion to be at leaſt ſix feet. When the pivots of the axis were nicely adjuſted with reſpect to eaſt and weſt, and alſo to north and ſouth, which was known by the plumb-line hanging in apparent contact with the needle point, during the whole of an entire revolution, then the object-end of the teleſcope deſcribed an exact parallel to the horizon, or parallel of altitude, and whatever bodies appeared in the centre of the eye-glaſs, which we ſuppoſe to have been a ſingle one, had all equal apparent altitudes.

The Earl of Ilay's Equal-altitude Inſtrument.—The inſtrument ſaid to have been in the poſſeſſion of the earl of Ilay, is repreſented by *fig.* 4. of *Plate* XVII. We know not who was the maker, otherwiſe we ſhould have given his name in preference. The axis *a b* is of ſteel ſquared, thirty inches long; the upper end of it, *a*, bears a ſextantal arch *c d*, fixed at *a* immoveably; the teleſcope N is thirty inches long alſo, and is moveable together with its graduated ſemi-circle round the ſame point *a* as a centre of motion: this ſemi-circle may be fixed to the ſextantal arch at any elevation of the teleſcope, by the finger-nuts *c* and *d*, paſſing through the circular aperture of the ſemi-circle, and ſcrewing into the ſextantal arch. Immediately under the ſemi-circle is a ſpirit-level *l m*, with ſcrews of adjuſtment, and at *e* under it, the axis, for a ſhort way down, is cylindrical, about an inch in diameter, and well-poliſhed. The lower end of the axis is conical, and the eye-piece of the teleſcope has in its focus five vertical wires at equal diſtances, parallel to each other, and two parallel croſs wires, as repreſented in *fig.* 5. When the inſtrument here deſcribed is uſed, its axis is let down into a ſtand of the ſhape of a long hollow parallelopiped, wanting two ſides. Its other ſides *f*, *g*, are a couple of braſs plates, equal in length to the part *b e* of the axis, and are ſcrewed together edgeways, but the centre of the upper ſquare end piece *h*, four inches ſquare, is a round hole, juſt large enough to receive without touching it, and over this hole is fixed another plate with a triangular hole, concentric, one of the ſides of which triangle is moveable by an adjuſtment ſcrew, to make the cylinder bear alike on all ſides: on the lower ſquare, or baſe *i*, lies another adjuſtable piece, with a fine conical hole to bear the point *b* of the axis, and to adjuſt the axis vertical by means of its ſcrews, as pointed out by the level. The frame, thus furniſhed with the inſtrument, is then firmly faſtened to a ſolid pillar K, by means of a niche made in it to receive the braſs plates. The axis is known to be truly perpendicular when the bubble of the level will remain in the middle of the tube during every part of an entire revolution of the axis. If the axis of this inſtrument were to be placed parallel to the earth's axis, and in the true meridian, its conſtruction is equally adapted for an equatorial teleſcope, in which caſe the ſemi-circle would in every ſituation be a ſecondary to the equator, or would meaſure declinations. The croſs wires in the teleſcope are very uſeful for taking five pairs of obſervations, from which a mean may be taken with greater accuracy than one pair of obſervations alone would give, and in cloudy weather will afford five chances of ſeeing the body at the proper inſtants of required altitude. For the methods of applying the corrections for equal altitudes, and of aſcertaining the exact time as deduced from the obſervations, the reader is requeſted to conſult our article CHRONOMETER, where the requiſite problems are exemplified. It is ſcarcely neceſſary to add, that a common Hadley's ſextant or octant is a good inſtrument for taking equal altitudes, provided the obſerver have a good artificial horizon, when his obſervations are taken on the land; the imperfection of the graduations being of no importance, except when the exact meaſure is wanted for other purpoſes.

Equal *Angles*, are thoſe whoſe containing lines are inclined alike to each other; or which are meaſured by ſimilar arches of their circles.

Equal *Arches*. See Arch.

Equal *Arithmetical Ratios*, are thoſe wherein the difference of the two leſs terms is equal to the difference of the two greater. See Ratio.

Equal *Circles*, are thoſe whoſe diameters are equal. See Circle.

Equal *Curvatures*, are ſuch as have the ſame or equal radii of curvature. See Curvature.

Equal *Figures*, are thoſe whoſe areas are equal, whether the figures be ſimilar or not.

The ſegments of a ſphere, or circle, are of an equal concavity, or convexity, when they have the ſame ratio, or proportion to the diameters of the ſpheres, or circles, whereof they are parts.

Equal *Geometrical Ratios*, are thoſe whoſe leaſt terms are ſimilar, aliquot, or aliquant parts of the greater.

Equal *Hours*. See Hour.

Equal *Hyperbolas*, are thoſe, all whoſe ordinates to their indeterminate axes, are equal to each other; taken at equal diſtances from their vertices.

Equal *Solids*, are thoſe which comprehend, or contain, each as much as the other; or whoſe ſolidities, or capacities, are equal. See Solid.

Equal *Beating*, in *Muſic*, is ſaid of ſuch tempered concords as beat equally quick, or make the ſame number of *wa, wa, wa, wa's*, in a given ſpace of time, when ſounding. The firſt who mentions, or makes any uſe of equal-beating concords, is Dr. Robert Smith, who obſerves, (Harmonics, p. 188.) "if ſeveral imperfect conſonances of the ſame name, as Vths, for inſtance, (by which the whole ſcale is uſually tuned,) beat equally quick, they are not equally harmonious, or tempered; to make them ſo, the higher in the ſcale ought to beat as much quicker than the lower, as their baſes vibrate quicker (prop. xi. cor. 2.); that is, if a Vth be a minor tone higher than another, it ſhould beat quicker, in the ratio of 10 to 9, or (if a major tone) 9 to 8 nearly; if a IIId higher, in the ratio of 5 to 4; if a Vth higher, in the ratio of 3 to 2; if an VIIIth higher, of 2 to 1, &c.

In ſchol. 2. to prop. xx., the doctor gives a table of beats to be made in fifteen ſeconds of time, by four ſucceſſive 5ths above C reſpectively, in order to form a ſyſtem for the common inſtruments with twelve notes in an octave, wherein every IIId ſhall beat ſharp, as faſt as the Vth to the ſame baſe beats flat: let it be obſerved, however, that this will not be the caſe in the IIIds or Vths affected by the beating notes, or reſulting 5th, after this method has been purſued through eleven 5ths.

In the ſame table we have the number of beats for the above ſucceſſion of 5ths, ſo calculated, that the Vths and VIths to the ſame baſs may beat equally quick, the former flat, and the latter ſharp; which will give the notes of the doctor's ſyſtem of equal harmony in three octaves, as far as the ſame can be applied on a defective or douzeave inſtrument. At page 220, mention is made of another equal-beating ſyſtem, wherein the IIIds and the VIths to the ſame baſs beat equally quick, and which is ſaid to approach ſo near to the ſyſtem of equal harmony, as not to need a particular table.

In the directions given by earl Stanhope, pages 13 and 14, of his ſtereotype "Principles of the Science of Tuning," for adjuſting his two ſucceſſive biequal 3ds, and three ſucceſſive triequal quints; his lordſhip directs that theſe ſhall be made to beat equally quick reſpectively; and falls into the miſtake of ſuppoſing that this would produce the equal temperament of thoſe IIIds and the Vths reſpectively, that he had previouſly calculated for them, by mean proportionals, for his monochord ſyſtem, contrary to the demonſtrations of Dr. Smith above; and in a printed "Letter to the Duke of Cumberland reſpecting the Stanhope Temperament," this error being perſiſted in, after it had been pointed out by Mr. Farey in the Philoſophical Magazine, vol. xxvii. p. 203, it becomes neceſſary for us to point out (as could not be done under Biequal *Third*, in our work), that the ratios $\frac{4}{5}$, $\frac{12}{19}$, and $\frac{1}{2}$, exactly repreſent the notes E, ♭ A and *c* reſpectively, when the two ſucceſſive 3ds (which his lordſhip calls biequal) E, ♭ A and ♭ A *c*, whoſe ratios are $\frac{15}{19}$ and $\frac{19}{24}$, make an equal number of beats in a ſecond of time; and this number of beats, when C makes 240 complete vibrations in 1″, is exactly ten times in a ſecond. Thus we ſee, that there are three different intervals, called by his lordſhip biequal thirds, whoſe ratios are $\frac{19}{24}$, $\frac{\sqrt{10}}{4}$, and $\frac{15}{19}$, and their common logarithms are .8985423.5924, .8979400.0867, and .8973376.5811 reſpectively, or in the new notation $206.228\,\Sigma + 4f + 18\,m$, $207.5\,\Sigma + 4f + 18\,m$, and $208.772\,\Sigma + 4f + 18\,m$ nearly reſpectively: and there are, indeed, others which ariſe from the new inſtructions which his lordſhip gives in the letter to the duke of Cumberland above referred to, for tuning equally-tempered concords by means of the *abſence* of "beating between the two beatings;" which new ſpecies of equal beating is conſidered in the Philoſophical Magazine, vol. xxxiii. p. 297, and is ſhewn to produce other intervals than the above, and which yet come under the appellation of biequal thirds, as defined by earl Stanhope.

Equal *Harmony*, has been applied by Dr. Robert Smith to the different concords V, VI, and III, (or their complements 4th, 3d, and 6th,) when they are ſo tempered, as to be equally harmonious or pleaſant to the ear, as tempered concords; and the reſult of his laborious calculations for forming a ſyſtem, wherein every concord within the compaſs of *three* octaves ſhall be equally and the moſt harmonious, (Harmonics, p. 140.) is, that each V, VI, and III, are to be tempered $\frac{-5}{18}$, $\frac{+3}{18}$, and $\frac{-2}{18}$ parts of a major comma reſpectively: or, in a ſyſtem of four octaves of equally harmonious concords, theſe temperaments are to be $\frac{-11}{40}$, $\frac{+7}{40}$, and $\frac{-4}{40}$ parts of a comma for the V, VI, and III, reſpectively. But it is to be obſerved, that theſe temperaments are applicable only to inſtruments with 21 ſtrings, or pipes, in each octave, and not to the common piano-fortes, organs, &c. in uſe, with only 12 ſtrings, or pipes, of different pitches within the compaſs of an octave.

The term equal harmony has been, as we think, improperly applied by Mr. Emerſon, and others, to the *iſotonic* or *equal temperament* ſyſtem of intervals (which ſee); it being obſervable that Dr. Smith's deſign is to effect an equal harmony among the different concords, and the equal temperament makes an equal harmony among the different keys, which are in effect very different ſyſtems, and ought not to bear the ſame name.

Equal harmony alſo denotes the tuning by perfect 5ths without temperament, making all the keys participate equally of the imperfection of the ſcale on keyed inſtruments. By this method of tuning, the thirds will, at firſt, ſeem very harſh and crude; but by a little uſe the ear will accommodate itſelf to the evil, and indulge the abbé Rouſſier, or his manes, with the *triple progreſſion*, by which Pythagoras formed the ſcale, and by which the Chineſe, in the moſt remote antiquity, according to Pere Amiot, produced the few ſounds with which their imperfect ſcale is furniſhed. See Temperament and Triple *Progreſſion*.

Equal *Temperament*, is a ſyſtem of twelve intervals within an octave, all equal to each other; each of which has the ratio of $\sqrt[12]{2} = 51\Sigma + f + 4\frac{5}{12}m$, (ſee Philoſophical Magazine, vol. xxix. p. 347.) the common logarithm of each of ſuch mean ſemitones being = .9749141.6703. This ſyſtem is often called the iſotonic, and ſometimes that of Merſennus, by M. Couperin, M. Marpurg, Mr. Emerſon, Mr. Cavallo, Mr. Davis, and others, who have written in its favour. Dr. Robert Smith, who diſapproves of this ſyſtem, ſtates the temperaments of its V and 4th, its VI and 3d, and its III and 6th, to be $\frac{1}{10}$, $\frac{7}{10}$, and $\frac{6}{10}$ parts of a major comma reſpectively (Harmonics, p. 167.), but theſe are incorrect, and ought to have been $\frac{1}{11}$, $\frac{7}{11}$, and $\frac{6}{11}$ of a comma, the temperaments of theſe concords, very nearly, as ſtated in the firſt column of Tab. II. page 158, of the ſame work. Mr. Emerſon, in his "Algebra," prob. ccii. calculates the beats which the concords in this ſyſtem make, in the octave above the G of the baſs cliff, and ſtates theſe at − 15, + 11, + $1\frac{1}{2}$, − 1, − 18, and + 13 in one ſecond of time, made by the 3d, III, 4th, V, 6th, and VI reſpectively, the flat temperaments being marked − and the ſharp ones +.

The equal temperament of Mr. Farey, (Philoſophical Magazine, vol. xxviii. p. 65, and xxx. p. 6.) differs only in an inſenſible degree from the above, his half note being $51\Sigma + f + 5m$ between the notes C and ♭D, ♭E and E, F and ♭G, G and ♭A, and ♭B and B; and $51\Sigma + f + 4m$ between the notes ♭D and D, D and ♭E, E and F, ♭G and G, ♭A and A, A and ♭B, and B, &c.; yet this very ſlight variation enables an organ tuner to tune the twelve notes of this ſyſtem, by help of certain combinations of perfect Vths, 4ths, and IIIds! In this method of obtaining an equal temperament, the ſucceſſive 5ths C G, G D, D A, A E, E B, B ♭G, G ♭D, and D ♭A, are to be tuned upwards, each by aſcending (on a ſpare range of pipes or different ſtop to the one intended to be tuned) five ſucceſſive perfect 4ths, and from the higheſt note of theſe deſcending two perfect 5ths and one major 3d, which laſt or loweſt note is to be transferred to the G of the ſtop intended to be tuned. From this ſame note, G, five 4ths up, and two V + III down, are to be tuned to get D, and ſo on to ♭A. The remaining 5ths *c* F, F ♭B, and ♭B ♭E, are to be tuned downwards, by deſcending from *c* five ſucceſſive 4ths, and thence aſcending two Vths and a IIId to obtain F, from which note, repeating the ſame proceſs until the note ♭E is obtained; when, if the operations have been carefully performed, and *no beats* ſuffered to remain in any of the perfect 4ths, 5ths, 3ds, or uniſons, or in the octave C *c*, &c. the reſulting 5th, or that between the beating notes ♭A and ♭E, will be found, but in an almoſt inſenſible degree flatter than all the other fifths in the ſcale; the difference being only *m*, or leſs than $\frac{1}{1400}$th part of a major comma! between this V and each of the other eleven Vths: this being $357\Sigma + 7f + 30m$, and each of the others $375\Sigma + 7f + 31m$. The logarithm of the firſt or largeſt of the half-notes in this ſyſtem is = .9749119.1920, and of the ſmalleſt .9749157.7262. See Temperament.

Equal, in *Optics*. We ſay, that things ſeen under equal angles are equal. Equal parts of the ſame interval, or magnitude, if unequally diſtant from the eye, appear unequal. Equal objects, and at equal diſtances, only the one placed directly, and the other obliquely, ſeem unequal; and that placed directly, the bigger.

Maſonry by Equal *Courſes*. See Masonry.

EQUALITY, in *Algebra*, is a compariſon of two quantities, that are equal both really and repreſentatively, *i.e.* which are ſo both in effect and letters.

A compariſon of two quantities equal in effect, but unequal in letters, to render them equal, is called an *equation*, which ſee.

Equality is uſually denoted by two parallel lines, as =: thus $2 + 2 = 4$, *i.e.* 2 plus 2 are equal to 4. This character was firſt introduced by Robert Recorde. Des Cartes, and ſome after him, in lieu thereof, uſe $\propto$: thus, $2 + 2 \propto 4$; ſo $z - y \propto b + c$; ſignifies that *z* minus y is equal to b plus c.

From an equation we arrive at an equality, by changing an unknown letter into another, whereby the two members of the equation, *i.e.* the two quantities compared together, and connected by the ſign of equality, are rendered equal. Thus, in the equation $aax = bcd$; ſuppoſing $x = \frac{bcd}{aa}$, we change *x* into $\frac{bcd}{aa}$, and by this ſubſtitution arrive at the equality $bcd = bcd$.

In the ſolution of a numerical problem, which is to be rendered rational, if there be only one power to be equalled to a ſquare, or other higher power, it is called ſimple equality.

Where there are two powers to be equalled, each to a ſquare, it is called double equality, &c.

Diophantus hath given us a method for double equalities, and F. de Billy, another for triple equalities, in his Diophantus Redivivus.

EQUALITY, in *Aſtronomy*. *Circle of* Equality, or the *equant*. See Circle and Equant.

Equality denotes the exact agreement of two or more things in reſpect of quantity. Thus, figures are equal which may occupy the ſame ſpace, by the fluxion or tranſpoſition of their parts. See on this ſubject an elaborate diſſertation by Dr. Barrow, in the 11th and 12th of his Mathematical Lectures.

Equality, *ratio*, or *proportion of*, in *Geometry*, is that between two equal numbers, or quantities.

Proportion of Equality *evenly ranged*, or *ex æquo ordinata*, is that in which two terms in a rank, or ſeries, are proportional to as many terms in another ſeries, compared to each other in the ſame order, *i.e.* the firſt of one rank to the firſt of another; the ſecond to the ſecond, &c.

Proportion of Equality *evenly diſturbed*, called alſo *ex æquo perturbata*, is that in which more than two terms of one rank are proportional to as many terms of another compared to each other, in a different and interrupted order; *viz.* the firſt of one rank to the ſecond of another; the ſecond to the third, &c.

Equality, *Union of*. See Union.

Equality, in *Law*, the law delights in equality; ſo that when a charge is laid upon one, and divers ought to bear it, he ſhall have relief againſt the reſt. 2 Rep. 25.

EQUANIMITY, in *Ethics*, denotes an even, uniform temper of mind, amidſt all the varieties and revolutions of time and chance. This virtue, together with prudence, forms the character which Horace gives of Ariſtippus:

"Omnis Ariſtippum decuit color & ſtatus & res."

EQUANT, or ÆQUANT, in *Aſtronomy*, a circle, formerly imagined by aſtronomers, in the plane of the deferent, or eccentric; for regulating and adjuſting certain motions of the planets, and reducing them more eaſily to a calculus. See APOGEE, CIRCLE, DEFERENT, and EXCENTRIC.

EQUATED ANOMALY. See ANOMALY and ELLIPTIC *Motion*.

EQUATED *Bodies*. On Gunter's ſector there are ſometimes placed two lines, anſwering to one another, and called the lines of equated bodies: they lie between the lines of ſolids, and ſuperficies, and are noted with the letters D, I, C, S, O, T, for dodecahedron, icoſihedron, cube, ſphere, octahedron, and tetrahedron.

The uſes of theſe lines are, 1. When the diameter of the ſphere is given, to find the ſides of the five regular bodies, ſeverally equal to that ſphere. 2. From the ſide of any of the bodies being given, to find the diameter of the ſphere, and the ſides of the other bodies, which ſhall be equal ſeverally to the firſt body given.

If the ſphere be firſt given, take its diameter, and apply it over in the ſector in the points S, S: if any of the bodies be firſt given, apply the ſide of it over in its proper points; ſo the parallels taken from between the points of the other bodies ſhall be the ſides of thoſe bodies, equal ſeverally to the firſt body given.

EQUATION, in *Algebra*, is when two equal quantities, differently expreſſed, are compared together, by means of the ſign = placed between them.

Thus, $9 - 4 = 5$, is an equation expreſſing the equality of $9 - 4$ and 5; and $a + b - c = d$, is an equation denoting that the difference between the ſum of $a + b$, and c, is equal to d; the quantities between which the ſign = is placed being called the two ſides of the equation.

It is ſometimes cuſtomary, however, to place all the quantities on one ſide of the equation, and to make them equal to 0, or zero, on the other ſide; as $a - b = c$, or $a + b - c = 0$, &c. which is only ſetting down the difference of two equal quantities and putting it equal to 0.

The *terms* of an equation, are the ſeveral quantities or parts of which it is compoſed: thus, in the equation $a + b = c$, the terms are a, b, and c; and the ſenſe or meaning of the expreſſion is, that ſome quantity repreſented by c, is equal to the ſum of two others, repreſented by a and b.

When a quantity ſtands alone, on one ſide of an equation, the terms on the other ſide are ſaid to be a *value* of that quantity. Thus, in the equation $x = a - b$, the difference of the two numbers repreſented by a and b is called the value of x.

Equations are alſo diſtinguiſhed by the denominations of *ſimple* and *compound*, or, as they are frequently called, *ſimple* and *affected*; which latter term, however, it would be better to diſcard, as being leſs natural and appropriate than that of *compound*.

A ſimple equation, is that which contains only one power of the unknown quantity; as $x + a = b$, or $a x^2 + b = c$, or $2 x^3 + 3 a^3 = 4 b$, &c. where x denotes the unknown quantity, and the other letters or figures ſuch quantities as are known.

A compound equation, is that which contains two or more powers of the unknown quantity; as $x^2 + a x = b$, or $x^3 + a x^2 - b x = c$, &c.

Equations are likewiſe divided into different *orders*, according to the higheſt power of the unknown quantity contained in any one of their terms; as *quadratic*, *cubic*, *biquadratic*, &c. thus,

A quadratic equation, is that in which the unknown quantity riſes to two dimenſions, or that contains both the unknown quantity and its ſquare; as $x^2 + 10 x = 30$, or $a x^2 + b x = c$.

A cubic equation, is that in which the unknown quantity is of three dimenſions, or that riſes to the cube or third power; as $x^3 - 3 x = 1$, or $x^3 + 2 x^2 = 4$, or $a x^3 + b x^2 + c x = d$.

A biquadratic equation, is that in which the unknown quantity is of 4 dimenſions, or that riſes to the fourth power; as $x^4 + 2 x = 5$, or $x^4 + 3 x^2 = 10$, or $x^4 + 4 x^3 + 7 x = 50$, or $a x^4 + b x^3 + c x^2 + d x = e$. And ſo on, for the 5th, 6th and other higher order of equations; which are all denominated according to the higheſt power of the unknown quantity contained in any one of their terms.

The root of an equation, is that quantity, whether poſitive, negative, or even imaginary, that when ſubſtituted for the unknown quantity, will make both ſides of the equation vaniſh, or become equal to 0.

Thus, in the equation $x^2 - 6 x = 72$, either $+ 12$ or $- 6$ is a root, or value, of the unknown *quantity*; for if each of theſe numbers be ſeparately ſubſtituted for x, they will be found to ſatisfy the conditions of the equation.

In the reſolution of an equation, containing only one unknown quantity, ſeveral previous operations are often required to be performed, in order to adapt it to the rule to which it belongs; the greater part of which may be performed by means of a few ſelf-evident and obvious principles; namely, that if equal quantities be added to, or ſubtracted from, equal quantities, the ſums or remainders will be equal; if equal quantities be multiplied or divided by the ſame quantity the products or quotients will be equal; or if equal quantities be raiſed to the ſame power, or have the ſame root extracted, the reſults will ſtill be equal.

From theſe ſimple conſiderations are derived the following rules, which will equally apply to equations of all orders, and are alone ſufficient for the reſolution of ſimple equations.

Rule 1.—Any quantity may be tranſpoſed from one ſide of the equation to the other by changing its ſign.

Thus, if $x - 5 = 8$
Then $x = 8 + 5$
Or $x = 13$
And if $4 x - 8 = 3 x + 7$
Then $4 x - 3 x = 7 + 8$
Or $x = 15$

From this rule it alſo follows that if any quantity be found on each ſide of the equation, with the ſame ſign, it may be left out of both. And that the ſigns of all the terms of an equation may be changed into the contrary ones, without affecting the truth of the equation.

Thus, if $x + 2 = 7 + 2$
Then $x = 7$
And if $a - x = b - c$
Then $x - a = c - b$
Or $x = a + c - b$

Rule 2.—If the unknown quantity, in an equation, be multiplied by any quantity, that quantity may be taken away, by dividing all the reſt of the terms by it.

Thus, if $7 x = 49$
Then $x = \frac{49}{7} = 7$
And if $a x = b - c$
Then $x = \frac{b - c}{a}$

Rule 3.—If any term of an equation be a fraction, its denominator may be taken away, by multiplying all the reſt of the terms by it.

Thus, if $\frac{x}{2}=3$
Then $x=6$
And if $\frac{x}{a}-b=c$
Then $x-ab=ac$
Or $x=a(b+c)$

Or the denominators may be taken away from ſeveral terms of an equation, by one operation, if all the terms be multiplied by any number which is a multiple of each of the denominators.

Thus, if $\frac{x}{2}+\frac{x}{3}+\frac{x}{4}=6$

Then, if all the terms be multiplied by 12, which is a multiple of 2, 3 and 4,
We ſhall have $6x+4x+3x=72$
And $13x=72$
Or $x=\frac{72}{13}=5\frac{7}{13}$

It alſo appears, from this rule, that if each of the terms of an equation be either multiplied or divided by the ſame quantity, that quantity may be left out of them all.

Thus, if $ax=ab+ac$
Then $x=b+c$
And if $\frac{x}{a}+\frac{b}{a}=\frac{c}{a}$
Then $x+b=c$
Or $x=c-b$

4. If the unknown quantity, in any equation, be in the form of a ſurd, let it be made to ſtand alone on one ſide of the equation, and the remaining terms on the other; then involve each ſide to a power denoted by the index of the ſurd, and the quantity will thus be rendered free from any ſurd expreſſion.

If, for example, $\sqrt{x}+2=5$
Then, by tranſpoſition, $\sqrt{x}=5-2=3$
And, by ſquaring both ſides, $x=9$
In like manner, if $\sqrt{x^2+a}-x=b$
Then, by tranſpoſition, $\sqrt{x^2+a}=b+x$
And by ſquaring $x^2+a=b^2+2bx+x^2$
And by leaving out x^2 on each ſide $a=b^2+2bx$
Or $a-b^2=2bx$
Or $x=\frac{a-b^2}{2b}$

5. Any analogy, or proportion, may be converted into an equation, by making the product of the two extremes equal to that of the two means.

Thus, if $3x:16::5:7$
Then $3x\times 7=16\times 5$
Or $21x=80$
Or $x=\frac{80}{21}=3\frac{17}{21}$

Having thus ſhewn the manner in which a ſimple equation, containing only one unknown quantity, may be ſolved, it will be proper, in the next place, to explain the methods by which two or more equations of this kind may be reduced to a ſingle one, and thence reſolved by ſome of the foregoing rules; obſerving, in this caſe, that there muſt always be the ſame number of equations as there are unknown quantities, otherwiſe the queſtion will admit of a variety of anſwers.

The principal methods, made uſe of for this purpoſe, as far as regards the reſolution of two ſimple equations, are the three following:

1. Obſerve which of the unknown quantities is the leaſt involved, and find its value in each of the two equations by the methods already explained.

This being done, let the values, thus found, be put equal to each other; and there will ariſe a new equation, with only one unknown quantity in it, the value of which may be found as before.

As an example in this caſe, let it be required to determine x and y from the two following equations.

$2x+3y=23$
$5x-2y=10$

Then, from the 1ſt equation $x=\frac{23-3y}{2}$
And from the 2d, $x=\frac{10+2y}{5}$
Hence, if theſe two values be put equal to each other,
We ſhall have $\frac{10+2y}{5}=\frac{23-3y}{2}$
Or $20+4y=115-15y$
Therefore $15y+4y=115-20$
Or $19y=95$
And conſequently $y=\frac{95}{19}=5$
And $x=\frac{10+2y}{5}=\frac{10+10}{5}=\frac{20}{5}=4$

2. Conſider which of the unknown quantities you would firſt exterminate, and find its value in that equation where it is the leaſt involved.

Then ſubſtitute this value for its equal in the other equation, and there will ariſe a new equation, with only one unknown quantity in it, the value of which may be found as before.

Thus, taking the ſame example as in the former rule.

$2x+3y=23$
$5x-2y=10$

Then, from the 1ſt equation, $x=\frac{23-3y}{2}$

And, if this value be ſubſtituted for x in the 2d equation, we ſhall have

$5\left(\frac{23-3y}{2}\right)-2y=10$
Or $115-15y-4y=20$
And conſequently $115-20=15y+4y$
Or $y=\frac{95}{19}=5$
And $x=\frac{23-3y}{2}=\frac{23-15}{2}=\frac{8}{2}=4$

3. Let the given equations be multiplied or divided by ſuch numbers or quantities as will make the term which contains one of the unknown quantities the ſame in both equations.

Then, by adding or ſubtracting the two equations, as occaſion may require, there will ariſe a new equation with only one unknown quantity in it, which may be reſolved as before.

Thus, taking the ſame example as in the two former methods.

$2x+3y=23$
$5x-2y=10$

Then, to exterminate x, let the firſt equation be multiplied by 5, and the 2d by 2, and we ſhall have

$$10x + 15y = 115$$
$$10x - 4y = 20$$

And ſubtracting the latter of theſe two equations from the former, the reſult will be

$$19y = 95$$

And conſequently $y = \frac{95}{19} = 5$

And if this be ſubſtituted for y in the laſt of the two given equations, we ſhall have

$$5x - 2 \times 5 = 10$$
$$\text{Or } 5x = 10 + 10 = 20$$
$$\text{Or } x = \frac{20}{5} = 4$$

As another example of this third method, which is commonly more eaſy and expeditious in practice than either of the other two,

Let there be given $\left\{\begin{matrix} ax + by = c \\ dx + fy = g \end{matrix}\right\}$ to find x and y

Then, in order to exterminate y, let the firſt equation be multiplied by f, and the ſecond by b, and we ſhall have

$$afx + bfy = cf$$
$$bdx + bfy = bg$$

And by taking the difference of theſe two equations, there will ariſe

$$afx - bdx = cf - bg$$
$$\text{Or } (af - bd)\,x = cf - bg$$
$$\text{And conſequently } x = \frac{cf - bg}{af - bd}$$

In like manner, if the firſt of the two given equations be multiplied by d, and the ſecond by a, we ſhall have

$$adx + bdy = cd$$
$$adx + afy = ag$$

And, the difference of theſe equations being taken as before, will give

$$bdy - afy = cd - ag$$
$$\text{Or } (bd - af) = cd - ag$$
$$\text{And conſequently } y = \frac{cd - ag}{bd - af}$$

In which caſe, x and y are here found in general terms; and conſequently the ſolution will hold true, whatever numbers may be ſubſtituted for a, b, c, d, e, f, and g.

If it be required to exterminate three unknown quantities, or to reduce the three ſimple equations containing them to a ſingle one, it may be done as follows:

Find the value of one of the three unknown quantities in each of the three ſimple equations containing it; then compare the firſt of theſe values with the ſecond, and the ſecond with the third, and there will ariſe two new equations, containing only two unknown quantities, the values of which may be found by either of the former rules.

Let there be given, for example, the three following equations, to find x, y, and z.

$$x + y + z = 53$$
$$x + 2y + 3z = 105$$
$$x + 3y + 4z = 134$$

Then, if x be exterminated in each of theſe equations, we ſhall have,

$$x = 53 - y - z$$
$$x = 105 - 2y - 3z$$
$$x = 134 - 3y - 4z$$

And by comparing the firſt of theſe with each of the other two, there will ariſe the two following equations:

$$53 - y - z = 105 - 2y - 3z$$
$$53 - y - z = 134 - 3y - 4z$$

From which, by tranſpoſition, and the rules of addition and ſubtraction, we ſhall readily find,

$$y = 52 - 2z$$
$$y = \frac{81 - 3z}{2}$$

And conſequently, by equating theſe two values of y, we ſhall obtain,

$$\frac{81 - 3z}{2} = 52 - 2z$$
$$\text{Or } 81 - 3z = 104 - 4z$$
$$\text{Or } 4z - 3z = 104 - 81 = 23$$

Hence $z = 23$

$$y = 52 - 2z = 52 - 46 = 6$$
$$x = 53 - y - z = 53 - 6 - 23 = 24$$

And if the three following equations be propoſed, in general terms,

$$ax + by + cz = d$$
$$a'x + b'y + c'z = d'$$
$$a''x + b''y + c''z = d''$$

Then the values of x, y, and z, found in a ſimilar manner, will be as below:

$$z = \frac{ab'd' - ad'b'' + da'b'' - bad'' + bd'a'' - db'a''}{ab'c'' - acb'' + ca'b'' - ba'c'' + bc'a'' - cb'a''}$$

$$y = \frac{ad'c'' - ac'd'' + ca'd'' - da'c'' + dc'a'' - cd'a''}{ab'c'' - ac'b'' + ca'b'' - ba'c'' + bc'a'' - cb'a''}$$

$$x = \frac{db'c'' - dc'b'' + cd'b'' - bd'c'' + bc'd'' - cb'd''}{ab'c'' - acb'' + ca'b'' - ba'c'' + bc'a'' - cb'a''}$$

Where, if any numbers whatever be ſubſtituted in the place of the literal coefficients, the equation will hold: and in a manner analogous to this, we may exterminate four or more unknown quantities in general terms; and thence, by ſubſtitution, determine their values in any numeral equations that may be propoſed.

Having thus ſufficiently ſhewn the method of ſolving ſimple equations, it will next be proper to proceed to the reſolution of quadratic equations, or thoſe of the ſecond power, which, omitting the ſimple caſe $x^2 = a$, and confining ourſelves only to ſuch as are compound, may always be reduced to one of the three following forms:

$$1.\ x^2 + ax = b$$
$$2.\ x^2 - ax = b$$
$$3.\ x^2 - ax = -b$$

Where the value of the unknown quantity x, in each of the equations, taken according to the order in which they ſtand, may be exhibited as below:

$$1.\ x = -\frac{a}{2} \pm \sqrt{\frac{a^2}{4} + b}$$

$$2.\ x = +\frac{a}{2} \pm \sqrt{\frac{a^2}{4} + b}$$

$$3.\ x = +\frac{a}{2} \pm \sqrt{\frac{a^2}{4} - b}$$

Or the general equation $ax^2 \pm bx = \pm c$, which comprehends all the three caſes above-mentioned, may be reſolved by means of the following rule:

Tranſpoſe all the terms that involve the unknown quantity to one ſide of the equation, and the known quantities to the other; obſerving to arrange them ſo, that the term which contains the ſquare of the unknown quantity may be poſitive, and ſtand firſt in the equation.

Then, if the ſquare of the unknown quantity have any coefficient prefixed to it, let all the reſt of the terms be divided by it, ſo that the coefficient of the ſquare of the unknown quantity may be 1.

This being done, add the ſquare of half the coefficient of the unknown quantity itſelf to both ſides of the equation, and the ſide which involves the unknown quantity will now be a complete ſquare.

Laſtly, extract the ſquare root of both ſides of the equation, by which means it will be reduced to a ſimple one; and if the unknown quantity be made to ſtand alone, on one ſide of the equation, and the known terms on the other, its value will be determined as was required.

Note. The ſquare root of the firſt ſide of the equation is always equal to the ſum or difference of the unknown quantity, and half the coefficient of the ſecond term, according as that term is + or −.

It may alſo be obſerved, that all equations, in which there are two terms involving the unknown quantity, and which have the index of the one juſt double that of the other, are ſolved like quadratics, by completing the ſquare.

Thus, $x^4 - ax^2 = b$, or $x^{2n} - ax^n = b$, are the ſame as quadratics; their roots being as below.

$$x = \sqrt{\frac{a}{2} \pm \sqrt{\frac{a^2}{4} + b}},\quad x = \sqrt[n]{\frac{a}{2} \pm \sqrt{\frac{a^2}{4} + b}}$$

As an illuſtration of the rule for quadratics given above, the following ſimple examples in numbers will be found ſufficient.

1. Given $x^2 + 4x = 140$, to find x.

Here $x^2 + 4x + 4 = 140 + 4 = 144$, by completing the ſquare.

And $\sqrt{x^2 + 4x + 4} = \sqrt{144}$, by extracting the root.
Or, which is the ſame thing, $x + 2 = 12$.
And conſequently $x = 12 - 2 = 10$.

2. Given $x^2 - 6x + 8 = 80$, to find x.
Here $x^2 - 6x = 80 - 8 = 72$, by tranſpoſition.
Then $x^2 - 6x + 9 = 72 + 9 = 81$, by completing the ſquare.
And $x - 3 = \sqrt{81} = 9$, by extracting the root.
Whence $x = 9 + 3 = 12$.

3. Given $2x^2 + 8x - 20 = 70$, to find x.
Here $2x^2 + 8x = 70 + 20 = 90$, by tranſpoſition.
Then $x^2 + 4x = 45$, by dividing by 2.
And $x^2 + 4x + 4 = 45 + 4 = 49$, by completing the ſquare.
Whence $x + 2 = \sqrt{49} = 7$, by extracting the root.
And conſequently $x = 7 - 2 = 5$.

4. Given $\frac{x^2}{2} - \frac{x}{3} + 20\frac{1}{2} = 42\frac{2}{3}$.

Here $\frac{x^2}{2} - \frac{x}{3} = 42\frac{2}{3} - 20\frac{1}{2} = 22\frac{1}{6}$, by tranſpoſition.

And $x^2 - \frac{2}{3}x = 44\frac{1}{3}$, by dividing by $\frac{1}{2}$, or multiplying by 2.

Whence $x^2 - \frac{2}{3}x + \frac{1}{9} = 44\frac{1}{3} + \frac{1}{9} = 44\frac{4}{9} = \frac{400}{9}$, by completing the ſquare.

And $x - \frac{1}{3} = \sqrt{\frac{400}{9}} = \frac{20}{3}$.
Therefore $x = \frac{20}{3} + \frac{1}{3} = \frac{21}{3} = 7$.

It muſt here, however, be obſerved, that ſince the ſquare root of any quantity may be either poſitive (+) or negative (−), it follows that all quadratic equations will admit of two ſolutions. Thus, the ſquare root of a^2 (or $\sqrt{a^2}$) is either $+a$ or $-a$; for $(+a) \times (+a)$ or $(-a \times -a)$ are each equal to a^2, by the rules for the ſigns in multiplication. So, in like manner, if there be given $x^2 + ax = b$, where $x + \frac{a}{2}$ is found $= \sqrt{b + \frac{1}{4}a^2}$, the root may be $+\sqrt{b + \frac{1}{4}a^2}$, or $-\sqrt{b + \frac{1}{4}a^2}$, ſince either of them being multiplied by itſelf will produce $b + \frac{1}{4}a^2$. And this ambiguity is uſually expreſſed by writing the uncertain ſign ± before $\sqrt{b + \frac{1}{4}a^2}$, by which means we have $x = \pm\sqrt{b + \frac{1}{4}a^2} - \frac{1}{2}a$; and the ſame mode of reaſoning is equally applicable to any literal or numeral quadratic equation whatever. Thus, in the firſt numeral equation above, $x^2 + 4x = 140$, it has been found that $x + 2 = \sqrt{144} = 12$; but if the uncertain ſign ± be put before $\sqrt{144}$, it will become $x + 2 = \pm\sqrt{144} = +12$ or -12; and conſequently $x = +12 - 2 = 10$ or $-12 - 2 = -14$, which are the two roots of the equation $x^2 + 4x = 140$, as will be found by ſubſtituting either of them for x; the reſult in both caſes being 144.

In addition to this, it may be ſtill farther remarked, that a quadratic equation may be propoſed of ſuch a form, or have its coefficients ſo related to each other, that the value of the unknown quantity can only be exhibited by means of the ſquare root of a negative quantity, which, it is plain, cannot be determined; as there is no quantity, either poſitive or negative, which being multiplied by itſelf produces ſuch a form of expreſſion. If, for example, the value of x were required from the equation $x^2 + 13 = 4x$, or $x^2 - 4x = -13$, we ſhould find $x = 2 \pm \sqrt{-9}$; and as it is here neceſſary to extract the ſquare root of -9, which cannot be determined, the queſtion is ſhewn to be impoſſible, or to involve a contradiction.

But although imaginary expreſſions of this kind are of no other uſe in the reſolution of quadratic equations, than to ſhew that a particular problem cannot be ſolved, they muſt not, on this account, be altogether rejected; as they are well known to be of the greateſt uſe in many mathematical inveſtigations, particularly in ſome of the higher branches of the ſcience, where no other mode of reaſoning could be ſo ſucceſsfully or advantageouſly employed.

Thus, if e be made to repreſent the number of which the hyperbolic logarithm is 1, it is well known, as a theorem in trigonometry, that

$$\text{Coſ.}\ x = \frac{e^{x\sqrt{-1}} + e^{-x\sqrt{-1}}}{2}$$

$$\text{Sin.}\ x = \frac{e^{x\sqrt{-1}} - e^{-x\sqrt{-1}}}{2\sqrt{-1}}$$

Where the ſine and coſine of any arc x is exhibited in a very commodious manner, by means of imaginary exponential expreſſions; which formulæ, though objected to, and ridiculed by certain writers, are conſidered, by the celebrated Lagrange (Leçons, ſur des Fonct. Analytiques) as one of the fineſt analytical diſcoveriesof the eighteenth century.

Having thus ſufficiently explained the nature of quadratic equations, it will be neceſſary, before we proceed to the reſolution of cubics and thoſe of higher dimenſions, to ſhew how the ſecond term of any equation may be taken away, in order to fit it for a ſolution; which is done as follows:

Divide the coefficient of the ſecond term of the propoſed equation by the exponent of the firſt term, and add the quotient, with its ſign changed, to ſome new unknown quantity: then if this ſum be ſubſtituted for the unknown quantity in the propoſed equation, a new equation will ariſe, which will want the ſecond term, as required.

For example, let the quadratic equation $x^2 - 8x + 15 = 0$, be that of which it is required to take away its ſecond term.

Then ſince $\frac{8}{2} = 4$, if x be put $= y + 4$, we ſhall have, $x^2 =$

$$\begin{array}{rl} x^2 = & y^2 + 8y + 16 \\ -8x = & \quad -8y - 32 \\ +15 = & \qquad\quad +15 \\ \hline \end{array}$$

Whence $y^2 - 1 = 0$, the equation required.

From which it appears, that any quadratic equation may be ſolved without completing the ſquare, by only taking away the ſecond term; for ſince in the above reduced equation $y = \sqrt{1} = 1$, we ſhall have $x = y + 4 = 1 + 4 = 5$.

Again, let the equation $x^3 - 9x^2 + 26x - 34 = 0$ be given, to exterminate the ſecond term.

Then ſince $\frac{9}{3} = 3$, if x be put $= y + 3$, we ſhall have,

$$\begin{array}{rl} x^3 = & y^3 + 9y^2 + 27y + 27 \\ -9x^2 = & \quad -9y^2 - 54y - 81 \\ +26x = & \qquad\quad +26y + 78 \\ -34 = & \qquad\qquad\quad -34 \\ \hline \end{array}$$

Whence $y^3 - y - 10 = 0$, or $y^3 - y = 10$, the equation required.

In like manner, let the following literal equations of the fourth power $x^4 + px^3 + qx^2 + rx + s = 0$ be given, to exterminate the ſecond term.

Then, by putting $x = y - \frac{p}{4}$, we ſhall have,

$$\begin{array}{rl} x^4 = & y^4 - py^3 + \frac{3p^2}{8}y^2 - \frac{p^3}{16}y + \frac{p^4}{256} \\ px^3 = & \quad + py^3 - \frac{3p^2}{4}y^2 + \frac{3p^3}{16}y - \frac{p^4}{64} \\ qx^2 = & \qquad\quad + qy^2 - \frac{pq}{2}y + \frac{qp^2}{16} \\ rx = & \qquad\qquad\quad + ry - \frac{rp}{4} \\ s = & \qquad\qquad\qquad + s \\ \hline \end{array}$$

Hence $y^4 + \frac{8q - 3p^2}{8}y^2 + \frac{8r - 4pq + p^3}{8}y + \frac{256s - 64rp + 16qp^2 - 4p^3 + p^4}{256} = 0$, the reduced equation required. And the ſame method of ſolution may be applied to the taking away the ſecond term of any equation whatever.

Another ſpecies of transformation, of uſe in reducing equations to their ſimpleſt form, is that of converting ſuch of the terms as have fractional coefficients into others that ſhall be integral; which is done by ſubſtituting a new unknown quantity, divided by the product of all the denominators, inſtead of the unknown quantity in the equation; and then, by proper reductions, the equation will be found to have the form required.

Thus, let $x^4 + \frac{p}{a}x^3 + \frac{q}{b}x^2 + \frac{r}{c}x + \frac{s}{d} = 0$, be the given equation.

Then, if x be aſſumed $= \frac{y}{abcd}$, we ſhall have, by ſubſtitution,

$$\frac{y^4}{a^4b^4c^4d^4} + \frac{py^3}{a^4b^3c^3d^3} + \frac{qy^2}{a^2b^3c^2d^2} + \frac{ry}{abc^2d} + \frac{s}{d} = 0.$$

And by multiplying the whole equation by $a^4b^4c^4d^4$ it will become

$$y^4 + bcdpy^3 + a^2bc^2d^2qy^2 + a^3b^3c^2d^3ry + a^4b^4c^4d^3 = 0,$$

which is of the form required.

This preparation being made, it will now be proper to proceed to the ſolution of *cubic equations*, or thoſe of which the higheſt power is of three dimenſions; all of which, when expreſſed in general terms, are of the form

$$x^3 \pm px^2 \pm qx \pm r = 0.$$

Or, if the ſecond term be taken away, by means of the above-mentioned rule, any equation of this kind may be exhibited under the form

$$x^3 \pm px = \pm q$$

And, in this caſe, the value of the unknown quantity x, according to the rule uſually aſcribed to Cardan, is as follows:

$$x = \sqrt[3]{\tfrac{1}{2}q + \sqrt{(\tfrac{1}{2}q)^2 + (\tfrac{1}{3}p)^3}} + \sqrt[3]{\tfrac{1}{2}q - \sqrt{(\tfrac{1}{2}q)^2 + (\tfrac{1}{3}p)^3}}$$

Or

$$x = \sqrt[3]{\tfrac{1}{2}q + \sqrt{(\tfrac{1}{2}q)^2 + (\tfrac{1}{3}p)^3}} - \frac{\tfrac{1}{3}p}{\sqrt[3]{\tfrac{1}{2}q + \sqrt{(\tfrac{1}{2}q)^2 + (\tfrac{1}{3}p)^3}}}$$

the values of p and q being always ſuppoſed to be taken with the ſign + or −1 according as they are found in the given equation.

The rule may be demonſtrated thus:

Let the equation, whoſe root is to be determined, be

$$x^3 + px = q$$

Then if x be aſſumed $= y + z$, we ſhall have, by ſubſtitution,

$$\begin{array}{rl} x^3 = & y^3 + 3yz(y + z) + z^3 \\ px = & \qquad p(y + z) \\ \hline \end{array}$$

$$\text{Or } x^3 + px = y^3 + \overline{3yz + p} \times \overline{y + z} + z^3 = q$$

And if, in this laſt equation, $3yz$ be taken $= -p$, we ſhall have the two following equations for determining the values of y and z: *viz.*

$$\begin{array}{rl} 3yz = & -p \\ y^3 + z^3 = & \quad q \end{array}$$

Where, ſince in the firſt of them, $z = -\frac{p}{3y}$, if this value be ſubſtituted in the ſecond, it will become

$$y^3 - \frac{p^3}{27y^3} = q$$

Or by multiplying by y^3, and then tranſpoſing the terms,

$$y^6 - qy^3 = (\tfrac{1}{3}p)^3$$

And as this equation is now in the form of a quadratic, on account of the index of the higheſt term being double that of the ſecond, we ſhall have, by the rule already given for that purpoſe, and by ſimple equations.

$$y = \sqrt[3]{\tfrac{1}{2}q \pm \sqrt{(\tfrac{1}{2}q)^2 + (\tfrac{1}{3}p)^3}}$$

$$z = \frac{\tfrac{1}{3}p}{\sqrt[3]{\tfrac{1}{2}q \pm \sqrt{(\tfrac{1}{2}q)^2 + (\tfrac{1}{3}p)^3}}}$$

Whence $x = y + z = \sqrt[3]{\tfrac{1}{2}q \pm \sqrt{(\tfrac{1}{2}q)^2 + (\tfrac{1}{3}p)^3}} - \dfrac{\tfrac{1}{3}p}{\sqrt[3]{\tfrac{1}{2}q \pm \sqrt{(\tfrac{1}{2}q)^2 + (\tfrac{1}{3}p)^3}}}$ as was to be ſhewn.

As a practical application of the rule, let there be given the equation $x^3 + 6x = 20$, to find the value of x.

Thus, if p be put $= 6$, and $q = 20$, the analytical expreſſion will become

$$\sqrt[3]{10 + \sqrt{100 + 8}} - \frac{2}{\sqrt[3]{10 + \sqrt{100 + 8}}} = \sqrt[3]{10 + \sqrt{108}} - \frac{2}{\sqrt[3]{10 + \sqrt{108}}}$$

$$= \sqrt[3]{10 + 10.3923} - \frac{2}{\sqrt[3]{10 + 10.3923}} = \sqrt[3]{20.3923} - \frac{2}{\sqrt[3]{20.3923}}$$

$$= 2.732$$

$= 2.732 - \frac{2}{2.732} = 2.732 - .732 = 2$, which is the required value of x.

It happens, however, that the value of the unknown quantity is here only found by approximation; but this, when the root is a whole number, may always be avoided, for ſince in the preſent inſtance, $\sqrt[3]{10 + \sqrt{108}} = 1 + \sqrt{3}$, as may be proved by raiſing it to the third power, if this be ſubſtituted in its proper place, in the above expreſſions, we ſhall have $\sqrt{10 + \sqrt{108}} - \frac{2}{\sqrt[3]{10 + \sqrt{108}}} = 1 + \sqrt{3}$

$$- \frac{2}{1+\sqrt{3}} = \frac{(1 + \sqrt{3})^2 - 2}{1+\sqrt{3}} = \frac{1 + 2\sqrt{3} + 3 - 2}{1+\sqrt{3}}$$

$= \frac{2 + 2\sqrt{3}}{1 + \sqrt{3}} = 2$, as before.

Again, as a ſecond example, let there be given $x^3 - 6x = - q$, to find the value of x.

Here $p = - 6$ and $q = - q$

Then, by ſubſtituting theſe values in the above formula, we have

$$x = \sqrt[3]{-4\tfrac{1}{4} + \sqrt{20\tfrac{1}{2} - 8}} - \frac{-2}{\sqrt[3]{-4\tfrac{1}{4} + \sqrt{20\tfrac{1}{2} - 8}}}$$

$$= \sqrt[3]{-4\tfrac{1}{2} + 3\tfrac{1}{2}} + \frac{2}{\sqrt[3]{-4\tfrac{1}{2} + 3\tfrac{1}{2}}} = \sqrt[3]{-1} + \frac{2}{\sqrt[3]{-1}}$$

$= -1 + \frac{2}{-1} = - 1 - 2 = - 3$, the required value of x.

But as a quadratic equation has been ſhewn to have two roots, or values, of the unknown quantity, ſo, in like manner, it may be proved that the unknown quantity, in a cubic equation, has three values or roots, each of which will be found to anſwer the conditions of the queſtion.

Thus, in the firſt equation $x^3 + 6x - 20 = 0$, given above, where x has been found $= 2$, or $x - 2 = 0$, if $x^3 + 6x - 20 = 0$ be divided by $x - 2$, we ſhall have $x^2 + 2x + 10 = 0$, or $x^2 + 2x = - 10$, the roots of which equation, found according to the rule for quadratics, are $- 1 + 3\sqrt{-1}$, and $- 1 - 3\sqrt{-1}$, each of which, as well as the former root 2, are values of the unknown quantity, as will be found by ſubſtituting them for x in the given equation.

It muſt be obſerved, however, that neither the formula of Cardan, nor any other that has yet been diſcovered, will be found ſufficient to determine the numerical value of the unknown quantity in every cubic equation that can be propoſed; for when the coefficient of the ſecond term of the equation is negative, and the cube of $\frac{1}{3}$ of it is greater than the ſquare of half the abſolute term, the expreſſion for the root becomes imaginary; and therefore no intelligible reſult can be derived from it.

Thus, if the equation propoſed, were $x^3 - 3x = 1$, the analytical expreſſion, when converted into numbers, will become $x = \sqrt[3]{\frac{1}{2} + \sqrt{\frac{1}{4} - 1}} - \frac{1}{\sqrt[3]{\frac{1}{2} + \sqrt{\frac{1}{4} - 1}}} =$

$\sqrt[3]{\frac{1}{2} + \frac{1}{2}\sqrt{-3}} - \frac{1}{\sqrt[3]{\frac{1}{2} - \frac{1}{2}\sqrt{-3}}}$, the value of which cannot be determined either in integers, fractions, or rational ſurds; although, by ſubſtituting it for x in the given equation, the terms will all vaniſh as they ought; and conſequently, in a certain ſenſe, it may be ſaid to be a root of the equation.

This defective ſtate of Cardan's formula, or that in which it fails as a general rule, has commonly been called the *irreducible caſe of cubic equations*; and notwithſtanding the reiterated efforts of the moſt celebrated analiſts in Europe, from the time when the want of generality in the rule was firſt obſerved, to the preſent day, no remedy has been found for this defect, except by a method of ſolution which is derived from the triſection of an angle, or by converting the expreſſion into an infinite ſeries; in which latter caſe that part of the quantity which is imaginary diſappears, and by that means enables us to compute the root to any degree of exactneſs. For it is to be remarked, that although the unknown quantity cannot be determined from the formula itſelf, yet all the three roots are, in this caſe, real, and can be found, at leaſt approximately, by either of the two methods laſt-mentioned.

Leaving this part of the ſubject, for the preſent, we ſhall next proceed to *biquadratic equations*, or thoſe of the fourth power; any one of which, when the ſecond term is taken away, may be repreſented, in general terms, by $x^4 + ax^2 + bx + c = 0$; and the rule for the reſolution of any equation of this form, is as follows:

Find the value of y in the cubic equation $y^3 - \frac{a^2 + 12c}{3}y = b^2 + \frac{2a}{27}(a^2 - 36c)$, by the rule before given for this purpoſe; and let the root, thus determined, be denoted by v.

Then find each of the values of x in the two following quadratic equations,

$$x^2 + (\sqrt{v - \tfrac{2}{3}a})x = - [\tfrac{1}{2}a + \tfrac{1}{2}(v - \tfrac{2}{3}a)] + \frac{b}{2\sqrt{v - \frac{2}{3}a}}$$

$$x^2 - (\sqrt{v - \tfrac{2}{3}a})x = - [\tfrac{1}{2}a + \tfrac{1}{2}(v - \tfrac{2}{3}a)] - \frac{b}{2\sqrt{v - \frac{2}{3}a}}$$

And the values of x, thus found, will be the four roots of the biquadratic equation $x^4 + ax^2 + bx + c = 0$, as was required.

The rule, which is here given in a more commodious form than that of Des Cartes, may be readily demonſtrated, by making the given equation $x^4 + ax^2 + bx + c = 0$, equal to the product of two quadratic equations, and then equating the coefficients of the homologous terms. Thus, if $x^2 + px + q$ be multiplied by $x^2 - px + r$, and the product thence ariſing put $= 0$, we ſhall have $x^4 + (r + q - p^2)x^2 + p(r - q)x + rq = 0$.

Hence $r + q - p^2 = a$, $p(r - q) = b$, and $rq = c$; and conſequently $2r = a + p^2 + \frac{b}{p}$, and $2q = a + p^2 - \frac{b}{p}$.

And if theſe values be ſubſtituted in the equation $rq = c$, or its equal $4rq = 4c$, we ſhall obtain, after proper reduction, the equation $p^6 + 2ap^4 + (a^2 - 4c)p^2 = b^2$.

Or, by putting $p^2 = y - \frac{2}{3}a$, and ſubſtituting it in the latter equation, we ſhall have for the reſult the cubic equation $y^3 - \frac{a^2 + 12c}{3}y = b^2 + \frac{2a}{27}(a^2 - 36c)$, which is that given in the rule.

Hence, if the value, or root of y, in this equation, be put $= v$, we ſhall have, from the equations given above, $p = \sqrt{v - \frac{2}{3}a}$, $q = \frac{1}{2}a + \frac{1}{2}(v - \frac{2}{3}a) - \frac{b}{2\sqrt{v - \frac{2}{3}a}}$, and $r = \frac{1}{2}a + \frac{1}{2}(v - \frac{2}{3}a) + 2\sqrt{v - \frac{2}{3}a}$. And by, ſubſtituting theſe values in the two quadratic equations $x^2 + px + q = 0$, and $x^2 - px + r = 0$, they will become $x^2 + \left(\sqrt{v - \frac{2}{3}a}\right) x = -\frac{1}{2}a - \frac{1}{2}\left(v - \frac{2}{3}a\right) + \frac{b}{2\sqrt{v - \frac{2}{3}a}}$, and $x^2 - \left(\sqrt{v - \frac{2}{3}a}\right) x = -\frac{1}{2}a - \frac{1}{2}\left(v - \frac{2}{3}a\right) - \frac{b}{2\sqrt{v - \frac{2}{3}a}}$; the roots of which equations will be the 4 roots of the propoſed biquadratic equation $x^4 + ax^2 + bx + c = 0$. As a practical example for the exerciſe of this rule, let there be given $x^4 - 6x^2 - 16x + 21 = 0$, to find the 4 values of x.

Then, if the numbers -6, -16, and 21 be ſubſtituted in the place of a, b, c, in the cubic equation $y^3 - \frac{a^2 + 12c}{3}y = b^2 + \frac{2a}{27}(a^2 - 36c)$, it will become $y^3 - \frac{36 + 252}{3}y = 256 - \frac{12}{27}(36 - 756)$, or $y^3 - 96y = 576$, where the value of y, as determined by the preceding rule for cubic equations, will be found $= 12$.

Hence, if 12 be put for v, -6 for a, and -16 for b, in the two quadratic equations,

$$x^2 + \left(\sqrt{v - \tfrac{2}{3}a}\right) x = -\tfrac{1}{2}a - \tfrac{1}{2}\left(v - \tfrac{2}{3}a\right) + \frac{b}{2\sqrt{v - \frac{2}{3}a}}$$

$$x^2 - \left(\sqrt{v - \tfrac{2}{3}a}\right) x = -\tfrac{1}{2}a - \tfrac{1}{2}\left(v - \tfrac{2}{3}a\right) - \frac{b}{2\sqrt{v - \frac{2}{3}a}}$$

they will become,

$$x^2 + \left(\sqrt{12 + 4}\right) x = 3 - 8 - 2 = -7$$
$$x^2 - \left(\sqrt{12 + 4}\right) x = 3 - 8 + 2 = -3$$

Or,

$$x^2 + 4x + 7 = 0$$
$$x^2 - 4x + 3 = 0$$

In the firſt of which $x = -2 + \sqrt{-3}$, or, $-2 - \sqrt{-3}$. And in the ſecond, $x = 3$ or 1, which are the roots of the given equation $x^4 - 6x^2 - 16x + 21 = 0$; there being always as many values of the unknown quantity, in any equation, as there are units in the index of its higheſt power; as will be ſhewn in a ſucceeding part of this article.

But before we proceed to any enquiries of this kind it will be proper to obſerve, that no general rule has hitherto been found for reſolving equations of the 5th, 6th, or other higher orders, notwithſtanding the numerous attempts that have been made for this purpoſe; ſo that in this reſpect we have not been able to advance a ſingle ſtep beyond what had been done by Louis Ferrari, Bombelli, and others in the early part of the 17th century, who were all acquainted with the method of reſolving biquadratic equations; which is ſtill the boundary that the moſt ſkilful analiſts, aſſiſted by all the advantages of a more comprehenſive and commodious calculus, have not been able to paſs.

But although no general reſolution has hitherto been given of equations higher than thoſe of the 4th power, there are, notwithſtanding, ſome particular equations, of all orders, which, on account of certain relations ſubſiſting between the coefficients of their different terms, may be reſolved by the rules which have been given for thoſe of the firſt four orders.

This is particularly the caſe with what have been uſually called *reciprocal equations*, which are ſuch that the coefficients of the terms form the ſame numerical ſeries, whether taken in a direct or an inverted order; or that remain the ſame when the reciprocal of the unknown quantity, or $\frac{1}{x}$ is ſubſtituted for x.

Thus, for example, the equations $x^5 + px^4 + qx^3 + qx^2 + px + 1 = 0$, $x^4 + px^3 + qx^2 + px + 1 = 0$, &c. which are of this kind, may always be transformed into others of a degree denoted by half the exponent of the higheſt power of the unknown quantity, if it be an even number, or by half the exponent diminiſhed by 1, if it be an odd number.

Thus, let the laſt of the two equations given above, $x^4 + px^3 + qx^2 + px + 1 = 0$, be taken in the form $x^2 + \frac{1}{x^2} + p\left(x + \frac{1}{x}\right) + q = 0$, to which it can be readily reduced; then if $x + \frac{1}{x}$ be put $= z$, we ſhall have $x^2 + 2 + \frac{1}{x^2} = z^2$, or $x^2 + \frac{1}{x^2} = z^2 - 2$; and if this be ſubſtituted in the original equation $x^4 + px^3 + qx^2 + px + 1 = 0$, it will become $z^2 + pz = 2 - q$. And ſince $x + \frac{1}{x} = z$, we ſhall have $x^2 - zx + 1 = 0$. Hence, if the two roots of the equation $z^2 + pz = 2 - q$, be denoted by r and r', we ſhall have the two following equations $x^2 - rx + 1 = 0$, and $x^2 - r'x + 1 = 0$; the roots of which will be the four roots of the given biquadratic equation $x^4 + px^3 + qx^2 + px + 1 = 0$.

And in a ſimilar way may any other equation of this kind be reſolved, when the index of the greateſt power of the unknown quantity is an even number.

And if the index of the unknown quantity be an odd number, as in the equation $x^5 + px^4 + qx^3 + qx^2 + px + 1 = 0$, it is obvious from inſpection only, that -1 is a root of the equation; and, conſequently, if $x^5 + px^4 + qx^3 + qx^2 + px + 1 = 0$, be divided by $x + 1$, it will be reduced to the form $x^4 + (p - 1)x^3 - (p - q - 1)x^2 + (p - 1)x + 1 = 0$, which is another reciprocal equation, a degree lower than the former; and having the index of its higheſt power an even number, it is conſequently reſolvible in the manner above explained.

Alſo, when two or more roots of any equation are equal to each other, the equation may always be reduced to another of an inferior degree, and the roots, by that means, determined.

Thus, if the cubic equation $x^3 - px^2 + qx - r = 0$, has two equal roots, each of them will be $x = \frac{pq - qr}{p^2 - 6q}$.

For, let the three roots be denoted by a, a and b; then by the compoſition of equations we ſhall have $x^3 - (2a + b)x^2 + (a^2 + 2ab)x - a^2b = 0$; where $2a + b = p$, $a^2 + 2ab = q$, and $a^2b = r$; and if theſe values be ſubſtituted in the above form, it will become $x = \frac{pq - qr}{p^2 - 6q} = \frac{2a^3 + 4a^2b + a^2b + 2ab^2 - 9a^2b}{8a^2 + 8ab + 2b^2 - 6a^2 - 12ab} = \frac{2a^3 - 4a^2b + 2ab^2}{2a^2 - 4ab + 2b^2} = a$, as was to be ſhewn.

Thus, let the equation $x^3 + 5x^2 - 32x + 36 = 0$, which has two equal roots, be the one propoſed to be reſolved.

Then ſince $p = -5$, $q = -32$, and $r = -36$, if theſe values be ſubſtituted in the formulæ $x = \frac{pq - qr}{p^2 - 6q}$, it will become $x = \frac{-5 \times -32 - 9 \times -36}{2 \times 25 - 6 \times -32} = \frac{160 + 324}{50 + 192} = \frac{484}{242} = 2$, which is one of the equal roots of the equation.

And in a ſimilar manner may the equal roots of equations of the higher orders be determined; but though the ſubject conſidered as a branch of analyſis is highly curious, and on that account has been far more completely and ſcientifically inveſtigated than in the caſe here given, its practical importance is too trifling to render any farther elucidation of it neceſſary, in an article ſo confined as the preſent. The ſame may alſo be ſaid of the method uſually given for determining the roots of an equation by means of the diviſors of its laſt term, and other ſimilar proceſſes, which are moſtly tentative, and only adapted to the finding ſuch roots of the equation as are rational, and for that reaſon readily diſcovered by a few trials.

It remains, therefore, only to ſhew how the roots of any numeral equation whatever may be determined by approximation; for which purpoſe, it will be ſufficient to give the rule firſt employed by Newton and Ralphſon, which, though attended with ſome defects, is as commodious, when conſidered as a general method of ready and eaſy application, as any one that has yet been propoſed. The rule is as follows.

Find, by trial, a number nearly equal to the root required, which call r; and let z be put equal to the difference between r and the true root x.

Then, inſtead of x in the given equation, ſubſtitute its equal $r \pm z$, and there will ariſe a new equation, affected only with z, and known quantities.

This done, reject all thoſe terms in which there are two or more dimenſions of z, and the value of z will then be found by means of a ſimple equation.

And if the value of z, thus found, be added to, or ſubtracted from, that of r, according as r was aſſumed too great or too little, it will give the root required *nearly*.

And if this root ſhould not be thought ſufficiently near the truth, the operation muſt be repeated, by ſubſtituting the laſt reſult inſtead of r, in the equation exhibiting the value of z; by which a ſecond correction of the root will be obtained more accurate than the former, and ſo on to any degree of exactneſs required.

As a practical example, for the illuſtration of the rule, let there be given the equation $x^3 + x^2 + x = 90$, to find the value of x by approximation.

Here it is ſoon found, by a few trials, that the root is ſomething greater than 4.

Let, therefore, $4 = r$, and $r + z = x$, then,

$$\begin{aligned} x^3 &= r^3 + 3r^2z + 3rz^2 + z^3 \\ x^2 &= r^2 + 2rz + z^2 \\ x &= r + z \end{aligned}$$

And conſequently by rejecting the terms $z^3 + 3rz^2 + z^2$, we ſhall have $r^3 + 3r^2z + r^2 + 2rz + r + z = 90$;

or, $z = \dfrac{90 - r^3 - r^2 - r}{3r^2 + 2r + 1} = \dfrac{90 - 64 - 16 - 4}{48 + 8 + 1} = \dfrac{6}{57} = .10$, and $x = 4 + .10 = 4.1$, nearly.

And again, if 4.1 be ſubſtituted in the place of r, in the laſt equation, we ſhall have.

$z = \dfrac{90 - r^3 - r^2 - r}{3r^2 + 2r + 1} = \dfrac{90 - 68.921 - 16.81 - 4.1}{50.43 + 8.2 + 1} = \dfrac{78.121}{59.63} = .00283$; and $x = 4.1 + .00283 = 4.10283$.

And by proceeding in this manner, the root may be obtained to any degree of accuracy required.

The chief defect in this rule is, that it does not ſhew the progreſs made in the approximation at each operation, and that when the roots are ſmall and ſome of them nearly equal to each other, they may be paſſed over, by this method of operating, without their being perceived; both of which circumſtances have been particularly noticed by Lagrange, who has given an improved method of approximation in his excellent work on the "Réſolution des Equations Numériques," to which we muſt refer the reader, as being but little ſuſceptible of that kind of conciſe elucidation which neceſſarily belongs to an article like the preſent.

It, therefore, only remains to give ſome account of the general theory of equations; in which it will be firſt neceſſary to ſhew, that every equation, of any order whatever, has as many roots as there are units in the index of the higheſt power of the unknown quantity in that equation.

For this purpoſe, let us take the general equation $x^n + Px^{n-1} + Qx^{n-2} \ldots\ldots + Tx + U = 0$, to which all others can be readily reduced: then if a root of this equation be denoted by a, the firſt ſide of it will be diviſible by $x - a$.

For, ſince $x^n + Px^{n-1} + Qx^{n-2} \ldots + Tx + U = 0$.

And $a^n + Pa^{n-1} + Qa^{n-2} \ldots + Ta + U = 0$.

Therefore, by ſubſtraction, $(x^n - a^n) + P(x^{n-1} - a^{n-1}) + Q(x^{n-2} - a^{n-2}) \ldots T(x - a) = 0$.

But any expreſſion of the form $(x^n - a^n)$, where n denotes any whole poſitive number, is $= (x - a) \times (x^{n-1} + ax^{n-2} + a^2x^{n-3} \ldots a^{n-2}x + a^{n-1})$, as may be readily proved by multiplication. Whence, if the quantities $x^n - a^n$, $x^{n-1} - a^{n-1}$, $x^{n-2} - a^{n-2}$, &c. be each divided by $x - a$, we ſhall have

$$\begin{array}{rrrrr} x^{n-1} + a\,x^{n-2} & + a^2 x^{n-3} & \ldots\ldots & + a^{n-1} \\ & x^{n-2} + a\,x^{n-3} & \ldots\ldots & + a^{n-2} \\ & + \quad x^{n-3} & \ldots\ldots & + a^{n-3} \\ & & \ldots\ldots\ldots\ldots & \\ & & & + 1 \end{array}$$

Or, if the ſame expreſſions be arranged according to the powers of x, they will become

$$\begin{array}{rrrr} x^{n-1} + a\,x^{n-2} & + a^2 x^{n-3} & \ldots\ldots & + a^{n-1} \\ + P\,x^{n-2} & + P\,a\,x^{n-1} & \ldots\ldots & + P\,a^{n-2} \\ & + Q\,x^{n-1} & \ldots\ldots & + Q\,a^{n-3} \\ & \ldots\ldots\ldots\ldots & & \\ & & & + T \end{array}$$

Where, by putting $P' = a + P$, $Q' = a^2 + aP + Q$, &c. we ſhall have $x^n + Px^{n-1} + Qx^{n-2} \ldots + Tx + U = (x - a) \times (x^{n-1} + P'x^{n-2} + Q'x^{n-3}$, &c.$) = 0$.

And if b be ſuppoſed to be a root of the equation $x^{n-1} + P'x^{n-2} + Q'x^{n-3}$, &c. $= 0$, the former of theſe will become $x^n + Px^{n-1} + Qx^{n-2}$, &c. $= (x - a) \times (x - b) \times (x^{n-2} + P''x^{n-3} + Q''x^{n-4}$, &c.$)$; which latter equation may be ſhewn to have a ſimilar factor, $x - c$; and by proceeding in the ſame manner, the original equation may be decompoſed into as many factors, $x - a$, $x - b$, $x - c$, $\ldots\ldots\ldots\ x - l$, as there are units in the exponent n of its higheſt term.

Hence, by conſidering equations as formed by the product of certain factors, $x - a$, $x - b$, $x - c$, &c. we are enabled to diſcover a number of relations which ſubſiſt between its roots and coefficients.

Thus ſuppoſing a, b, c, d to be the roots of the biquadratic equation $x^4 + px^3 + qx^2 + rx + s = 0$, if this be repeſented by its factors $(x - a) \times (x - b) \times (x - c) \times (x - d) = 0$, we ſhall have, by multiplying them together, $x^4 - (a + b + c + d)x^3 + (ab + ac + ad + bc + bd + cd)x^2 - (abc + abd + acd + bcd)x + abcd = 0$; and by proceeding in the ſame manner, a ſimilar reſult may be obtained for any equation whatever.

Hence, from the bare inſpection of this equation, the following conſequences are readily derived.

1. The coefficient of the ſecond term of any equation, taken with a contrary ſign, is equal to the ſum of all the roots of that equation.

2. The coefficient of the third term is equal to the

ſum of the products of all the roots, multiplied together, two by two.

3. The coefficient of the fourth term, taken with a contrary ſign, is equal to the ſum of the products, of all the roots, multiplied together, three by three; and ſo on to the laſt term, which is equal to the product of all the roots with contrary ſigns.

From this it alſo follows, that in an equation wanting its ſecond term, there muſt be both poſitive and negative roots, and that the ſum of the former is equal to that of the latter.

And in the ſame way, a number of other properties of the various orders of equations may be derived, which will be found of great uſe, not only with reſpect to their reſolution, but as furniſhing the materials for a complete inveſtigation of this curious and intereſting branch of analyſis.

We ſhall only farther add, that beſides the ſimple factors into which any equation may be decompoſed, it may likewiſe be produced by multiplying together factors of any degree, provided the ſum of their dimenſions be equal to that of the propoſed equation.

For the application of the principles and rules, illuſtrated in the preceding article, to the ſolution of arithmetical, geometrical, and other queſtions and problems, we refer to REDUCTION of *Equations*, APPLICATION of *Algebra*, &c.

EQUATION, in *Aſtronomy*, is a term uſed to expreſs the correction, or quantity, to be added to or ſubtracted from the mean poſition of a heavenly body, to obtain the true; it alſo, in a more general ſenſe, implies the correction ariſing from any erroneous ſuppoſition whatever. *E. g.* The time of noon, determined by taking equal altitudes of the ſun, is firſt obtained by ſuppoſing the ſun's declination conſtant during the whole interval, which falſe ſuppoſition is corrected by an appropriate equation. Moſt of the principal equations will be found under their different articles, in the various tables to which they belong.

EQUATIONS, *Conſtruction of.* See CONSTRUCTION *of Equations.*

EQUATIONS, *Converſion of.* See CONVERSION *of Equations.*

EQUATIONS, *Abſolute, adfected* or *affected, differential, eminential, exponential, fluential, fluxional, literal, numeral,* and *tranſcendental.* See the adjectives.

EQUATION *of a Curve,* is an equation ſhewing the nature of a curve, by expreſſing the relation between any abſciſs and its correſponding ordinate, or elſe the relation of their fluxions, &c. Thus, the equation for the circle is $ax - x^2 = y^2$, where a is its diameter, x any abſciſs or part of that diameter, and y the ordinate at that part of the diameter; and the equation denotes, that whatever be the abſciſs expreſſed by x, the ſquare of its correſponding ordinate will be $ax - x^2$. Thus alſo the equation for the ellipſe is $\frac{p}{a} \times \overline{ax - x^2} = y^2$; for the hyperbola $\frac{p}{a} \times \overline{ax + x^2} = y^2$; and for the parabola $px = y^2$; in all which a is an axis, and p the parameter. This method of expreſſing the nature of curves by algebraical equations was firſt introduced by Des Cartes, who, by thus connecting together the two ſciences of algebra and geometry, made them naturally ſubſervient and auxiliary to each other, and thus laid the foundation of the moſt conſiderable improvements that have been made in every branch of them ſince that time. See APPLICATION of *Algebra*, &c. See alſo CURVE.

EQUATION *of Payments,* in *Arithmetic,* is the method of reducing ſeveral debts payable at different times, and bearing no intereſt till after the term of payment of a ſingle debt or payment, to be diſcharged at once, without loſs either to debtor or creditor, allowing ſimple intereſt; or, it is the method of finding the equated term at which theſe ſeveral debts ſhould be paid in one ſum. Cocker, Hatton, Kerſey, ſir Samuel Moreland, and Ward, have given rules for this purpoſe, which Mr. Malcolm has examined and found to be erroneous; and though the error reſulting from any of the rules which they have propoſed is not very conſiderable, the following proceſs furniſhes one more accurate.

Let the debt firſt payable be called	d	The laſt payable debt	D
The diſtance of the term of payment	t	The diſtance of the term	T

The diſtance of the equated time x

The rate of intereſt, or 1 year's intereſt of 1*l.* r

The diſtance of the time t and x is $x - t$
The diſtance of the time T and x is $T - x$ } for x lies between them.

Then the intereſt of d for the time $x - t$ is $dr \times x - t$, or $drx - drt$, dr being one year's intereſt of d; and $\frac{DTr - Drx}{1 + Tr - rx}$ is the diſcount of D for the time $T - x$, becauſe $Tr - rx$ is the intereſt of 1*l.* for that time, which is conſequently the diſcount of $1 + Tr - rx$ for the ſame time; conſequently, from the nature of the queſtion, we ſhall have $drx - drt = \frac{DTr - Drx}{1 + Tr - rx}$; which being reduced, gives $T + t + \frac{D + d}{dr} \times x - x^2 = \frac{DT + dt}{dr} + Tt$. Then make $T + t + \frac{D + d}{dr} = a$, and $\frac{DT + dt}{dr} + Tt = s$, and $ax - x^2 = s$; and reſolving this quadratic equation, $x = \frac{a}{2} \pm \sqrt{\frac{a}{4} - s}$.

E. gr. Suppoſe 100*l.* payable one year hence, and 105*l.* payable three years hence; what is the equated time, allowing ſimple intereſt at 5 *per cent. per annum?*

Here $\begin{matrix} d = 100 \\ t = 1 \end{matrix} \left\{ \begin{matrix} D = 105 \\ T = 3 \end{matrix} \right\} \; r = .05.$

Then $D + d = 205$, $dr = 5$, and $\frac{D + d}{dr} = \frac{205}{5} = 41$.

And $T + t + \frac{D + d}{dr}$, or $a = 4 + 41 = 45$.

And s or $\frac{DT + dt}{dr} + Tt = \frac{315 + 100}{5} + 3 = 83 + 3 = 86$. Conſequently,

$x = \frac{45}{2} \pm \sqrt{\frac{2025}{4} - 86} = \frac{45}{2} \pm \sqrt{506.25 - 86} = 22.5 \pm \sqrt{420.25} = 22.5 \pm 20.5 = 43$ or 2: but 43 cannot be the true anſwer by the conditions of the queſtion, ſince it is greater than the diſtance of the laſt term in the queſtion; and therefore 2 is the anſwer required.

If there are more debts than two you muſt firſt find an equated time for the two that are firſt payable; then conſider their ſum as a debt payable at that equated time, and find another equated time for that debt and the next of the given debts, &c. See Malcolm's Arithm. book vi. § 5. or p. 616—621.

EQUATION *of the Centre.* This is the firſt and moſt conſiderable of all the equations that are applied to the mean motion of a planet. It ariſes immediately from the nature of the ellipſe. If the orbit of a planet was perfectly circular it would have no equation of the centre; and a ſpherical body, revolving round a centre of force in an elliptic orbit, undiſturbed by the motion of other bodies, would require no other equation to correct its mean motion than the equation of the centre.

The neceſſity of applying this equation to the motion of the ſun, in its apparent orbit, was known to the early aſtronomers; for, in fact, no very accurate obſervations were neceſſary to ſhew that the ſun did not perform equal parts of its annual motion in equal portions of time. When, by means of gnomons, the length of the year and the obliquity of the ecliptic were pretty well eſtabliſhed, it muſt have been eaſy, with the ſame inſtrument, to have obſerved the declination of the ſun every day, and from thence to have computed its longitude. The firſt aſtronomers who undertook this examination muſt naturally have expected to find a regular increaſe in the ſun's longitude for every day in the year; but when they found that in the courſe of three months the obſerved longitude differed near two degrees from that which they had computed, it became then evident, that if the ſun's orbit was circular, and its motion uniform, at leaſt the earth was not placed in the centre of it.

This difference, which we now call the equation of the centre, was named by the ancient aſtronomers προσθαφαιρεσις, from προσθεσις, *addition*, and αφαιρεσις, *ſubtraction*, becauſe this equation is ſometimes additive and ſometimes ſubtractive, a name almoſt applicable to all equations, but applied to the equation of the orbit as the moſt conſiderable of all. Hipparchus was acquainted with this unequality in the motion of the ſun, which had not long been diſcovered before his time. He obſerved, that from the equinox of ſpring to the ſummer ſolſtice, there was an interval of $94\frac{1}{2}$ days, and from the ſolſtice to the next equinox $92\frac{1}{2}$ days; that is, two days leſs, notwithſtanding theſe points were equally 90° from each other. The motion of the ſun in two days is $1^\circ\ 58'$, which is nearly the quantity of the greateſt equation. To explain this difference, and to aſſign the exact proportion to every day in the year, the ancient aſtronomers either placed the earth out of the centre, at a ſufficient diſtance to produce the greateſt equation, or imagined an epicycle to revolve upon the circular orbit, on whoſe circumference the ſun was ſuppoſed to move. Theſe ſuppoſitions would give the ſun's longitude near enough the truth to ſatiſfy the imperfect obſervations of thoſe days, and when ſimilar unequalities were obſerved in the moon and planets, new cycles and epicyles were invented to explain them. But theſe contrivances, however ingenious, had very little pretenſion to be claſſed as theories or hypotheſes, capable of giving a ſatiſfactory explanation of the cauſes of theſe phenomena. An ingenious mechanic may make a clock, that ſhall repreſent all the inequalities of ſolar time, and by a proper application of ſome very ſimple principles in practical mechanics, we may repreſent the moſt complicated ſyſtem of motions; yet theſe machines would give us no inſtructions as to the original motions which they imitated; and in proportion as they became complicated, ſhould we be the leſs inclined to ſuppoſe any reſemblance between their mechaniſm, and that of the motions they repreſented.

Nevertheleſs, in the ſimple caſe that we are now conſidering, had obſervation accurately agreed with the ſuppoſition, there would have been no reaſon for not admitting it; it would have reſted on the ſame ground as Kepler's elliptic hypotheſis, before Newton had demonſtrated how obviouſly it is derived from one general law of nature.

For the method of calculating the greateſt equation of excentric orbits, we refer the reader to De la Lande's Aſtronomy, vol. ii.

We ſhall here only explain the nature of this equation in an orbit perfectly elliptical. The equation of the orbit of a planet is evidently nothing at the apſides; beginning to reckon from the aphelion it augments rapidly; as the true or real motion being there the ſloweſt, differs moſt from the mean motion, it continues to increaſe, but leſs and leſs rapidly, till the planet has arrived at ſome point about three ſigns, and ſomething more from the aphelion, at which point the true and mean motions are equal. At this time the equation is the greateſt, it begins then ſlowly to diminiſh, and the diminution becomes more and more rapid, as it approaches the perihelion, at which time the real motion exceeds the mean motion by the greateſt quantity. When it arrives at the aphelion the equation is again nothing. In the ſame manner it increaſes again to a maximum, and then diminiſhes till its return to the aphelion, where it is again nothing. The equation is ſubtractive in the firſt ſix ſigns from the mean motion, and additive in the others.

The greateſt equation may be derived directly from obſervation; or if the excentricity be known it may be computed, and at the ſame time the degree of anomaly in which it happens. For this purpoſe it is ſufficient to find the point M (*Plate* XII. *Aſtronomy, fig.* 107.) where the planet is at its mean diſtance. For it is evident, that the moment the planet arrives at the point where its angular velocity D F M is equal to its mean velocity, the mean longitude will ceaſe to gain upon the true longitude, but their difference will be a maximum; becauſe till that moment the real velocity, which was leaſt, had continually cauſed the mean velocity to accelerate upon the true, but from the moment they are equal, the real velocity begins to accelerate upon the mean, and to regain the quantity which it had before loſt: from this time the true and mean place approach each other, and the equation begins to diminiſh. Thus the problem conſiſts in finding the point M, and the true anomaly A F M of the planet, at the moment that its true velocity is equal to the mean angular velocity.

Take F M a mean proportional between the two ſemi-axes of the orbit. With the focus F as a centre, and diſtance F M, deſcribe a circle M N, which circle will have a ſurface equal to the ellipſe. Suppoſe a body to deſcribe uniformly this circle in the ſame time in which the planet deſcribes its ellipſe, its angular velocity will always be equal to the mean angular velocity of the planet in the ellipſe; and the area deſcribed in the circle will be always equal to the area deſcribed in the ellipſe, becauſe the planet always deſcribes equal areas in equal times. For example, if the planet deſcribes in one day an area D F R $=\frac{1}{365}$ th part of the elliptic ſurface, the area E F O, deſcribed in the circle, will likewiſe be the $\frac{1}{365}$th part of the area of the circle; and the real velocity of the planet, or the angle D F R, will be equal to the mean velocity in M, that is, to the angle E F O; for there are two equal ſectors having the ſame length E M, the ſame ſurface, and conſequently the ſame angle. Beſides the equal triangles M E D, M R O, which are the one without, and the other within the circle, ſhew that the elliptic ſector is preciſely equal to the circular ſector, that has the ſame angle in F. Therefore to find the point of the mean velocity, we muſt find at what degree the interſection of the ellipſe correſponds with the circle equal to it in ſurface. From the point M let the ſtraight line M B be drawn to the other focus of the ellipſe, then in the triangle B E M three ſides will be known; namely, B F, which is the double of the excentricity, F M, which is the mean proportional between the two ſemi-axes, and B M, which is the difference between

F M, and the greater axis, becauſe the two lines E M and M B are together equal to the greater axis. By reſolving this triangle the angle F may be found, which will be the true anomaly of the planet, at the time of its greateſt equation.

In the caſe of the greateſt equation, the reſolution of the above triangle gives the following rule. From the aphelion diſtance take ſeparately the mean proportional of the two ſemi-axes, and the third ſide B M (difference between the greater axis and the mean). Take the logarithms of theſe differences, and ſubtract the leaſt from the greateſt; from this difference take the difference of the logarithms of the aphelion and perihelion diſtances; the half of the remainder is the logarithmic tangent of half the true anomaly. By the method of coſines take the logarithms of the aphelion diſtance, and of the difference of the ſide B M; add the complements of the logarithms of B E and F M, the half of the ſum is the logarithmic coſine of half the true anomaly. If the angle is ſmall, this method of the coſines is leſs exact; but when the angle is large, it is preferable to the other, being ſomewhat ſhorter.

Having thus deſcribed the method of calculating the greateſt equation, we have now to conſider the manner of obſerving it.

From the inſtant a planet departs from its aphelion A, to the time it arrives at the point M of its greateſt equation, its real velocity is leſs than its mean velocity; therefore, the true anomaly is leſs than the mean anomaly, and differs from it more and more. When the planet has paſſed the point P, or its perihelion, and arrives at the point G, having about nine ſigns of anomaly, its true diſtance A F G from the aphelion is in the ſame manner leſs than its mean diſtance, by a quantity equal to the greateſt equation. If we obſerve two true longitudes of the planet in G and M, they will differ from each other by the angle G F M, which is the ſum of two true anomalies: but the ſum of two mean anomalies will be greater by the double of the equation, ſince each true diſtance is leſs than the mean diſtance by the whole of the equation. It is eaſy to calculate the ſum of two mean anomalies without knowing the place of the aphelion A, becauſe the ſum of two mean anomalies is equal to the mean motion of the planet for this interval of time, which is found by taking its proportion of the whole revolution: thus, the exceſs of the mean motion, calculated over the true diſtance obſerved, will be double the greateſt equation, provided the two obſervations are made in M and G, the times that the mean velocities equal the true. It will, on the contrary, be the true or obſerved motion that will exceed the mean, if the obſervations are taken on each ſide the perihelion. To determine the time and the obſervations moſt ſuitable to this inveſtigation, an obſerver, who ſhould be ſuppoſed to have no previous knowledge of the ſituation of the orbit, muſt begin by collecting a great number of obſerved poſitions, and compare them two and two together, and obſerve how much the obſerved motion differs from the mean for each interval: in this manner the greateſt of the obſerved diſtances will be found double the greateſt equation; but if this compariſon is made with a ſingle obſervation, then the greateſt difference additive and the greateſt ſubtractive, added together, will give double the equation. But ſince at preſent we know very nearly the place of the apſides, and of the mean diſtances of all the planets, we can immediately ſelect the obſervations that are made about the time of the greateſt equation.

Example.—The 7th October, 1751, the place of the ſun obſerved by La Caille, was, after three ſucceſſive obſervations

	6'	13°	47′	13″.7
And the 28th March, 1752	0	8	9	25.5
The difference is	5	24	22	11.8
The mean motion calculated for this interval is	5	20	31	43.2
Difference, or double the equation	0	3	50	28.6
The half is the equation required	0	1	55	14.3

This would be exactly the greateſt equation, if the obſervations had been made exactly at the moment of the greateſt equation; but having calculated by the tables theſe equations, it was found that 18″.6 muſt be added to have the greateſt equation, which will make the above quantity 1° 55′ 33″.

With reſpect to this 18″.6 it may be remarked, that an error of ſeveral minutes in the equation of the tables would have produced no ſenſible alteration in this correction, as the error would be the ſame for the given day as for the greateſt of all which happened extremely near it.

As it is extremely rare to meet with two obſervations which are preciſely ſituated in the two points M and G of the mean time, ſo it is not eaſy to find by the firſt calculation the exact value of the equation; but after having found it very nearly, and likewiſe the place of the apſide, the equation may be calculated for the times of obſervation, and likewiſe the greateſt equation; by the method explained above, it may be then ſeen how much the equation derived from the obſervations ſhould differ from the greateſt. It was by this means that La Caille, in the preceding example, found the above correction 18″.6. The greateſt equation of the ſun is that which may be obſerved the moſt frequently, and with the greateſt eaſe. A perſon ſtudying aſtronomy, and deſirous of making himſelf converſant with the methods by which all theſe elements of the planetary motions have been obtained, may deduce them himſelf from the Nautical Almanac, or other ſimilar publications; he may regard the longitudes and latitudes of the planets there found as ſo many obſervations, and by computing from them, the original elements ſhould be found, from which the tables themſelves were calculated. If the minutes and ſeconds be omitted, or the neareſt half or quarter of a degree only taken, they will repreſent the obſervations of the early aſtronomers, and it will then be ſeen what very imperfect theories were ſufficient to explain ſuch inaccurate obſervations.

Theſe methods of finding the greateſt equation cannot be applied to Mercury, as we never can obſerve its heliocentric longitude but when on the ſun's diſc. Its elongation, and that of Venus, is found by obſerving the greateſt digreſſion when the planet is in the apſides. For a farther account of this method conſult De la Lande's Aſtronomy.

Caſſini employed the tranſits of Mercury obſerved in 1661, 1690, and 1697, and found the greateſt equation 24° 3′. De la Lande, from the tranſits of 1740, 1743, and 1753, found 23° 27′ 51′. But theſe obſervations are not well ſuited, as the three points of the orbit are not diſpoſed at diſtances ſufficiently great. The equation of the centre does not remain for ever the ſame; by compariſon with ancient obſervations the equation of the earth's orbit appears to have undergone a diminution, and the theory of attraction explains the cauſe, and aſſigned the quantity more correctly than can be obtained by obſervation. La Place makes the diminution for the earth's orbit 0°.0058 decimals in a century;

tury ; this phenomenon ſuppoſes a correſponding diminution in the excentricity, for if the excentricity was nothing, the equation would be nothing. The correſponding diminution of the excentricity is 0.000045553, the ſemi-axis major being taken as unity.

This is nearly equal to 1548 French leagues in a century, or 40 Engliſh miles in a year. Thus, fractions which appear inſenſible in the heavens, become conſiderable when compared with our known meaſures. If this diminution was always progreſſive, the ſolar ellipſe would in time be changed into the circumference of a circle, and in the end, the excentricity decreaſing always, the earth, after a great number of ages, would fall into the ſun ; but the theory of attraction indicates that the variation in the equation of the orbit and excentricity are periodic, and that after having diminiſhed for a certain period, they will again increaſe and take the ſame values they had before, and will thus oſcillate within narrow limits ; but the periods of theſe oſcillations are ſtill unknown, and thus the ſyſtem might be eternally maintained, except ſome exterior and unknown cauſe ſhall come to change the ſyſtem of the world, and new-modify its laws.

Table of the greateſt Equation of the Centre according to different Aſtronomers.

	Bouillaud, 1645.	La Hire, 1702.	Halley, 1719.	Caſſini, 1740.	La Lande, 1750.	Annual Variation.
Mercury - - -	24° 17′ 20″	24° 16′ 52″	23° 42′ 36″	24° 2′ 58″	23° 40′ 0″	+ 0″.02
Venus - - -	0 54 36	0 50 0	0 48 0	0 49 6	0 47 20	− 0.25
The Sun - -	2 2 41	1 55 42	1 56 20	1 55 51	1 55 36.5	− 0.188
Mars - - -	10 36 12	10 40 40	10 40 2	10 39 19	10 40 40	+ 0.37
Jupiter - - -	5 34 0	5 36 54	5 31 36	5 31 17	5 30 38.3	+ 0.5536
Saturn - - -	6 37 10	6 30 00	6 32 4	6 31 40	6 26 42	− 1.11
Herſchel - - -					5 27 16	− 0.11

Equation, *Secular, of the Mean Motion of the Moon.* The motion of the moon, and its elements, do not remain conſtant, but undergo progreſſive alterations, which would ſoon render the tables inaccurate, if we were obliged to improve merely by compariſon with recent obſervations. The only method of avoiding this inconvenience is to calculate the elements of the lunar motion for different periods very remote from each other, to deduce the variations they have undergone, and then to inveſtigate the laws proper to repreſent them.

We may apply theſe conſiderations to the mean and ſecular motion of the moon, which has been determined with great exactneſs by modern obſervations, and which ſerves as a baſis for all the other reſults, and compare it with ancient obſervations, to ſee if it is the ſame, or if it has materially changed. The method of making this compariſon conſiſts in conſidering the ancient obſervations of the moon as ſo many obſerved longitudes ; the place of the moon is then calculated by the tables for this diſtant epoch, and the reſult compared with the obſervation.

The moſt ancient eclipſe upon record may be taken as an example. It was obſerved by the Chaldeans 721 years before the Chriſtian era, and recorded by Ptolemy. The obſervation was made at Babylon the 19th March : the moon began to be eclipſed about an hour after its riſing. At the middle of the eclipſe the longitude of the moon was equal to that of the ſun ; this latter is eaſy to calculate by the ſolar tables ; thus the longitude of the moon is given at the period of the eclipſe. Now, if the place of the moon be calculated by the tables for this epoch, it will be found leſs advanced in its orbit, than it muſt have been by the obſervation : the difference is about one degree and a half ; and as this is too great an error to be attributed to the inaccuracy of the tables, we muſt conclude that the motion of the moon is now accelerated : ſo that in referring it to a diſtant period, we throw it too far back in its orbit, which diminiſhes its longitude.

And this reſult acquires additional confirmation, by making ſimilar compariſons with obſervations made at intermediate periods ; for if the motion of the moon is really accelerated, we ſhould ſtill find the longitude calculated by the tables too ſmall, though the error ſhould be leſs as the interval is ſmaller ; and this appears to be the caſe by a ſimilar compariſon with an eclipſe obſerved at Cairo by Ibn-junis, an Arabian aſtronomer of the 10th century.

This coincidence leaves no doubt as to the reality of the phenomenon ; and it appears certain, that the motion of the moon has accelerated from the time of the Chaldeans to the Arabians, and from that time to the preſent. To repreſent this acceleration, a third term, proportional to the time, muſt be added to the ſecular motion of the moon, and another leſſer term proportional to the cube ; this, together, is what is called the ſecular equation of the moon. According to La Place, (Mecanique celeſte, vol. iii. p. 273.) if n be the number of centuries elapſed ſince 1750, the formula for the correction will be $31''.424757\, n^2 + 0''.05721742\, n^3$. Theſe ſeconds are according to the decimal diviſion.

But we are not to infer that this acceleration will always be increaſing, or that the preceding formula will always repreſent it ; the theory of attraction, in making known the cauſe, has ſhewn that it is periodic, and connected with the variations of the excentricity of the terreſtrial orbit. See Excentricity, and Equation *of the Centre*.

This acceleration, after increaſing to a certain limit, will be changed into a retardation, but the extent of this period is very conſiderable ; and the interval, which ſeparates us from the moſt ancient obſervations, has yet only developed an extremely ſmall part of this revolution. The inequalities which will reſult in the motion of the moon will amount at leaſt to a 40th part of the circumference of her orbit. Poſterity, who will obſerve theſe great phenomena, may remark, and not without gratitude, that the geometricians of the preſent age have foreſeen, calculated, and prepared for their ſucceſſors the means of judging of the paſt and future ſtate of the ſyſtem of the world, with the ſame certainty as in the age in which they lived.

It was the celebrated Dr. Halley who firſt diſcovered the effects of this acceleration ; and La Place, by a moſt profound

found analyſis, has explained both the cauſe and the law. The obſerver and the geometrician are each entitled to admiration. If the reſult of the latter is more ſatisfactory and uſeful to ſcience, it muſt be confeſſed, that it was a proof of no ſmall ſagacity in the former to be the firſt to doubt of the uniformity of the mean motions which had been admitted as an eſtabliſhed principle for above two thouſand years.

Equations, *Secular, which affect the Elements of the Orbit of the Moon.* The motion of the lunar perigee is not uniform, but ſubject to a ſecular equation analogous to that of the mean motion, and depending on the ſame cauſe. The compariſon of ancient obſervations with the modern leaves no doubt of this fact; but it is to the theory of attraction that we are indebted for the diſcovery. This equation is equal to that of the mean motion, multiplied by the coefficient -3.00052, that is to ſay, that if k repreſent the ſecular equation of the mean motion, the term $-3.00052k$ muſt be added to the mean longitude of the perigee, calculated from the duration of a tropical revolution. Mec. celeſte, vol. iii. p. 247.

The motion of the nodes is likewiſe ſubject to a ſimilar inequality, and the equation has the ſame ſign as that of the perigee, it is equal to the equation of the mean motion multiplied by -0.735452, that is, to the mean longitude of the node add $-0.735452\,k$. Theſe reſults are confirmed by obſervation.

It appears from this, that the ſecular equation diminiſhes the longitude of the perigee and of the nodes when it augments the mean motion of the node, and reciprocally; hence the motion of the perigee and of the nodes becomes ſlower, when that of the moon is accelerated, and on the contrary is accelerated when that of the moon is retarded. Moreover, theſe inequalities are connected together by very ſimple analogies, ſince they are repreſented by the numbers 1; 3.00052; -0.735452.

The anomaliſtic revolution, depending at the ſame time on the motion of the moon and of the perigee, is likewiſe modified by the ſecular variation. It is the ſame with all the quantities which depend on the apogee, and on the nodes.

The theory of attraction indicates, that the diſtance of the moon from the earth, the excentricity, and the inclination to the orbit, are equally ſubject to ſecular equations, which are connected with that of the mean motion. But hitherto their effect is ſcarcely perceptible; nevertheleſs, in the courſe of ages, it will become neceſſary to attend to them, and they have been calculated in advance. The expreſſion for the greater axis of the orbit contains no inequality of this kind. This likewiſe is the reſult of theory. The cauſe of all theſe extremely curious facts has been explained by La Place, who was led to them by the diſcovery of the original cauſe which produced the ſecular equation of the moon. For the ſecular equations of the other celeſtial bodies, ſee their reſpective names, and Secular.

Equation-*Clock*, in *Horology*, is a clock contrived ſo as to indicate both *mean* and *equated* ſolar time, and conſequently their difference, which at any inſtant is the *equation of time.* Various contrivances have been invented to anſwer this purpoſe by ingenious men, who at one time were ſeized with a rage for inventing ſuch uſeleſs appendages of the clock, but the dictatorial power of faſhion has nearly baniſhed ſuch ſuperfluities, that are now conſidered as mere matters of curioſity. For a deſcription of a clock of this ſort by Enderlin, ſee our article Clock, and *Plate* XXIV. of *Horology*.

Equation-*Mechaniſm*, in a planetarium or orrery, is a mechanical contrivance for repreſenting the alternate accelerations and retardations of motion in the requiſite parts of the reſpective orbits of the different planets, which contrivance has been variouſly effected by different ingenious men. If the motions of the heavenly bodies had been in concentric circles, and perfectly equable in every point of their orbits, the conſtruction of a common planetarium would have been well calculated to exhibit all the phenomena in a natural and exact manner, provided the trains of wheelwork were accurately calculated for the reſpective periods, and the length of the arms proportional to the reſpective diſtances; but as all the planets that have conſiderable excentricity, and conſequently conſiderable equations of the centre alternately *plus* and *minus*, have their motions conſtantly varying in angular velocity, a common planetarium, without equation-mechaniſm, is a very imperfect machine, and by no means competent to ſolve any of the phenomena, in a particular way, that depend on the relative velocities; for when the heliocentric motions are improperly repreſented, the geocentric appearances depending on them are deranged, and no dependance can be placed in the *times* pointed out of the apparent conjunctions, oppoſitions, ſtations, retrogradations, longitude, or latitude of any of the heavenly bodies. For inſtance Mercury, which planet performs its period through the ecliptic in ſomewhat leſs than 88 days, inſtead of continuing 44 days in each half of its orbit, at oppoſite ſides of the conjugate axis, as it does reſpectively in thoſe at each ſide of the tranſverſe axis, continues about $55\frac{1}{2}$ days in the aphelion portion, and only $32\frac{1}{2}$ in the perihelion portion, ſo that the times of conjunction with the earth or other planet, even allowing the motion of that planet to be equable, would from this cauſe alone become very irregular, exceeding or falling ſhort of the mean ſynodic period by many days, according to circumſtances. It is evident, therefore, that the variations of velocity depending on the equation of the centre of both orbits of two planets, one received from the other, require to be taken into conſideration, and allowed for in the conſtruction of any mechaniſm that profeſſes to be accurate in the repreſentation of planetary motion.

Contrivances by Mr. Huygens.—The earlieſt attempt that we have met with, to produce the requiſite inequalities of planetary motion by mechaniſm, is that of Mr. Huygens, the Dutch mathematician and philoſopher, which he has deſcribed in his Latin treatiſe on the conſtruction of his *Automaton*, or ſelf-moving planetarium; he has availed himſelf of two different applications of the ſame principle, that are reſpectively applicable to different degrees of inequality of motion, that the excentricity of an orbit may require; his account and demonſtration of both which methods we ſhall give in a free tranſlation from his own words, which will probably be intereſting to thoſe who cannot read the original, particularly as there has been no notice taken of them by any writer, or inſtrument-maker, except perhaps Rowley, during the laſt century.

"It remains now," ſays our very ingenious author, "that we explain how the true anomalies may be repreſented by wheelwork; for this purpoſe let A N P, *fig.* 1. of *Plate* III. of *Planetary Machines*, be the orbit of a planet, the centre of which is C with the ſun at S, and let the point E be taken any where in the line S C, ſo that the excentricity S C may be to the radius C A, as C E is to E D; with which radius and centre E let the circle D M be deſcribed. Now let it be underſtood, that upon the centre of the circle A L there be fixed immoveably the contrate wheel D M with equal teeth, which therefore will neceſſarily revolve round the point C as a centre; let it be alſo ſuppoſed that the arbor of the long pinion K H be directed to C, and turned equally with its teeth adapted to thoſe of the wheel D M, which will agree ſufficiently, although on account of the excentricity of this wheel it will not always have the pinion at right angles; by this motion, I ſay, a planet will be carried unequably in its orbit, and in ſuch a manner that its motion will very nearly correſpond to Kepler's hypotheſis. For having taken in the circle D M, deſcribed from the point E, any arc D O, let the teeth of that arc paſs over to the line C D by turning the pinion K H, and the line C O will coincide with the line C A D, but not ſo that the point O may fall on the point D, but within at R, becauſe C D, which is equal to both C E and E O, is greater than C O: now whatever may be the angle O C D, ſuch will be that over which the line C A D has moved round the centre C; therefore if we make the angle D C T equal to the angle D C O, C T will be the right line into which C A D will have advanced, ſo that the planet will have proceeded from A to the point N, where the right line C T cuts the circumference of the circle A N deſcribed from the centre C. But the circle D M, having its centre E advanced to F by making F T equal to E D, will have the ſame ſituation as the circle T R: and it appears that on account of the equality of the angles O C D and D C T, the arc D M, which the right line C T cuts in the circumference of O D M, is equal to the arc D O; ſo that M and E being joined, the angle M E D will be equal to D E O. If, therefore, the arc A L be made to contain as many degrees as the arc D M, and C F be joined, this line will be parallel to E M.

"In the triangles C E M and S E L, therefore, the angles L C S and M E C will be equal, and the ſubtending ſides proportional; for by conſtruction S C is to C L, as C E is to E M, C L being equal to C A, and E M to E D. Alſo the angles M C E and L S C are equal, and conſequently the lines C M and S L are parallel.

"Now by this rotation of the circles D M and A L, the planet placed in A will be moved through the circle A L, very nearly according to Kepler's hypotheſis, as may be thus ſhewn. Let the planet be ſuppoſed to have moved from A to N, the ſpace or area N S A will be equal to its mean anomaly; but ſeeing the lines S L and C N are parallel, the triangles N S C and C L N will be equal, at leaſt their difference will be inſenſible; the ſpace or area, therefore, C L A, and conſequently the arc A L, will anſwer to the mean anomaly when the planet has advanced from A to N. If, however, we make A Q P the elliptic orbit of Kepler, the planet will be in Q, where the perpendicular N Q falling on A P cuts the ellipſe A Q P, and not in N; but the ellipſes are ſo like circles, that the variation in a machine is imperceptible, N will, therefore, be the true place of the planet correſponding to the mean motion A L, which arc is equal to D O or D M.

"Again, if the pinion be placed in any other point, as at G, equally diſtant from the centre C, to which the arbor is directed, and the point D, which is the moſt diſtant from the centre C, in the wheel O D M, be placed under the pinion, the planet being again at its aphelion A, it appears that the ſame angles are formed round the centre C by an equable motion of the pinion placed in G as in D. Wherefore in whatever ſituation the pinion be placed, the motion of the planet will be unequable, notwithſtanding the teeth of the wheel D M are made equal among themſelves, provided the pinion that points to the centre C have its teeth made long enough to act with all the teeth of the wheel which come ſucceſſively to it at different diſtances from the centre C, and provided that the planet be put to its aphelion point of its orbit, when the longeſt line, or radius, drawn from C to D M, is in contact with the pinion.

"But ſince in our machine (automaton) all the pinions are placed on one common arbor, it cannot be placed properly towards the centres of more than two planets; we muſt, therefore, conſider how the ſame effect can be produced by *unequal teeth*: for this end let us ſuppoſe the circle D M divided into the equal parts D *a*, *a b*, *b* M, and M *g*, and right lines be drawn to them from the point C, theſe lines C *a*, C *b*, C M, C *g*, will divide A N L, the orbit of the planet, into the unequal parts A *d*, *d e*, *e* N, N *f*. By this method as many unequal teeth may be determined in the circle A N L, as there are equal ones in the circle D M. If now the pinion be applied to theſe teeth, cut into the ſame number as in the former caſe, they will work together pretty well, though ſome are too large and others too ſmall for the pinion, and the wheel A N will move unequably as the wheel D M did before, which has been proved to be according to the hypotheſis of Kepler."

This is a faithful tranſlation of Mr. Huygens' account and demonſtration of his two methods of repreſenting the irregularities of a planet's motion in its orbit, concerning which we have to obſerve, that, though both of them manifeſt great ingenuity as to the originality of the projects, yet they fall ſhort of producing ſeparately that full effect which he attributes to them, and which he ſeems to have credited; whereas the truth is, that inſtead of effecting the *whole* equation of the centre, the methods juſt deſcribed effect each only *one half* thereof; for agreeably to Kepler's theory, which ſuppoſes equal areas in equal times, biſhop Ward has proved that *double the excentricity* of a planet's orbit ſubtends very nearly its greateſt equation, and that, according to his elliptic hypotheſis, which is an excellent approximation to the truth, if the angular velocity of a planet round one focus of the ellipſe be uniformly equable, its angular velocity, as ſeen from the other focus, will be ſo unequable, that one will repreſent the mean and the other the true or equated anomaly very nearly; but the diſtance between the two foci of any ellipſe is its excentricity laid off both ways from the centre, or *doubled*; whereas the method of Mr. Huygens' propoſes the excentricity to be taken only *once*, ſo that he has demonſtrated rightly enough, but from wrong data; for if he had made the diſtance C E equal to double the excentricity, then the whole of the equation would have been very nearly repreſented. The demonſtration which Mr. Olinthus Gregory of Woolwich, then of Cambridge, has given in the 2d vol. of Mr. Nicholſon's Philoſophical Journal of the 8vo. ſeries, to which we beg leave to refer, has proved with great perſpicuity what the Rev. W. Pearſon of Parſon's Green had before aſſerted, that "the excentricity of any planet's orbit is very nearly equal to the ſine of one half only of its greateſt equation." It may be conſidered as a ſingular circumſtance that a man of Mr. Huygens' genius and mathematical ſkill, whoſe whole life was devoted to the ſciences, ſhould not diſcover that the methods which he ſo ingeniouſly deviſed to exhibit a planet's equated motion, produced but one half of the grand equation; and equally ſingular, perhaps, may it be conſidered, that no one before the writer of this article has detected the deficiency. When both theſe methods of conſtructing a planetary wheel are *united*, the full effect will be produced; or either of them may be united with any other contrivance that produces only one half the equation.

Mr. Roemer's Contrivance.—The next contrivance that we have met with, for repreſenting planetary motion, is that of Roemer, who was mathematician to the king of France in the time of Mr. Huygens; this contrivance is detailed in Mr. Nicholſon's Journal, vol. 4. of the 4to. ſeries, by a correſpondent, who tranſlated his account from the French of "Machines and Inventions approved by the Royal Academy of Sciences for 1699," and who, in our opinion, ſpeaks better of it than it deſerves. The plan propoſed might anſwer for one planet only, but is not applicable to a number of planets at the ſame time, for the planetary wheel propoſed is intended to be ſo thick as to conſtitute the fruſtum of a cone, on the ſurface of which a diagonal elliptical line is to be drawn round it, from the ſmaller to the larger diameter and back again, in which line the teeth are to be formed, after they have been laid down by a pair of dividers from a diagram previouſly made; ſo that, ſetting aſide the tediouſneſs of making ſuch a wheel by the mechanical manipulation deſcribed; there could not be a number of theſe wheels brought into action by any of the uſual arrangements of wheelwork, ſeeing the pinions that are to act with them muſt neceſſarily be conical alſo, and be the drivers in every caſe, which the requiſite calculations of the trains in planetary machines will not always admit, where the extreme ratios of relative velocity are ſo widely different from each other. This plan, therefore, of exhibiting unequable motion in a planetarium, or orrery, muſt be conſidered among thoſe projects of ingenuity which are more plauſible in theory than ſerviceable in practice, and no doubt was abandoned for the reaſons that have been here ſtated; which are our reaſons for paſſing over it without further notice.

Dr. Deſaguliers' Contrivance.—The next mechaniſm in the order of time, as far as we know, was Dr. Deſaguliers' elliptic pulleys, or oval wheels with grooves at the circumference, and an endleſs cat-gut ſurrounding them, as deſcribed under our article COMETARIUM. This was certainly a ſcientific contrivance, and admits of application where the excentricity of the orbit is great; for the excentricity and ſhape of the pulleys may be made exactly ſimilar to the excentricity and ſhape of the orbit to be repreſented. The principal objection to the adoption of this invention in a planetarium, is the liability of the cat-gut to contract and elongate with the variations of moiſture in a room, and conſequently to be ſometimes too tight for the pulleys, and ſometimes too looſe, ſo as not to perform their office of giving motion to the elliptic plates. We have ſeen the elliptic plates with their edges cut into teeth, which is a great improvement in the contrivance; and where the excentricity is not very great, a pair of excentric circular wheels will act together very well, to anſwer the ſame purpoſe, as we ſhall have occaſion to ſhew preſently.

Mr. Adam Walker's Contrivance.—Another method of exhibiting planetary motion we have witneſſed in the philoſophical lectures of Mr. Walker, ſenior, which, if we recollect perfectly, was effected thus: A wooden board was ſhapen nearly into the form of an epicycloid, and had equal teeth cut on its circumference by hand, with an arm fixed faſt to one of its extremities, that carried the ſtem of a planet, or of a ball to repreſent a planet; then a pinion was fixed on the ſurface of an inclined plane, down which the epicycloidal wheel was ſuffered to ſlide by its own weight, in a detached ſtate, till its teeth came in action with the teeth of the pinion; and a motion given to the pinion by a handle, made the wheel, thus circumſtanced, to revolve with unequal velocities, accordingly as its central point was near to, or removed from, the pinion, during its revolution in this ſliding ſtate; thus were not only the accelerations and retardations of motion alternately exhibited, but alſo the variations of diſtance, as they regarded the ſun's ball fixed in the focus of an elliptical board, placed over this mechaniſm, and divided into twelve triangular areas, ſo that the planetary body was ſeen to move through the twelve ſectors, coloured alternately white and black, in a manner correſponding to the ſame number of revolutions of the pinion; and to perform apparently equal areas in equal times. It is hardly neceſſary to obſerve on this contrivance, that, however convenient it might be to illuſtrate in a general way the nature of planetary motion to an audience, it is obvious that detached wheels acting thus at liberty cannot be introduced into any machine that gives motion to a ſyſtem of bodies, where their apſides croſs one another in various directions, and would require as many inclined planes as there are planets to be repreſented; likewiſe the planetary arms would require to be attached to *wheels* in every inſtance, though the calculations of the ratios of velocity might, and, according to the general conſtructions, would require in ſome inſtances *pinions* to be the laſt movers; all which difficulties in practice are inſurmountable. The *ſhape* of the planetary wheel, we have underſtood, was not determined geometrically, nor yet by calculation, but by a repetition of manual rectifications of the figure till it was found to correſpond with the areas previouſly delineated.

Mr. Joſeph Prieſtley's Contrivance.—When Dr. Birbeck was appointed profeſſor to ſucceed the late Dr. Garnet, at Anderſon's Univerſity in Glaſgow, his friend, Mr. Joſeph Prieſtley of Bradford, contrived an orrery, which was made for him by a watch-maker at Halifax, of the name of Thomas Liſter, which orrery the doctor has lately brought with him to London, on quitting the ſaid profeſſorſhip. It was finiſhed in the year 1801, and will be deſcribed in its proper place with the other planetary machines. The inequalities of motion in this machine are produced by two ſeparate methods; the two ſuperior planets Saturn and Jupiter have their equations effected by inequalities made in the teeth of the laſt moving wheels; but the others have their equations, with the exception of the earth, produced by a contrivance which is at the ſame time novel, ſimple, and accurate enough for mechanical repreſentation. The inventor has been kind enough to comply with our requeſt of his giving us an account of his mode of producing unequable motion by mechaniſm, which account we ſhall preſent to our readers in his own words. The figure to which he refers, is *fig.* 2. of *Plate* III. of *Planetary Machines.*

Let A P B, ſays Mr. Prieſtley, be the orbit of the planet, O its centre, and S and F the two foci; in the former of which the ſun is ſuppoſed to be placed. On the other focus F, as a centre, deſcribe a circle D E *p*.

Let P be any given place of the planet in its orbit; draw F *p*, cutting the circle D E *p* in *p*. Now, agreeably to the hypotheſis of Ward, it will be,

As the periodical time of the planet,
Is to the time of its paſſing from A to P;
So is 360 degrees,
To the angle E F *p*.

Hence, if a point *p* be made to revolve equably in the circle D E *p*, deſcribed on the lower focus F of the orbit, performing one revolution in the periodical time of the planet; and if, at any given time, the point be found at *p*, then a line drawn from the focus F through *p*, will cut the orbit of the planet in P, its place at the ſame time.

There are different ways of adopting this hypotheſis in machinery. The firſt I ſhall mention, will immediately occur to any one viewing the figure. Let a wire, ſomething longer than F B, be made to revolve equably round F, in the time repreſenting one revolution of the planet. On this wire let a ſtud P be made to ſlide freely, and confined to move in the orbit A P B; then the motion of the ſtud will, very nearly, repreſent that of the planet.

In the conſtruction of an orrery, where each planet will require a ſeparate arm F *p*, moveable on its peculiar centre, with the ſlider P confined to its own orbit, it may not be eaſy to contrive the whole ſo as to prevent one part of the machinery from interfering with another; nor can this method be conveniently uſed, where the wheels carrying the arms are rims. The following conſtruction has been found to anſwer the intention, and the motion to be very free and regular.

Let E *p* D be the toothed rim moving equably, the time of a revolution repreſenting that of the planet. This rim may have any convenient diameter, not differing greatly from the orbit. Upon this rim, or on any projection attached to it, is fixed a pin C, round which one end of a bar C P moves; on the other end of the bar is fixed a perpendicular wire, or ſtem P, which carries the planet. This ſtem is confined to move in the orbit A P B; and, during its revolution, is made to riſe and fall, ſo as to ſhew the inclination of the orbit to the ecliptic. The bar C P may be made of any convenient length; and the pin C ſhould be ſo ſituated, that when P is at *p*, the bar becomes a tangent to the circle E *p* B. This is neceſſary, that the end P, in its vibrations on C, may be always found, as nearly as poſſible, in the line F *p*; and on this account, the length of the bar ſhould be as great as circumſtances will conveniently admit.

Contrivances by the Rev. William Pearſon.—Some time previouſly to the year 1796, the Rev. William Pearſon, who lived at that time in the city of Lincoln, had read the accounts of Mr. Benjamin Martin's and Mr. James Ferguſon's planetary mechaniſm with ſuch attention, as enabled him to diſcover many imperfections in them, which it appeared to him might be avoided, and among the reſt that defect which ariſes from equable motion and unvarying diſtance. On entering into a correſpondence with one of the inſtrument-makers in London, he found that the modern machines owed their origin chiefly to one or the other of the above-named authors, and that little or no improvement had been made in the accuracy of their repreſentations ſince their time. In conſequence of this information, and unacquainted with the contrivances we have juſt deſcribed, except that of Dr. Deſaguliers, deſcribed by Mr. Ferguſon, he turned his mind towards the ſubject with a view of deviſing ſome improvements in this kind of machinery, which required an union of mechanical ſkill, with a knowledge of the ſcience of aſtronomy, to enable him to ſtrike out original plans for the accompliſhment of his purpoſe. His firſt object was to render the trains of wheel-work as nearly as poſſible ſuch as would produce the true periods of the different planets in their orbits, in doing which he found no difficulty after he had adopted a direct and unerring ſyſtem of calculation, which became eaſy and familiar by practice; but this part of his purſuit is not the object of our preſent article: the next object of his attention was to deviſe the mechanical means of exhibiting planetary motion, both with regard to variable velocity and variable diſtance; different methods preſented themſelves in ſucceſſion at different times, ſome of which he afterwards found had been tried before by others, but the firſt project that promiſed to be really ſubſervient to his purpoſe was that which was repreſented in *fig.* 3. of *Plate* III. of *Planetary Machines*, and which was made for the arm of Mercury, in an orrery conſtructed under his direction, by a clock-maker at Lincoln. The contrivance had three objects in view, the variable diſtances, the variable velocities, and the latitudes of the planets, or deviation from the ecliptic, two of which purpoſes it anſwered moſt completely, and the third in a certain degree, beſides preſerving, fourthly, the paralleliſm of the planet's axis in every part of its orbit. It occurred to the contriver of the mechaniſm in queſtion, before he had ever ſeen Mr. Adams's "Geometrical and Graphical Eſſays," and before he had heard of "Suardi's Geometric Pen," that if a ſmall arm were by any means made to revolve in a retrograde direction, when placed at the diſtant end of the long arm, or radius vector of any planet, during the time that the radius vector itſelf revolved juſt once by a direct motion round the ſun in the centre, the curve traced by a pencil placed at the remote end of the ſmall arm would be *an excentric circle*; and alſo that there would be an alternate acceleration and retardation of angular velocity in the pencil with reſpect to the ſun, or central point round which the radius vector might be carried; which velocity would be the quickeſt when the pencil was in its neareſt ſituation, and ſloweſt when moſt remote; becauſe in the former caſe, the compound motion would be the ſum of two motions, both in the ſame direction, and in the latter the difference of two motions in contrary directions. This idea, having at the moment of its occurrence made a ſtrong impreſſion on the mind of the inventor, excited in him much impatience to have it brought to the practical teſt of an experiment; the ſmall frame, ſhewn in *fig.* 3, was roughly put together, and the equal wheels A, B, and C, were included, ſo that A was faſt to the arbor S, but B and C revolved on their arbors in the frame; the arbor of the latter, however, was left long enough for its pivot to protrude downwards, and to receive a crank-piece P, bearing a ſhort pencil: the ſtem or arbor S, having its conical point at S fixed on a ſheet of paper, was then held faſt by a milled nut above it, to prevent its revolving, and the frame was carried round while the three ſmall wheels, with equal numbers of teeth, were connected together; the conſequence was, as had been expected, that the pencil traced a circle of a diameter equal to twice the diſtance of the arbors A and C from each other, but the centre of the circle was found to be at G inſtead of S, juſt the length of the ſhort arm or crank-piece P, from the point S, from which the excentric circle was deſcribed. This fact determined at once that the frame and ſhort arm ought to be to each other in length as the mean diſtance is to the excentricity of the orbit of any planet thus to be deſcribed, and, as orbits with but little excentricity are very nearly *excentric circles*, a circle thus deſcribed cannot be diſcriminated in a machine from an ellipſe of the ſame excentricity.

Before we proceed to deſcribe the mechaniſm reſulting from the principle of a little arm revolving backwards on the end of the radius vector of any planet juſt once in each revolution of the planet, let us illuſtrate the principle itſelf more clearly. Suppoſe the line A C, in *fig.* 4. of *Plate* III. to repreſent the length of the frame or radius vector S C, and alſo the ſhort arm C A, repreſenting the excentricity or diſtance from the centre to the focus of the orbit, to be both directed into one right line S A, before any motion be communicated to the frame; then as the teeth of the three wheels A, B, and C, of equal numbers of teeth, are connected together, and the wheel A is at reſt, the wheel B will have a motion in the ſame direction as the frame, and the wheel C will have its motion in a contrary direction, but of the ſame velocity; conceive the centre of the wheel C to be carried along the circumference of the concentric circle C O I E, the ſpace of the quadrant C O, this wheel C by means of its connection with the wheel A, through the medium of wheel B, will in the ſame time have made a quarter of a revolution, and the remote end of the ſmall arm attached to this wheel will be at N, at right angles to the radius vector, after having paſſed along the quadrant A N, of the excentric circle A N P E, of which the point G is the inviſible centre, and during the whole continuance of theſe two equal but contrary motions of the radius vector and ſhort arm, through theſe quadrants reſpectively, the latter will have preſerved itſelf parallel to its original ſituation A C; again, while the radius vector is moving through the three remaining quadrants of the concentric circle from O to I E and C, ſucceſſively, the remote end of the ſmall arm will deſcribe the three correſponding quadrants of the excentric circle from N to P, M, and A, in equal portions of time, and its paralleliſm will ſtill be preſerved throughout the whole circle, as ſeen in the figure. Thus, while the centre of the wheel C deſcribes the concentric circle C O I E round the point S with an equable motion, the remote end of the ſmall arm, ſuppoſed to carry a planetary body, will deſcribe the excentric circle A N P M, during the whole of which time the motion of the planet will be equable as it reſpects the point G or centre, but unequable as it reſpects the point S out of the centre, where the ſun is ſuppoſed to be placed: for conceive lines like S N to be drawn from S to the planet in different parts of the circle A N P M, or orbit, and they will interſect the circle C O I E *behind* the remote end of the radius vector in one half of a revolution, and *before* it in the other, and the angle at S, ſubtended by the ſhort arm in any ſituation, will expreſs the *equation of the centre* in that point of the orbit, which equation, therefore, is *additive* to the mean motion of the radius vector in one ſix ſigns of anomaly, and *ſubtractive* from it in the other ſix. The nature of the alternate retardation and acceleration of motion produced by this mechaniſm round the point S, and alſo the variation of diſtance, may be eaſily apprehended by attending to the ſucceſſive retrograde and direct motions of the arm in each revolution of the radius vector; from A to N theſe move in oppoſite directions, and the difference of their velocities, as viewed from S, is equal to the quantity of retardation in any particular point of this quadrant; at N the difference is nothing, in which ſituation of the arm the equations would be a *maximum* if the arm were perpendicular to the line S N, *i. e.* if S N were a tangent, to the circle of which the arm O N is radius; but this will not happen till the radius vector has advanced beyond the ſpace of an exact quadrant, and the arm has come to *n*, where the angle ſubtended at S by the arm will be the greateſt poſſible.

The diſtance of this point, where the equation is a maximum from 90° of mean anomaly, will evidently depend on the relative proportions in length of the radius vector and ſhort arm, or which is the ſame thing, of the mean diſtance and excentricity of the planet to be repreſented. From *n* to P, through the remainder of the firſt ſemi-circle, the radius vector and arm will both move in the ſame direction, and will cauſe an acceleration which will be greateſt at P, the perihelion point, where they will both be again in a right line, ſhortened by double the whole length of the ſhort arm, as compared with the original ſituation at the aphelion point. From the perihelion to the point of greateſt equation at the oppoſite ſide of the orbit, the motions of the radius vector and arm continue to be in the ſame direction, but through the laſt quadrant and a ſmall portion of the third, the directions are again oppoſite till the planet arrives at the aphelion point A, where it has undergone all its changes of velocity and diſtance, and where it commences the ſame alternation of ſlow and quick motions that were before exhibited.

Thus, if S be conſidered as the ſun, A the place of the aphelion of any planet, P its perihelion, *m* and *n*, in the ſmall circle of the arm, the places of mean motion, the concentric circle C O I E the ecliptic, and the excentric one A N P M the planet's orbit, it is evident that both the excentricity, and alſo a *certain equation* of the centre of a planet's orbit, may be very conveniently repreſented by the ſame apparatus that has long been uſed for no other purpoſe but that of preſerving the paralleliſm of its axis.

But ſtill the main queſtion is not diſpoſed of; *viz.* what portion of the equation, conſidered as an arc of the orbit, will a line equal to the excentricity ſubtend? The analogy for reſolving this query is as follows:

As the mean diſtance, or radius vector, of the planet,
Is to radius,
So is the excentricity, or ſhort arm,
To the ſine of the greateſt angle at S ſubtended by the ſhort arm.

This angle, taken in degrees and minutes, we find is invariably, as nearly as may be, *one-half of the greateſt equation*, as has been already mentioned.

It will now have occurred to the reader, probably, that, if a line equal to the excentricity ſubtends one-half the equation of the centre of a planet, *double* the excentricity will be the meaſure of a ſhort arm that will ſubtend the *whole* equation; this is nearly true as to the queſtion of the equation alone, but then the diſtances and excentricity of the orbit, on which the geocentric appearances depend, would be greatly out of proportion; and what is gained in the heliocentric apparent places would be loſt in the geocentric appearance in the ſyſtem. To keep all the deſiderata within their due bounds, and to make the elements of the orbit accord with both heliocentric and geocentric appearances in the mechanical repreſentation, an additional contrivance was ſuperadded, which ſupplied the defect of the revolving ſhort arm without deranging materially the effect of its operation; the laſt wheel of the train, which carries the radius vector round in the due period, had its teeth ſo unequally cut as to repreſent the ſecond half of the equation, by cauſing an alternate acceleration and retardation in the revolution of the radius vector itſelf, ſo that the total effect produced by theſe two contrivances acting together was very nearly agreeable to the real motion of the planet itſelf in its own orbit. But we have ſaid, that the latitude of the planet was repreſented by the ſame contrivance that ſhews the diſtances and one-half of the equation. This was done by placing the ſtem of the planet in a ſquare ſocket, at the remote end of the ſmall arm, in ſo detached a way, that it was at liberty to reſt on the plane of an inclined plate, carried by the radius vector, to repreſent the inclination of the orbit, and to receive the circular ſcale of latitudes pointed to by the end of the ſtem as it travelled up and down the ſaid plane in its retrograde revolution.

The little frame we have had occaſion to mention might do very well as a piece of mechaniſm for a radius vector, where the length is ſmall, but where the planet is repreſented as moving at a conſiderable diſtance from the ſun, the mechaniſm contained in *fig.* 3. of *Plate* IV. is better adapted, where A B is the radius vector proportional to the mean diſtance, and embracing faſt the upper extremity of the tube of the wheel with unequal teeth; C is a contrate wheel of any number of teeth made faſt to a ſurrounding tube that has no motion; the horizontal arbor D has two pinions of equal numbers, no matter what, one of which, E, is connected with the fixed wheel C, and the other, F, is connected with a ſecond contrate wheel G, which is every way like the wheel C, except that its poſition is inverted for the ſake of making its direction of motion retrograde; the lower pivot of wheel G reſts in a cock H, attached to the end of the radius vector, and its upper pivot aſcending above the ſame carries the ſhort arm that ſupports the ſtem of the planet; laſtly, I is the inclined plate with a ſcale of latitudes, on which the end of the ſtem reſts, and by which it is made to aſcend through one portion of its orbit, after which its own weight brings it gradually down again. The inclined plate is ſo placed that the nodes may fall at their reſpective diſtances from the aphelion point; and all the changes of place ariſing from the combined cauſes of varying diſtance, varying velocity, and inclination of the orbit, are duly repreſented.

A ſimilar combination of mechanical contrivances was afterwards, in the year 1802, adopted by Mr. Pearſon, when he contrived and ſuperintended the conſtruction of the large planetarium at the houſe of the Royal Inſtitution in Albemarle ſtreet, London; though the means are ſomewhat different. The plane of the inſtrument was deſired by Dr. Thomas Young, at that time the lecturer, to be vertical inſtead of horizontal, which afforded the means of making the ſhort arms, repreſenting the reſpective excentricities revolve backwards by a weight ſuſpended to each, inſtead of the wheel-work which we have deſcribed: the inequalities among the teeth of the tubed wheels in this inſtrument effect one half of the equation, and the retrograde revolutions of the little arms produce the other, and make all the planets revolve according to equated motion, while the ſtems round which the ſaid ſhort arms revolve are, agreeably to Dr. Young's ſuggeſtion, ſo bent, as to repreſent alſo the inclination of the orbits, and conſequent heliocentric latitudes, for eſtimating which the ecliptic plate is put exactly in the plane paſſing through the centre of the ſun, or coincident with the plane of the earth's orbit. The ſmall divided plates carried by the ends of the radii vectores indicate both the equations and heliocentric latitudes; which obſervations we make here, becauſe the conſtruction of the inſtrument has never yet been publicly explained, except perhaps partially in the lectures, and becauſe the uſes of the different parts, not being obvious by mere inſpection, are as yet but little underſtood. For a more particular deſcription of this inſtrument, ſee our article PLANETARIUM.

But we are not to take for granted, becauſe one half of the greateſt equation will be thus repreſented at the point of mean diſtance by a radius vector and ſhort arm, that are to each other as the mean diſtance to the excentricity, that therefore half the equation will be equally well repreſented in every other part of the orbit of a planet. Let us examine this matter more particularly, and bring it to the teſt of actual calculation. Let the line S H, *fig.* 5. of *Plate* III. be the radius vector of Mercury, and H A the ſhort arm repreſenting the excentricity, which are to each other very nearly as 5 to 1; then when the planet is at A, its greateſt diſtance from S, the ſun, it is obvious from what has been ſaid, that its angular velocity, as it reſpects S, muſt be ſlower than if it were at P, or any other part of the line S A; conceive now the point H, round which the little arm revolves, to move forwards ſo far that the planet may fall back by means of the arm to the point *a*; then if a line were drawn from S to *a*, the equation or angle at S would be ſubtended by *a b*, the ſine of the angle A H *a* to radius A H, which line conſequently is perpendicular to the radius vector at the point *b*; the diſtance *b* H is the coſine of the ſame angle, and we have $\overline{\mathrm{S\,H} + \mathrm{H}\,b)}$ for the baſe of a right-angled triangle, and *b a* for the perpendicular of the ſame, to determine the angle at S or ſemi-equation, which is one of the ſimple caſes in plane trigonometry, where the baſe is uſed as radius, and the perpendicular as tangent of the required angle. For example, the mean diſtance of Mercury, as given by La Lande, is 38710, and its excentricity 7955.4, the mean diſtance of the earth being 100000; then if, agreeably to this ratio, we take the ſmall arm repreſenting the excentricity at unity, the radius vector muſt be 4.86587; for as 7955.4 : 38710 :: 1 : 4.86587; let the point *a* now be taken equal to 30° from A, and from the tables of natural ſines we have *a b* = .5000000 and S H + H *b* = 4.86587 + .8660254 = 5.7318954, hence

As log. 57319 - Ar. co. - .2417014
Log. 5000 - - - - .6989700

Tang. of ½ equation 4° 59′ 7″ - .9406714

In the ſame manner one half of the equation, correſponding to any other point *c* in the quadrant A Q, may be found where H *d* is the coſine to be added to the radius vector, and *c d* the ſine which conſtitutes the ſubtenſe of the required angle at S. In the ſecond quadrant from Q to P the radius vector minus the coſine becomes the baſe of the triangle at any point *e* or *g*, but the ſines at thoſe points are the perpendiculars *e f* and *g h*, as in the laſt quadrant, ſo that the baſe of the triangles ſucceſſively taken is conſtantly ſhortening from the aphelion to the perihelion points of the orbit, whilſt the perpendiculars are increaſing in the firſt quadrant, and then decreaſing in an inverted order in the ſecond, which circumſtance makes the equation greater in a given quantity of mean motion near the perihelion than near the aphelion, as the Newtonian theory requires. That a due eſtimate may be had of the effect produced by this mechaniſm in every part of Mercury's orbit, we ſhall ſubjoin a ſmall table containing the data and reſult of correſponding calculations for every ten degrees of mean motion; and parallel to the ſemi-equations ſo obtained, we ſhall put a parallel column of half the equations taken from the beſt tables as publiſhed by La Lande, from which it will be ſeen that the errors, which at moſt are a ſmall portion of the whole equation, are in exceſs from the aphelion or 0° to 102° of mean anomaly, and in defect from 102° to about 258°, then from 258° to 360° or 0° again in exceſs, which deviations from the truth are agreeable to the deviations ariſing from the approximation called the "elliptic hypotheſis," which Buliald proved from four obſerved places of the planet Mars, as obſerved by Tycho Brahe, makes the computed places more *backward* than the true ones in the firſt and third quadrants of mean motion, and more *forward* in the ſecond and fourth.

TABLE.

Diſt. from the A-phelion	Baſe Line.	Perpendicular.	Diſt. from the A-phelion	Correſponding Semi-Equations by Mechaniſm.			Semi-Equations by La Lande.		
°			°	°	′	″	°	′	″
0	586587	00000	360	0	0	0	0	0	0
10	585068	17365	350	1	41	52	1	37	44
20	580556	34202	340	3	22	17	3	14	1
30	573190	50000	330	4	59	7	4	47	21
40	563191	64279	320	6	29	47	6	16	11
50	550866	76604	310	7	55	0	7	38	49
60	53687	86603	300	9	10	5	8	53	26
70	520789	93969	290	10	13	41	9	58	0
80	503952	98481	280	11	3	26	10	50	16
90	486587	100000	270	11	36	48	11	27	43
100	469222	98481	260	11	51	2	11	47	34
110	452385	93969	250	11	44	5	11	46	54
120	436587	86603	240	11	14	41	11	22	44
130	422308	76604	230	10	16	52	10	32	23
140	409983	64279	220	8	53	25	9	14	3
150	399984	50000	210	7	8	30	7	27	35
160	392618	34202	200	4	58	2	5	15	24
170	38816	17365	190	2	23	42	2	43	13
180	386587	00000	180	0	0	0	0	0	0

In examining the preceding table it may be ſeen that the place of mean motion, or point where the equation is a maximum, falls, according to the mechaniſm, ſomewhere between 100° and 110°, which, in La Lande's tables, is at 105°; let us try where it will fall exactly by the mechanical repreſentation.

The point B, where the line S B is a tangent to the ſmall circle, is the place of the planet's greateſt equation, and this point will be found beyond the firſt quadrant, a quantity equal to the angle Q H B, or, which is the ſame thing, H S B, or greateſt ſemi-equation; for as S H Q and S B H are both right-angled, and have the angle at S common to both, the third angle, H Q S, is equal to the third angle B H S, and, conſequently, the ſupplemental angle Q H B is equal to the ſupplemental angle H S Q, or greateſt ſemi-equation. *Q. E. D.*

But the greateſt ſemi-equation by the mechaniſm when computed is 11° 51′ 34″, therefore the place of mean motion falls at 90° + 11° 51′ 34″, or at 101° 51′ 34″, which point is ſhort of 105° by a quantity upwards of 3°. This want of exact coincidence is, however, of little or no moment in the mechanical repreſentation of the orbit, becauſe the quantity of the greateſt equation is nearly ſtationary for many degrees both before and after the exact point of mean motion. The repreſentation will be ſtill more accurate where the orbits have leſs excentricity, than that of Mercury, which is the caſe with all the other planets, except two out of the four newly diſcovered ones, *viz.* Pallas and Juno.

As we have had frequent occaſion in this article to ſpeak of a wheel with unequal teeth, made for the purpoſe of effecting alternate accelerations and retardations of angular motion, and have alſo ſeen the theory explained by Mr. Huygens, it may be proper to ſay a few words here about the practical method of cutting ſuch a wheel. This operation may be done by three different methods; firſt, the divided circle of the plate, to be uſed with the engine, may have the diviſions laid down unequally by Huygens' mode of transferring equal diviſions from an excentric circle to a concentric one, as already explained; and then the teeth may be cut in the ordinary way from theſe unequal ſpaces, when punched or drilled into dividing holes; or, ſecondly, an equally divided circle of the engine plate may be uſed, and the increments and decrements, previouſly calculated, may be given at each tooth by the micrometer ſcrew of ſuch an engine as either Hindley's or Rehé's; or, thirdly, which is the readieſt method, the wheel to be cut may have a hole drilled in the excentric point, and be placed thereby on the arbor of the engine, till all the teeth are marked with ſlight notches by the cutter, adjuſted for diſtance at each cutting, and then the hole in the centre muſt be uſed for completing the teeth in their proper direction; for when the cutter is put into the notches ſucceſſively, it will cut the teeth towards the centre without any guidance of the index or alidade; and this method is practicable with any common engine without a micrometer ſcrew for taking and giving ſmall portions, as deductions from or additions to a mean tooth. For the wheels with unequal teeth in the large planetarium of the Royal Inſtitution, in Albemarle ſtreet, London, the firſt method was uſed by the maker, M'Culloch, under the direction of the contriver both of the machine itſelf, and of the method uſed of rendering the teeth of certain wheels gradually unequal round each ſeparate ſemicircle, agreeably to the planetary motions to be produced thereby in the planets themſelves; but in an accurate and elegant machine ſince made (by Fidler) for himſelf, the laſt method was uſed with ſucceſs for the large wheel that produces the ſun's, or rather earth's annual equation.

Another, and that a very recently contrived method of exhibiting the equations of all the planetary orbits at the ſame time, together with their variable diſtances, by very ſimple mechaniſm, has been adopted by Mr. Pearſon in the machine we have juſt mentioned, as made by Fidler, under his own direction; this method has the advantage of ſhewing alſo the mean motions, and is well calculated for illuſtrating the irregularities of motion on which the various phenomena of the heavenly bodies depend, as well as for ſhewing the exact times at which they occur, and the countries to which they will be viſible. For a deſcription of the machine itſelf we refer the reader to the articles PLANETARIUM and ORRERY, and ſatisfy ourſelves in this place with an account of the principle by means of which the equations of the centre are effected. *Fig.* 1. of *Plate* IV. of *Planetary Machines*, which is illuſtrative of the principle in queſtion, is derived from *fig.* 4. of *Plate* III. which has been explained, but has the addition of a third diminutive arm at the end of the longer arm placed at the extremity of the radius vector; we have ſeen that one arm, equal in length to the excentricity of the orbit to be repreſented, will, by its retrograde revolution, give the diſtances and one half of the equation, very nearly, in every part of the orbit, and we have ſeen that if the ſaid arm were made equal to twice the excentricity it would give the whole equation near enough, but would not give the diſtances truly; now the introduction of the additional arm is to make the apparent place of the planet fulfil both theſe conditions, which it does in a ſurprizing manner. Let S J, in *fig.* 2, be a radius vector, revolving equably round the point S, in *fig.* 1, in which caſe the extreme end J will deſcribe the concentric circle J K O L Q R T V; let J *a* be a ſhort arm equal in length to the excentricity once and a half taken, which arm is made to revolve in a backward direction by means of the faſt grooved circle *d*, of the catgut *e f*, and of the pulley *g* of the ſame diameter as *d*, which mechaniſm anſwers as well as that in *fig.* 3, before deſcribed, and is ſimpler: over the pulley *g* is fixed faſt to a ſtem, borne by the radius vector, round which the pulley turns, another grooved circular piece J, round which the gut *h i* goes, and embraces alſo a diminutive pulley *a* of half the ſize of J, ſo that whilſt the radius vector and arm J *a* go each once round in contrary directions, the third or little arm *a* A, which is equal in length to only one half the excentricity, goes twice round in the ſame direction, in which the radius vector moves, and thus carries a planet at its extremity round the point S, in which the ſun is placed, very nearly agreeably to the laws of planetary motion, with regard both to angular velocity and diſtance in every part of the orbit. To render the effect thus produced more intelligible, conceive two pins made faſt in the line J A, *fig.* 1, conſidered as one line equal to twice the excentricity of the orbit to the radius S J, and let one of them be at C, the middle of the line, and the other at A, the extremity; then if this line preſerves its paralleliſm all round the orbit, by a retrograde motion given to it by the catgut *e f* and pulley *g*, *fig.* 2, the pin C being at the diſtance of the excentricity S G from the end J of the radius vector, will deſcribe the excentric orbit 1, 2, 3, I, 4, 5, 6, of the planet, while the pin at A will have the proper velocity as ſeen from S, but will move in the circle A B D E P F M H, which is too excentric to become the true orbit; but if the point A of the additional ſmall arm be put to C when the motion begins, and has the planetary body placed on its extremity, then it will move in the ſame excentric circle as the firſt pin C, but with the apparent angular velocity of the ſecond pin A as ſeen from the other focus W, and very nearly ſo as ſeen from the ſun at S: for conceive the radius S J to have moved to K, the pin A will be found at B, on account of the angle B K *b* being equal to the angle J S K, which is here 45°, but the planet has moved a quadrant to 1, and is found in the circle deſcribed by the pin C, or middle circle; but, viewed from W, according to the elliptic hypotheſis, is ſeen in the line W B, as though it had been actually at B in the outermoſt circle; again, when the radius vector has completed a quadrant and is in the ſituation S O, the firſt pin is at N, the ſecond at D, and the planet at 2, in the line W D as before, and the additional arm has now deſcribed a ſemicircle: here the equation D S O is ſubtended by double the excentricity very nearly: when J is advanced 135° to L, the additional arm has moved $\frac{3}{4}$ of a circle, and is found at 3, ſtill in the middle circle, and alſo in the line W E, extended: and when S Q is the ſituation of the radius vector the planet is at I, the perihelion point of the middle circle, and alſo in the line W P, extended as before. In like manner in the other ſemicircle of mean anomaly, when the extreme end of the radius vector is ſucceſſively at the points R, T, and V, the planet will be found at the points 4, 5, and 6, and alſo in the lines W F, W M, and W H, reſpectively, ſtill moving in the middle circle, till it arrives at the aphelion point C, from which it originally ſet out. When the pulleys are made to produce this effect very nicely, the band or gut, that embraces two pulleys of different diameters, will effect the ratio of 1 : 2 in practice, and will require the ſmaller pulley to be ſomewhat leſs in diameter than what the exact proportion requires in theory. The radius vector has a ſlit in its remote end, with a thumb-ſcrew under it, to fix the pulley at a greater or leſs diſtance, as the tenſion of the gut may require, and the whole contrivance being ſimple, ſteady in its motion, and light in its conſtruction, as well as having a tendency to prevent the radius vector from bending downwards, is far preferable, in every point of view, to any contrivance we have before ſeen for anſwering the ſame purpoſe. The mechanical repreſentation of the orbit bears the ſame analogy to the elliptic hypotheſis, that an excentric circle does to an ellipſe of the ſame excentricity, and in the orbits of the planets theſe figures are ſo nearly alike, that they may be ſubſtituted for each other, without ſenſible error; and we may add, that the equation produced by only one arm, equal to twice the excentricity, is by no means ſo accurate as the *equation doubled*, that is, produced from an arm equal to the exact excentricity, becauſe the tangents of different angles do not increaſe by equal quantities.

Beſides the preceding methods of producing the equation of a planet's orbit, our author has contrived to indicate the quantity thereof in any point of the orbit, as well as the latitude alſo, as ſeen from the ſun; this is done by means of a hand fixed under the revolving pulley J, travelling over a divided and ſilvered plate, fixed faſt in the ſituation of the dotted circle, on the end of the radius vector, concentric with the pulley, which plate not only ſhews the equation and latitude at any time, but is of uſe in placing the arms in their proper ſituations by the latitudes taken from the Ephemeris or Nautical Almanac.

Theſe are all the methods that have fallen within our notice, of effecting the grand equation of a planet's orbit, as applied to an orrery, or planetarium; but there remain yet two pieces of mechaniſm, contrived by our preſent inventor, that are well calculated to explain in a lecture-room the equation of an individual planet, as detached from the ſyſtem, which we ſhall briefly deſcribe, as being contrivances equally novel and competent to their purpoſe. The firſt is repreſented by *figs.* 4 and 5 of our laſt plate, the former being a ſection of the wheel-work, and the latter a ſketch of a part of the viſible part of the inſtrument. AB is a little frame, containing four wheels, *a*, *b*, *c*, and *d*; *a* and *b* are equal in diameter, and of ſimilar numbers of teeth, *a* fixed on the arbor of the handle *e*, and *b* on a tubed arbor *f*, that carries the index *g*, ſeen in *fig.* 5 of the ſhape of a T, with a point touching the circle *k*, which is an ecliptic circle; ſo that whatever velocity is given by the handle to the wheel *a* in an equable manner, the ſame is communicated, by the medium of the wheel *b*, to the index *g*, which therefore moves according to mean motion in the ecliptic circle K. The wheels *c* and *d* are excentric, and have alſo ſimilar diameters and numbers of teeth, but are placed to act ſo, that the longeſt radius of one always acts with the ſhorteſt of the other, and thus produce the ſame effect as Dr. Deſaguliers' elliptic grooved plates with the endleſs catgut. The excentricity of the wheels bears the ſame proportion to their common radius, that the excentricity of the planet's orbit does to its mean diſtance: wheel *c* is fixed faſt to the ſame arbor of the handle as wheel *a* is, but wheel *d* has a ſeparate arbor, which goes with the tube of wheel *b*, and carries the hand *i*, and on its upper end a ball to repreſent the ſun. The ſectoral arc of the index *g* is graduated, for Mercury for inſtance, into 24° each way from the middle, to which the hand *i* muſt be put when the index points to that part of the ecliptic circle in which the aphelion point of the planet is; then as the handle is turned the index ſhews the mean motion in the ecliptic, which may have a ſecond circle divided into ſigns of mean anomaly, beginning at the aphelion point, and as the motion proceeds the hand *i* falls back, till at the end of three ſigns and a half of mean anomaly it is found near the extremity of the ſectoral arc, at *g*; at the perihelion point the hand is again in the middle; and at eight and a half ſigns of mean anomaly it will be in its preſent ſituation again, at its greateſt equation, at the oppoſite end of the ſectoral piece; and laſtly, at the aphelion point the hand will be again found in the middle, which is the zero of both the poſitive and negative equations, which are reſpectively marked + and − on the oppoſite ends of the graduated ſectoral arc. Thus, the index *g* ſhews the mean motion, the hand *i* the equated motion, and the graduated portion of the index has the quantity of the equation plus or minus, ſhewn by the hand *i* in every part of the orbit, while a line drawn from S, the ſun, over the point of the hand *i* to the ecliptic K, ſhews the equated or true heliocentric place of the planet. The other inſtrument for explaining the nature of the mean and equated anomaly of a detached planet, and of its equation, which is their difference, is ſimply a mechanical conſtruction of the elliptic hypotheſis of biſhop Ward, and is repreſented by *fig.* 6. of the ſame plate. S G W is an elliptic plate of wood or metal, deſcribed from the foci S and W, the ſmall circle at S is divided into an ecliptic circle with a ſlender ſtem in the centre bearing a ball to repreſent the ſun, and the other ſimilar circle at W is divided into as many ſpaces as there are days or weeks in the period of the planet; of which 88^d are proper for Mercury; the bar *a* G is concealed under the dotted line, and turns on the vertical ſtem of the ſtand that ſupports the elliptical plate at G, by means of a piece of braſs tube fixed at its end; on the bar *a* a ſliding piece *b* is inſerted, that bears a ſmall pulley *c*, and a planet in the angular point behind it, on a ſtem as high as that of the ſun; this ſliding piece has two rollers, bearing againſt the edge of the elliptical plate, to facilitate the motion of the bar round the plate, which is produced by hand; an endleſs gut or ſilk cord S W *c* draws the ſliding piece cloſe to the ſaid plate, and cauſes the pulley and planet to deſcribe the proper ellipſe for the orbit. According to the elliptic hypotheſis, if the angle *c* W A be the meaſure of the mean anomaly, the angle at the ſun in the other focus, *viz.c* S A, will always be the equated anomaly, and the ſmall angle S *c* W will, in every ſituation, be the equation of the centre, as being the ſupplement of the ſum of the other two angles, that is, the external angle *c* W A, that repreſents the mean anomaly, is equal to the ſum of both the internal angles of the triangle at S and *c*, as being reſpectively the ſupplement of the other internal angle at W; but the internal angle at S is the equated anomaly; therefore the angle *c* W A − ∠*c* S W is the angle *c*, or equation during the firſt ſix ſigns of mean anomaly; in the other ſix ſigns the angle repreſenting the mean anomaly at W will be ſmaller than the angle at S, repreſenting equated anomaly, therefore the equation, or difference between them, which has been ſubtractive, becomes now additive; and the hypotheſis, thus mechanically conſtructed, affords the ready means of explaining the particulars of planetary motion, for which purpoſe equal ſectoral arcs are laid down on the plate alternately black and white, which the thread S *c* moves over in equal arcs of the circle W, moved over by the thread W *c*; which are equal portions of time; and when the circle W is divided into days or weeks, and the circle S into ſigns of longitude, and alſo into ſigns of anomaly, the ſame reſults will follow as from the preceding mechaniſm, as nearly as may be, while, at the ſame time, all the variations of diſtance, as well as of the equation, will be faithfully exhibited. Both theſe contrivances may be conſtructed ſo as to be uſed either horizontally or vertically, and on any ſcale of magnitude that the audience of a lecture room may require.

Equation *of Time.* Having, under the article Day, explained the origin of the difference between ſolar and mean time, we have now only to explain the method by which this difference is calculated.

To effect this, it is neceſſary to know preciſely the motion of the ſun, and the dimenſions of its orbit: we may then calculate the arc which it deſcribes every day in the year parallel to the equator. If this real and variable motion be compared with its mean motion, the difference will be the equation of time.

If we imagine two meridians, drawn through the two extremities of the arc of the ecliptic, which the ſun deſcribes in one day, the arc of the equator, which they intercept, is the difference between the ſolar and a ſidereal day; for when the rotation of the celeſtial ſphere is terminated, this ſmall arc of the equator muſt traverſe the meridian before the centre of the ſun can arrive there. Now as this arc is not always of the ſame length, the ſolar days are not all equal.

Nor would they be ſo, even if the ſun deſcribed every day an equal arc of the ecliptic, for theſe arcs take ſucceſſively different inclinations relatively to the equator. At the moment of the equinoxes, they cut this plane at an angle equal to the obliquity of the ecliptic, and at the period of the ſolſtices they are parallel to it. The meridians drawn through the extremities of theſe diurnal arcs are more ſeparated at the ſolſtices than if they contained the ſame arc at the time of the equinoxes; and, as it is this ſeparation of the two meridians which meaſures the ſucceſſive retardations of the ſun, theſe are unequal, and leſs at the equinoxes than at the ſolſtices. The daily variation of the motion of the ſun in its orbit is another ſource of inequality, as it augments and diminiſhes the diurnal arc of the ecliptic, and this produces a correſponding variation in the arcs of the equator contained between the above-mentioned meridians.

Thus the inequality in the ſolar days ariſes from two diſtinct cauſes, the obliquity of the ecliptic, and the unequal motion of the ſun in its orbit. As theſe two cauſes each produce their ſeparate effect, they muſt be both deſtroyed, to render the ſolar days equal, that is, the motion of the ſun muſt become uniform, and the ecliptic muſt coincide with the equator.

To calculate the value of the equation of time, we muſt calculate the arc which the ſun deſcribes each day on the ecliptic, and project it on the equator, and from this deduct the mean diurnal motion: the difference will give the equation of time for that day.

To repreſent theſe reſults geometrically, we may ſuppoſe an artificial ſun to move in the manner deſcribed under the article Day, the mean day is the interval between two ſucceſſive returns of this fictitious ſun, and the mean noon the inſtant of its paſſage over the meridian; and the mean equinox is the inſtant of its paſſage through the equinoctial point. It is obtained by a ſimple proportion, when the longitude of the perigee is known, and the epoch when the true ſun is in the apſides, the time which elapſes between two conſecutive returns to the mean equinox, forms the mean tropical year, and which is equal to 365,^{d} 242250.

To calculate the place of the mean ſun on the equator for a given inſtant, it is ſufficient to calculate the mean longitude, and this, reduced to the equator, is the mean right aſcenſion of the ſun.

The projection of the true ſun on the equator may either be determined from obſervation, or from calculating its right aſcenſion. The difference between their right aſcenſions, reduced into time, in the proportion of 24^h to 360°, indicates the interval between the paſſage of the true and mean ſun, and is the required equation of time: it is ſometimes additive, and ſometimes ſubtractive, and has the remarkable property of becoming zero four times in a year.

To underſtand the reaſon of this phenomenon, let us imagine (*fig.* 108.) two ſuns, S^2 and S^4, to ſet out at the ſame time from the equinox, both moving with an uniform motion; the one, S^2, in the ecliptic, the other, S^4, in the equator, and let the motion of each be referred to the latter plane. S^3 will at firſt advance upon the meridian of S^3, but afterwards this latter will approach it, and they will arrive together at the ſolſtice; after this the meridian of S^2 will advance upon that of S^3, till the ſecond equinox, where they will arrive together. The ſame circumſtances will occur in the other half of the orbit, and thus the two ſuns will coincide together four times in the year, namely, at the equinoxes and ſolſtices.

But, in reality, the mean ſun does not ſet out at the ſame time as the true ſun; they will not, therefore, meet at the ſame points; the unequal motion of the ſun changes this difference, but theſe two cauſes united only change the epoch of the coincidences; their number remains the ſame.

Let us conſider the motion of the two ſuns, S^2, and S^3, ſuppoſed to ſet out together from the autumnal equinox, and proceeding towards the perigee. The true ſun, S^1, which deſcribes the ecliptic, being referred by its meridian to the plane of the equator, will then be found behind the others, for it is preceded by S^2 till the perigee; let us now conſider the motion of the other two. Till the moment of the ſolſtice, S^3 precedes S^1, and S^2 precedes S^1, their order is therefore S^1, S^2, S^3. At the ſolſtice S^3 joins S^1, and afterwards paſſes it; their order is then S^2, S^3, S^1, but at the perigee S^1 coincides with S^2, and afterwards precedes it: to do this S^1 and S^3 muſt meet in the interval. The order then becomes S^1, S^3,

S^2, S^1; thus between the winter ſolſtice and the perigee the true ſun S^1, referred to the equator, meets the mean ſun S^3, and the equation becomes zero. From the perigee to the vernal equinox S^1 precedes S^2, and S^2 precedes S^3; they none of them meet therefore in this interval. At the equinox S^3 joins S^2, and their order becomes S^2, S^3, S^1; but S^3 cannot remain long between the two others, for at every quadrant the ſeparation of S^3 and S^2 increaſes to 2° 24′ 24.″4, as appears by calculation; but the diſtance of S^1, S^2 never exceeds 1° 55′ 27″, which is the greateſt equation of the centre, and as, in the preſent ſituation of the ſolar orbit, this takes place near the equinoxes, the arc which correſponds to it on the equator is ſtill leſs than it. It is evident, therefore, after the vernal equinox, and before the ſummer ſolſtice, there muſt be ſome moment when the mean ſun S^3 arrives upon the meridian of S^1, when the equation is again zero. From that point to the ſummer ſolſtice the order is as follows, S^2, S^1, S^3: at the ſolſtice S^2 joins S^3, and afterwards paſſes it. But S^1 precedes S^2 as far as the apogee, conſequently the meridian of S^1 joins the mean ſun S^3, before the ſolſtice, and the equation becomes zero for the third time.

From the ſolſtice to the apogee, the order of the three ſuns is as follows, S^3, S^2, S^1; at the apogee S^2 joins S^1, and afterwards precedes it till the perigee, the order thus becoming S^3, S^1, S^2; but at the autumnal equinox S^3 joins S^2, and conſequently meets in this interval the meridian of S^1, and the equation becomes zero for the fourth time.

The order of the three ſuns then becomes S^1, S^2, S^3, and the ſame appearances are re-produced in the ſame order as before.

Hence it appears, that in conſequence of the obliquity of the ecliptic, combined with the unequal motion of the ſun, the equation of time becomes zero four times a year, *viz.* once between the winter ſolſtice and the perigee, twice between the vernal equinox and the ſummer ſolſtice, and for the laſt time between the apogee and the autumnal equinox. The epochs of theſe phenomena evidently vary with the poſition of the greater axis of the ſolar orbit; at preſent they happen about the 24th December, 15th April, 15th June, and the 31ſt of Auguſt. If the equator coincided with the ecliptic, that part of the equation of time depending on their inclination would diſappear, and the mean motion would only differ from the true by the equation of the centre, and mean and true time would agree twice a year when the ſun is in the apſides.

Dr. Maſkelyne has invented a rule for computing the equation of time, in which all the three cauſes are conſidered; it was inveſtigated in the following manner.

Let A P L Q (*Plate* XII. *fig.* 109.) be the ecliptic, A L Q the equator, A the firſt point of Aries, P the point where the ſun's apparent motion is ſloweſt, S any place of the ſun; draw $S v$ perpendicular to the equator, and take $A n = A P$. When the ſun begins to move from P, ſuppoſe a ſtar to begin to move from n, with the ſun's mean motion in right aſcenſion or longitude, *viz.* at the rate of 59′ 8″ in a day; and when n paſſes the meridian, let the clock be adjuſted to 12; take $n m = P s$, and when the ſtar comes to m, if the ſun moved uniformly with his mean motion he would be found at s, but at that time let S be the place of the ſun. Let the ſun S, and conſequently v, be on the meridian; and then as m is the place of the imaginary ſtar at that inſtant, $m v$ muſt be the equation of time. The ſun's mean place is at S, and as $A n = A P$, and $n m = P s$, we have $A m = A P s$; conſequently $m v = A v - A m = A v - A P s$. Let A be the mean equinox, or the point where it would have been if it had moved with its mean velocity, and draw $A z$ perpendicular to $A Q$: then $A m = A z + x m = A a \times$ coſine $z A a + z m$: or becauſe the coſine of $z A a$, the obliquity of the ecliptic 23° 28″ $= \frac{11}{12}$ very nearly, $A m = \frac{11}{12} A a + x m$: hence $m v = A v - z m - \frac{11}{12} A a$. Here $A v$ is the ſun's true right aſcenſion; $z m$ the mean right aſcenſion, or mean longitude; and $\frac{11}{12} A a$ (*viz.* $A x$) is the equation of the equinoxes in right aſcenſion; therefore the equation of time is equal to "the difference of the ſun's true right aſcenſion, and his mean longitude corrected by the equation of the equinoxes in right aſcenſion."

When $A m$ is leſs than $A v$, mean or true time precedes apparent; when it is greater, apparent time precedes mean: that is, when the ſun's true right aſcenſion is greater than his mean longitude, corrected as above ſhewn, we muſt add the equation of time to the apparent to obtain the mean time; and when it is leſs we muſt ſubtract. To convert mean time into apparent, we muſt ſubtract in the former caſe, and add in the latter.

Tables of the equation of time are computed by this rule for the uſe of aſtronomers; they are either calculated for the noon of each day, as given in the Nautical and ſome other Almanacs, or for every degree of the ſun's place in the ecliptic, as is done in the annexed tables.

Strahan and Preſton,
New-ſtreet Square, London.

TABLE

Of Equation of Time to convert apparent into mean Time for 1810, with the ſecular Variation.

Argument.—Sun's mean Longitude.

Deg.	Sig. 0.	Diff.	Secular Variation. ±		Sig. I.	Diff.	Secular Variation. +		Sig. II.	Diff.	Secular Variation. +	
	′ ″	″	″		′ ″	″	″		′ ″	″	″	
0	+ 6 59.2	18.8	2.97	25	− 1 31.2	12.5	4.31	24	− 3 43.4	4.5	10.83	18
1	6 40.4	18.9	2.72	24	1 43.7	12.0	4.55	24	3 38.9	5.0	11.01	17
2	6 21.5	18.9	2.48	24	1 55.7	11.4	4.79	23	3 33.9	5.5	11.18	18
3	6 2.6	18.8	2.24	24	2 7.1	10.8	5.02	24	3 28.4	6.1	11.36	17
4	5 43.8	18.9	2.00	25	2 17.9	10.4	5.26	23	3 22.3	6.6	11.53	16
5	5 24.9	19.0	1.75	24	2 28.3	9.8	5.49	24	3 15.7	6.9	11.69	16
6	5 5.9	18.8	1.51	24	2 38.1	9.3	5.73	23	3 8.8	7.7	11.85	16
7	4 47.1	18.8	1.27	25	2 47.4	8.8	5.96	23	3 1.1	8.0	12.01	15
8	4 28.3	18.7	1.03	24	2 56.2	8.3	6.19	23	2 53.1	8.4	12.16	15
9	4 9.6	18.6	0.78	24	3 4.5	7.6	6.42	23	2 44.7	8.8	12.31	14
10	3 51.0	18.4	0.54	25	3 12.1	7.1	6.65	23	2 35.9	9.2	12.45	14
11	3 32.6	18.5	0.29	24	3 19.2	6.6	6.88	23	2 26.7	9.8	12.59	14
12	3 14.1	18.3	0.05	25	3 25.8	5.9	7.11	22	2 16.9	10.0	12.73	13
13	2 55.8	18.0	0.20	24	3 31.7	5.4	7.33	23	2 6.9	10.3	12.86	13
14	2 37.8	17.9	0.44	24	3 37.1	4.9	7.56	22	1 56.6	10.8	12.99	12
15	2 19.9	17.6	0.68	25	3 42.0	4.2	7.78	22	1 45.8	11.2	13.11	12
16	2 2.3	17.3	0.93	24	3 46.2	3.4	8.00	22	1 34.6	11.4	13.23	11
17	1 45.0	17.1	1.17	24	3 49.6	3.0	8.22	21	1 23.2	11.6	13.34	11
18	1 27.9	16.9	1.41	25	3 52.6	2.5	8.43	22	1 11.6	11.9	13.45	10
19	1 11.0	16.7	1.66	24	3 55.1	1.9	8.65	20	0 59.7	12.1	13.55	9
20	0 54.3	16.4	1.90	24	3 57.0	1.3	8.85	21	0 47.6	12.3	13.64	9
21	0 37.9	16.0	2.14	25	3 58.3	0.6	9.06	21	0 35.3	12.5	13.73	9
22	0 21.9	15.5	2.39	24	3 58.9	0.1	9.27	21	0 22.8	12.7	13.82	8
23	+ 0 6.4	15.1	2.63	24	3 59.0	0.5	9.48	20	− 0 10.1	12.8	13.90	8
24	− 0 8.7	14.7	2.87	24	3 58.5	1.1	9.68	20	+ 0 2.7	12.9	13.98	7
25	0 23.4	14.3	3.11	24	3 57.4	1.7	9.88	19	0 15.6	13.1	14.05	6
26	0 37.7	13.9	3.35	24	3 55.7	2.2	10.07	20	0 28.7	13.1	14.11	6
27	0 51.6	13.5	3.59	24	3 53.5	2.8	10.27	20	0 41.8	13.2	14.17	5
28	1 5.1	13.2	3.83	24	3 50.7	3.4	10.47	18	0 55.0	13.1	14.22	5
29	1 18.3	12.9	4.07	24	3 47.3	3.9	10.65	18	1 8.1	13.0	14.27	4
30	− 1 31.2		4.31		3 43.4		10.83		1 21.1		13.31	

Strahan and Preſton,

TABLE

Of Equation of Time to convert apparent into mean Time for 1810.

Argument.—Sun's mean Longitude.

Deg.	Sig. III.	Diff.	Secular Variation. +		Sig. IV.	Diff.	Secular Variation. +		Sig. V.	Diff.	Secular Variation. +	
	′ ″	″	″		′ ″	″	″		′ ″	″	″	
0	+ 1 21.1		14.31		+ 5 59.3		13.14		+ 2 46.2		8.78	
1	1 34.1	13.0	14.35	4	6 1.4	2.1	13.03	11	2 31.2	15.0	8.61	17
2	1 47.2	13.1	14.38	3	6 3.0	1.6	12.91	12	2 15.7	15.5	8.44	17
3	2 0.3	13.1	14.40	2	6 4.2	1.2	12.79	12	1 59.8	15.9	8.27	17
4	2 13.3	13.0	14.42	2	6 4.8	0.6	12.67	12	1 43.4	16.4	8.10	17
5	2 26.1	12.8	14.44	2	6 4.7	0.1	12.55	12	1 26.6	16.8	7.93	17
6	2 38.7	12.6	14.45	1	6 4.0	0.7	12.42	13	1 9.4	17.2	7.76	17
7	2 51.1	12.4	14.45	0	6 2.6	1.4	12.29	13	0 51.8	17.6	7.59	17
8	3 3.3	12.2	14.45	0	6 0.6	2.0	12.16	13	0 33.8	18.0	7.42	17
9	3 15.3	12.0	14.44	1	5 58.1	2.5	12.03	13	+ 0 15.4	18.4	7.25	17
10	3 27.0	11.7	14.43	1	5 54.8	3.3	11.89	14	− 0 3.2	18.6	7.08	17
11	3 38.4	11.4	14.41	2	5 51.0	3.8	11.75	14	0 22.1	18.9	6.91	17
12	3 49.5	11.1	14.39	2	5 46.6	4.4	11.61	14	0 41.3	19.2	6.74	17
13	4 0.3	10.8	14.36	3	5 41.6	5.0	11.47	14	1 0.8	19.5	7.56	18
14	4 10.8	10.5	14.32	4	5 35.9	5.7	11.32	15	1 20.6	19.8	7.39	17
15	4 20.9	10.1	14.28	4	5 29.5	6.4	11.17	15	1 40.6	20.0	7.21	18
16	4 30.6	9.7	14.24	4	5 22.6	6.9	11.02	15	2 0.8	20.2	6.04	17
17	4 40.0	9.4	14.19	5	5 15.1	7.5	10.87	15	2 21.3	20.5	5.87	17
18	4 49.0	9.0	14.13	6	5 7.0	8.1	10.72	15	2 41.9	20.6	5.69	18
19	4 57.5	8.5	14.07	6	4 58.3	8.7	10.57	15	3 2.7	20.8	5.52	17
20	5 5.6	8.1	14.01	6	4 49.0	9.3	10.41	16	3 23.6	20.9	5.34	18
21	5 13.2	7.6	13.97	7	4 39.2	9.8	10.25	16	3 44.7	21.1	5.16	18
22	5 20.6	7.4	13.87	7	4 28.8	10.4	10.09	16	4 5.8	21.1	4.98	18
23	5 27.5	6.9	13.79	8	4 17.9	10.9	9.93	16	4 27.0	21.2	4.81	17
24	5 33.7	6.2	13.71	8	4 6.4	11.5	9.77	16	4 48.3	21.3	4.63	18
25	5 39.4	5.7	13.62	9	3 54.3	12.1	9.60	17	5 9.7	21.4	4.45	18
26	5 44.5	5.1	13.53	9	3 41.6	12.7	9.44	16	5 31.0	21.3	4.27	18
27	5 49.0	4.5	13.44	9	3 28.6	13.0	9.28	16	5 52.3	21.3	4.09	18
28	5 52.9	3.9	13.34	10	3 15.0	13.6	9.12	16	6 13.7	21.4	3.91	18
29	5 56.3	3.4	13.24	10	3 0.8	14.2	8.95	17	6 35.0	21.3	3.73	18
30	5 59.3	3.0	13.14	10	2 46.2	14.6	8.78	17	− 6 36.3	21.3	3.54	19

TABLE

Of Equation of Time to convert apparent into mean Time for 1810, with the ſecular Variation.

Argument.—Sun's mean Longitude.

Deg.	Sig. VI.	Diff.	Secular Variation. ±		Sig. VII.	Diff.	Secular Variation. −		Sig. VIII.	Diff.	Secular Variation. −	
	′ ″	″	″		′ ″	″	″		′ ″	″	″	
0	− 6 56.3	21.2	3.54	18	− 15 17.8	8.8	2.56	23	− 13 54.9	16.0	9.64	24
1	7 17.5	21.0	3.36	19	15 26.6	8.1	2.79	23	13 38.9	16.8	9.88	23
2	7 38.5	20.8	3.17	18	15 34.7	7.4	3.02	23	13 22.1	17.5	10.11	22
3	7 59.3	20.7	2.99	19	15 42.1	6.7	3.25	23	13 4.6	18.2	10.33	22
4	8 20.0	20.6	2.80	19	15 48.8	6.0	3.48	23	12 46.4	19.1	10.55	22
5	8 40.0	20.4	2.61	19	15 54.8	5.2	3.71	23	12 27.3	19.9	10.77	21
6	9 1.0	20.1	2.42	19	16 0.0	4.4	3.94	24	12 7.4	20.6	10.98	21
7	9 21.1	19.9	2.23	19	16 4.4	3.7	4.18	23	12 46.8	21.3	11.19	21
8	9 41.0	19.7	2.04	19	16 8.1	2.9	4.41	24	11 25.5	22.0	11.40	21
9	10 0.7	19.4	1.85	19	16 11.0	2.0	4.64	24	11 3.5	22.7	11.61	20
10	10 20.1	19.2	1.66	20	16 13.0	1.2	4.89	24	10 40.8	23.4	11.81	20
11	10 39.3	18.8	1.46	20	16 14.2	0.5	5.13	24	10 17.4	24.0	12.01	19
12	10 58.1	18.4	1.26	20	16 14.7	0.5	5.37	24	9 53.4	24.5	12.20	19
13	11 16.5	18.0	1.06	20	16 14.2	1.3	5.61	24	9 28.9	25.2	12.39	19
14	11 34.5	17.7	0.86	20	16 12.9	2.1	5.81	24	9 3.7	25.8	12.58	19
15	11 52.2	17.3	0.66	20	16 10.8	3.0	6.09	24	8 37.9	26.4	12.77	18
16	12 9.5	16.8	0.46	21	16 7.8	3.8	6.33	24	8 11.5	26.9	12.95	17
17	12 26.3	16.4	0.25	21	16 4.0	4.7	6.57	24	7 44.6	27.3	13.12	17
18	12 42.7	16.0	0.04	20	15 59.3	5.6	6.81	24	7 17.5	27.6	13.29	16
19	12 58.7	15.5	0.16	21	15 53.7	6.4	7.05	24	6 49.7	28.1	13.45	16
20	13 14.2	14.9	0.37	21	15 47.3	7.3	7.29	24	6 21.6	28.5	13.61	15
21	13 29.1	14.4	0.58	22	15 40.0	8.3	7.53	24	5 53.1	28.8	13.76	15
22	13 43.5	13.9	0.80	21	15 31.7	9.1	7.77	24	5 24.3	29.2	13.91	14
23	13 57.4	13.4	1.00	22	15 22.6	10.0	8.01	24	4 55.1	29.5	14.04	14
24	14 10.8	12.8	1.23	22	15 12.6	10.9	8.25	24	4 25.6	29.7	14.19	13
25	14 23.6	12.1	1.45	22	15 1.7	11.7	8.49	23	3 55.9	30.0	14.31	12
26	14 35.7	11.5	1.67	22	14 50.2	12.5	8.72	24	3 25.9	30.1	14.44	12
27	14 47.2	10.8	1.89	22	14 37.5	13.4	8.96	23	2 55.8	30.3	14.56	11
28	14 58.0	10.2	2.11	22	14 24.1	14.2	9.19	23	2 25.5	30.5	14.67	11
29	15 8.2	9.6	2.33	23	14 9.9	15.0	9.42	22	1 55.0	30.3	14.78	10
30	− 15 17.8		2.56		− 13 54.9		9.64		− 1 24.7		14.88	

TABLE

Of Equation of Time to convert apparent into mean Time for 1810, with the ſecular Variation.

Argument.—Sun's mean Longitude.

Deg.	Sig. IX.	Diff.	Secular Variation. —		Sig. X.	Diff.	Secular Variation. —		Sig. XI.	Diff.	Secular Variation. —	
	′ ″	″	″		′ ″	″	″		′ ″	″	″	
0	− 1 24.7	30.5	14.88	10	+ 11 36.3	17.0	14.89	10	+ 14 6.9	7.0	9.96	22
1	0 54.2	30.5	14.98	9	11 53.3	16.2	14.79	11	13 59.9	7.8	9.74	22
2	− 0 23.7	30.5	15.07	8	12 9.5	15.3	14.68	11	13 52.1	8.5	9.52	22
3	+ 0 6.8	30.4	15.15	8	12 24.8	14.5	14.57	11	13 43.6	9.1	9.30	22
4	0 37.2	30.3	15.23	7	12 39.3	13.8	14.46	12	13 34.5	9.6	9.08	22
5	1 7.5		15.30		12 53.1		14.34		13 24.9		8.86	
		30.1		6		13.0		13		10.2		23
6	1 37.6	29.9	15.36	5	13 6.1	12.1	14.21	13	13 14.7	10.7	8.63	22
7	2 7.5	29.7	15.41	5	13 18.2	11.2	14.08	14	13 4.0	11.6	8.41	23
8	2 37.2	29.5	15.46	5	13 29.4	10.4	13.94	14	12 52.4	12.0	8.18	22
9	3 6.5	29.3	15.51	4	13 39.8	9.5	13.80	15	12 40.4	12.5	7.96	23
10	3 36.0		15.55		13 49.3		13.65		12 27.9		7.73	
		28.9		3		8.7		15		13.0		24
11	4 4.9	28.6	15.58	2	13 58.0	7.9	13.50	15	12 14.9	13.4	7.49	23
12	4 33.5	28.3	15.60	1	14 5.9	7.0	13.35	16	12 1.5	14.0	7.26	23
13	5 1.8	27.8	15.61	1	14 12.9	6.1	13.19	16	11 47.5	14.4	7.03	24
14	5 29.6	27.3	15.62	0	14 19.0	5.2	13.03	17	11 33.1	14.8	6.79	24
15	5 56.9		15.62		14 24.2		12.86		11 18.3		6.55	
		26.8		0		4.4		17		15.1		23
16	6 23.7	26.3	15.62	1	14 28.6	3.7	12.69	17	11 3.2	15.6	6.32	23
17	6 50.0	25.9	15.61	2	14 32.3	2.8	12.52	18	10 47.6	16.0	6.09	24
18	7 15.9	25.3	15.59	2	14 35.1	2.0	12.34	18	10 31.6	16.3	5.85	24
19	7 41.0	24.6	15.57	3	14 37.1	1.1	12.16	19	10 15.3	16.7	5.61	24
20	8 5.8		15.54		14 38.2		11.97		9 58.6		5.37	
		24.1		4		0.3		19		17.0		24
21	8 29.9	23.4	15.50	5	14 38.5	0.6	11.78	19	9 41.6	17.2	5.13	23
22	8 53.3	22.8	15.45	4	14 37.9	1.3	11.59	19	9 24.4	17.4	4.90	24
23	9 16.1	22.1	15.41	6	14 36.6	2.0	11.40	20	9 7.0	17.7	4.66	24
24	9 38.2	21.5	15.35	6	14 34.6	2.7	11.20	20	8 49.3	17.9	4.42	24
25	9 59.7		15.29		14 37.9		11.00		8 31.4		4.18	
		20.9		7		3.6		21		18.1		24
26	10 20.6	20.2	15.22	8	14 28.3	4.4	10.79	20	8 13.3	18.3	3.94	24
27	10 40.8	19.3	15.14	8	14 23.9	5.0	10.59	21	7 55.0	18.5	3.74	25
28	11 0.1	18.5	15.06	8	14 18.9	5.6	10.38	21	7 36.5	18.6	3.45	24
29	11 18.6	17.7	14.98	9	14 13.3	6.4	10.17	21	7 17.9	18.7	3.21	24
30	+ 11 36.3		14.89		+ 14 6.9		9.96		+ 6 59.2		2.97	

Equation, *lunar* and *ſolar*, in *Chronology*. See Metempsychosis.

EQUATOR, or Æquator, in *Aſtronomy* and *Geography*, a great circle of the ſphere, equally diſtant from the two poles of the world, or having the ſame poles with thoſe of the world.

Such is the circle D A (*Plate* XII. *Aſtron. fig.* 109.) its poles being P and Q. It is called the equator, becauſe when the ſun is in it the days and nights are equal; whence alſo it is called the *equinoctial;* and when drawn on maps and planiſpheres, the *equinoctial line*, or ſimply the *line*. Every point of the equator is a quadrant's diſtance from the poles of the world; whence it follows, that the equator divides the ſphere into two hemiſpheres, in one of which is the northern, and in the other the ſouthern pole.

By the paſſages or tranſits of arcs of the equator over the meridian, equal or mean time is eſtimated; hence we have frequent occaſion for the converſion of degrees of the equator into time; and again, for the re-converſion of parts of time into degrees or parts of the equator.

For the performance whereof, we ſubjoin the following table; wherein are exhibited the arcs of the equator, which paſs the meridian in the ſeveral hours, minutes, &c. of equated or mean time.

Converſion of the Parts of the Equator into Time, and *vice verſâ.*

Deg. of Equat.	Hours.	Min.	Hours.	Deg. of Equat.	Hour. Min.	Deg. of Equat.	'
Min.	Min.	Sec.	Min. '	Min. '	Sec.	Min. '	"
Sec.	Sec.	Third	Sec. "	Sec. "	Third.	Sec. "	‴
Third.	Third.	Fourth.	Th. ‴	Th. "	Fourth.	Th. ‴	‴
1	0	4	1	15	1	0	15
2	0	8	2	30	2	0	3
3	0	12	3	45	3	0	45
4	0	16	4	60	4	1	0
5	0	20	5	75	5	1	15
10	0	40	6	90	6	1	30
15	1	0	9	135	10	2	30
30	2	0	12	180	20	5	0
60	4	0	15	225	30	7	30
90	6	0	18	270	40	10	0
180	12	0	21	315	50	12	30
360	24	0	24	360	60	15	0

The conſtruction of this table is very eaſy; for the equator being divided into 360 degrees, and revolving always in 24 hours, any point of it moves through 15° in one hour, and in one minute through the 60th part of 15°, or 15′ of a degree, and in one ſecond through 15″ of a degree, &c. and therefore nothing more is neceſſary beſides ſimple addition, in order to have the number of degrees, minutes, and ſeconds, which it deſcribes in any given time.

The uſe of the table is obvious; ſuppoſe, *e. gr.* it were required to turn 19° 13′ 7″ of the equator into time: againſt 15 deg. in the firſt column we have 1^h 0′ 00″; againſt 4 deg. we have 16′ 0″; againſt 10 minutes, 40″; againſt 3 minutes, 12″ 0″; againſt 5 ſeconds, we have 0′ 20‴; and againſt 2 ſeconds, 8″; which, added together, give 1^h 16′ 52″ 28‴.

Again, ſuppoſe it were required to find how many degrees, minutes, &c. of the equator anſwer to 23 hours 25 min. 17 ſec. and 9 thirds. Againſt 21^h in the fourth column of the table, you have 315; and againſt 2 hours, 30; againſt 20′, 5°; againſt 5′, 1° 15′; againſt 10 ſec. 2′ 30″; againſt 5 ſec. 1′ 15″ 0‴; againſt 2 ſec. 30″ 0‴; againſt 6 thirds, 1″ 30‴; and againſt 3 thirds, 45‴; which, added together, give 351° 19′ 17″ 15‴. See Equinoctial.

Equator, *elevation* or *altitude of the*. See Elevation *of the equator*.

Equator *of the Sun*, or *Solar Equator*. The ſun revolves from eaſt to weſt on an axis inclined to the ecliptic, and the plane, paſſing through the centre of the ſun perpendicular to this axis, is called the plane of the ſun's equator. It cuts the plane of the ecliptic in a ſtraight line, called the line of the nodes of this equator; and the nodes themſelves are the points where this line, produced each way, meets the celeſtial ſphere.

To determine the poſition of the axis of rotation in ſpace, it is neceſſary to determine the inclination of the ſolar equator to the ecliptic, and the angle which the line of nodes makes with ſome fixed line in the plane of the ecliptic, for example, with the line of the equinoxes. This angle is called the longitude of the nodes of the ſolar equator, and is thus determined: when the poſition of a ſpot on the diſc of the ſun has been obſerved, and its latitude and longitude determined, the direction of the viſual rays drawn to the ſpot at the moment of obſervation is known. The longitude of the ſun at the ſame inſtant is likewiſe known, its diſtance from the earth, and its apparent diameter.

The interſection, therefore, of its ſurface with this ray, is found by a ſimple geometrical proceſs. Three ſimilar obſervations of the ſame ſpot determine three points upon the ſurface of the ſun, and theſe three ſpots are ſituated on the ſame circumference of ſome circle parallel to the ſolar equator, and the poſition of a plane is known when it paſſes through three given points. The plane of this circle deſcribed by the ſpot will, therefore, be known by theſe obſervations, by which the poſition of the ſolar equator may be determined.

To determine the ſucceſſive poſitions of the ſpots on the ſurface of the ſun, ſuppoſed ſpherical, we may imagine the three rectangular co-ordinates or axes paſſing through the centre of the ſun, and continuing parallel to each other during the whole annual revolution. The firſt of theſe axes is perpendicular to the ecliptic, the two others are ſituated in this plane, one parallel to the line of the equinoxes, the other perpendicular to it. Latitudes and longitudes, reckoned relative to theſe axes from the centre of the ſun, are called heliocentric, and they may evidently be found by trigonometric methods, if we can determine their analogous longitudes and latitudes meaſured in the ſame manner from the centre of the earth, and which are called geocentric.

By methods of this kind it has been found that the ſolar equator is inclined to the ecliptic about 7°. It continues conſtantly parallel to itſelf, the points of this equator, as they are raiſed by the rotatory motion of the ſun above the plane of the ecliptic, traverſe this plane in a point which, ſeen from the centre of the ſun, was, in 1750, 85°. This was then the heliocentric longitude of the ſolar equator. Since that time it has undergone no variation except what ariſes from the motion of the equinoctial points.

EQUATORIAL Instrument, is an inſtrument made uſe of in *Practical Aſtronomy*. When a ſimple teleſcope, mounted on a ſtand, is elevated to view any heavenly body at the moment of its meridian paſſage, the obſerved body appears to paſs horizontally acroſs the field of view, but in any other ſituation to the eaſt or weſt of the meridian, the apparent paſſage of any heavenly body through the field of view, is in an oblique direction, and the more ſo, the greater the declination towards the viſible pole, and alſo the greater the diſtance from the meridian line. Hence the motion of the ſimple teleſcope, which moves in a parallel of altitude, or circle parallel to the horizon, when turned round in a ſtate of elevation on its vertical axis, will never coincide with the motion of a heavenly body, that moves either in the equator, or in a circle parallel to it; unleſs indeed the obſerver could ſtand at one of the poles, in which caſe the equator would become the horizon, and circles of altitude would be alſo circles of declination. But no obſerver can be ſo circumſtanced. He may, however, incline the axis of motion of his teleſcope, ſo as to be placed in the meridian, and exactly parallel to the earth's axis, and then, when the field of view is directed to take in any heavenly body, the motion of ſuch inclined axis, or the motion of the teleſcope round ſuch axis, ſuppoſing the axis to be fixed, will attend the ſaid body during the remainder of its path above the horizon. Accordingly we find Chriſtopher Scheiner uſing a teleſcope mounted on a polar axis in the year 1620, which time was ſoon after Galileo had invented the ſimple dioptric teleſcope, and though John Muller, or Regiomontanus, had contrived and deſcribed his torquet, a kind of portable equatorial, in the year 1544, and alſo Tycho Brahe had given the name of *equatoriæ* to ſome of his inſtruments about thirty years afterwards, yet the idea of Scheiner's polar axis no doubt ſuggeſted to the modern inſtrument-makers the beſt principle on which an equatorial inſtrument, as well as equatorial ſector, and equatorial ſtands, ought to be conſtructed. Scheiner's contrivance was competent to the following of a ſtar or other heavenly body through its diurnal arc, but had no appendages by which to aſcertain the place of the obſerved body, as to right aſcenſion, declination, diſtance from the meridian, &c. neither would the teleſcope be directed to a body inviſible to the naked eye for want of ſuch appendages.

Mr. Henry Hindley, an eminent clock-maker at York, was probably the firſt man who contrived and attached the different adjuſtable circles as companions to the teleſcope. Mr. Smeaton, in his paper on the "Graduation of Aſtronomical Inſtruments," read before the Royal Society of London, on November 17, 1785, has informed us, that Hindley contrived an inſtrument of the equatorial kind ſo early as the year 1741, which was ſent up to London to be ſold in the year 1748. This inſtrument had the equatorial plate, quadrant of latitude, and declination ſemi-circle indented at the circumference, and moved by worm-ſcrews, containing fifteen threads each, all in action together, which ſcrews at the ſame time meaſured as micrometer ſcrews, the angular motions, and, as it ſeems, without other graduations. The teleſcope was of the refracting kind, and inverted the object viewed. "It ſtaid with me," ſays Mr. Smeaton, "two years, in which time I ſhewed it to all my mechanical and philoſophical friends, amongſt whom was Mr. Short, who afterwards publiſhed, in the Philoſophical Tranſactions, an account of a portable obſervatory, but without claiming any particular merit from the contrivance. However, the model of it differs from Hindley's equatorial only in the following articles: he added an azimuth circle and compaſs at the bottom; he omitted the endleſs ſcrews, placing verniers in their ſtead, and at the top a reflecting teleſcope inſtead of a refractor. This inſtrument of Hindley's being afterwards returned to him unſold, I pointed out the principal deficiencies that I found therein; *viz.* that in putting the inſtrument into different poſitions, the ſpringing of the materials was ſuch, as in ſome poſitions to amount to conſiderable errors. This remained with him in the ſame ſtate till the year of the firſt tranſit of Venus in 1761, when it was ſold to —— Conſtable, eſq. of Burton Conſtable in Holderneſs. Mr. Hindley, to remedy the evil above-mentioned, applied balances to the different movements. He ſoon after completed one, *de novo*, upon this improved plan, for his Grace the late duke of Norfolk." The next, in point of time, to Mr. Hindley, was Mr. Short, who placed his reflecting teleſcope over a ſyſtem of graduated circles, and who has generally been conſidered as the firſt contriver of the equatorial inſtrument, though it appears evident from Mr. Smeaton's account, that Hindley's inſtrument was prior to his. Mr. Short publiſhed his account in the Tranſactions of the Royal Society, not in the year 1789, as ſtated by a typographical error under our article CIRCLE, but in 1749, in vol. xlvi. N° 493. About the year 1770 a rage for making equatorial inſtruments generally prevailed, and numberleſs were the modifications that makers of every deſcription produced, but the chief improvers of the inſtrument at that period were Nairne, Ramſden, and Dollond, who married Ramſden's ſiſter, all of whom, ſoon after the year juſt ſpecified, improved on the original portable inſtrument, chiefly by introducing the improved dioptric in place of the heavy catoptric teleſcopes, and by uſing the beſt divided circles, together with the moſt accurate adjuſtments, balancing of the parts, and nicely divided verniers. Mr. Ramſden, to ſecure the advantages of his ſhare of the improvements, took out a patent for his inſtrument, including the refraction apparatus, and hanging level in the year 1775.

Still, however, the equatorial inſtrument had its ſcale of magnitude adapted only for portability, and its circles conſequently were not capable of meaſuring with that degree of accuracy that celeſtial obſervations demand, to be of real uſe in the preſent improved ſtate of aſtronomy; and it remained for Mr. Edward Troughton to conſtruct an equatorial inſtrument ſufficiently large to be placed in an obſervatory, for the purpoſe of making uſeful obſervations. This ingenious artiſt contrived many commodious modifications of the inſtrument under our preſent conſideration, but we mean to confine our notice to two of the principal of them, both worthy of future imitation; one as a moveable, though not very portable inſtrument, and the other as a fixed one. The firſt was made to go to Coimbra, in Portugal, where it has had the ill fate to be ſhut up in the dark, though it was finiſhed ſo long ago as the year 1788; the latter is now in uſe under the direction of Dr. Hamilton, at Armagh, in Ireland, and is that with which the Armagh obſervations were made; of theſe Mr. Pond, the lecturer on aſtronomy at the Royal Inſtitution, availed himſelf when he compoſed his famous catalogue of declinations of ſome of the principal ſtars, which we noticed under our article CIRCLE, and which is inſerted in the article DECLINATION. This inſtrument was made in the year 1796; about three years after ſir George Shuckburgh's large equatorial inſtrument was deſcribed in the Philoſophical Tranſactions of London, as an inſtrument on a large ſcale, carefully made under Mr. Ramſden's direction by Mr. Berge, who has ſince become his ſucceſſor. The principal modern authors who have deſcribed the different equatorial inſtruments, are Mr. Short, Mr. Benjamin Martin, Mr. Nairne, Mr. Dollond, the Hon. Stuart M'Kenzie, profeſſor Vince, and ſir George Shuckburgh; at one time it was our intention to deſcribe one or two only of the different conſtructions of this inſtrument, and to have noticed the differences of the others; but to do juſtice to the ſubject, and to ſhow more clearly the progreſſive improvements in the art of conſtructing aſtronomical inſtruments of this deſcription, we have determined to give drawings and correſponding deſcriptions, in ſucceſſion, of each inſtrument that appears to poſſeſs any claim to originality. Of courſe we muſt avail ourſelves of the reſpective deſcriptions that have been publiſhed of the various inſtruments that have been before deſcribed, but our detail will be a condenſed one, and interſperſed with original remarks, tending to aſſiſt the reader in forming his opinion of their reſpective merits; and where no deſcription has been previouſly given, as is the caſe with Mr. Troughton's inſtruments, and a neat portable one by his nephew, Mr. Farer, we ſhall ſupply the accounts from original and authentic ſources, preſerving, as we proceed, that order of time in which the ſeveral inſtruments were conſtructed, except in the inſtance of Mr. Farer's, which being portable, we have thought it better to place immediately after the portable ones of older date, by way of contraſt, than to give it a place after the larger and more complete inſtruments.

Portable Equatorial Inſtrument by Mr. James Short.—We have already ſaid that Mr. Short's equatorial inſtrument, called by him the equatorial teleſcope, or portable obſervatory, was the firſt inſtrument probably made in England that could be conſidered as a well arranged aſſemblage of graduated circles for aſcertaining the various data of a heavenly body's place, out of the meridian, by a ſingle obſervation. Mr. Ben. Martin has given a brief deſcription of this inſtrument, together with its uſes, in appendix II. of his Philoſophia Brittannica, the ſubſtance of which, not being in every one's hands, we think may be acceptable to our readers, particularly as its peruſal will afford the beſt means of contraſting the more improved inſtruments with the original model, and, conſequently, of tracing the progreſs that the art of making inſtruments of this kind has made within the period of our own recollection. *Fig.* 1. of *Plate* XI. of *Aſtronomical Inſtruments*, exhibits a perſpective view of all the eſſential parts of Mr. Short's inſtrument, which is compoſed of four graduated circles, two of them entire, and two of them about three-fourths of a circle, together with a four-footed ſtand, a variety of ſupporting pillars, levels, wheels, and endleſs ſcrews, axes of motion, and a reflecting teleſcope ſurmounted over the whole. A, A, are two horizontal plates one over the other, and repreſenting the horizon of the place of obſervation; theſe plates reſt on four pillars of the pedeſtal, that contains a magnetic box and needle, and that is ſupported by the four adjuſtment ſcrews B, B, B, B, the lower plate being faſt to the pillars, and the upper one, that carries two ſpirit levels on its plane at right angles to each other, being moveable by a rod or handle C, the ſcrew on which takes into the teeth cut on the edge of this upper horizontal plate. This moveable plate is divided into 360°, and a vernier borne by the under plate reads to the accuracy of every *three minutes*. Another ſet of four pillars, inſerted into the moveable horizontal plate, ſupports the vertical circle D D, or rather portion of a circle, which is divided into twice 90°, and ſomewhat more at each ſide, and is called the meridian circle; its vernier, placed on the upper horizontal circle, reads alſo every three minutes of ſpace. The handle or rod E moves this circle in like manner as the rod C moves the horizontal circle deſcribed. On the upper or mutilated part of the meridian circle D D, are placed two other plates, the upper one moveable on the under one, like the horizontal plates, and the vernier carried by the under one. It does not appear from the drawing or account whether the axis of motion rotates or is fixed. The upper or moveable plate, marked F F, is divided into hours and ten-minute ſpaces, and theſe again are ſubdivided by the vernier into ſingle minutes of time. This plate, which is called the equatorial plate, has a third ſet of pillars inſerted into it, and is moveable by the rod G, like the other moveable plates; the pillars ſupport a fourth circle, or rather mutilated circle H H, on the upper part of which the teleſcope L L is mounted, as ſeen in the drawing. This uppermoſt circle is called the circle of declination or horary circle, and is divided into twice 90°; it is alſo moveable by the rod or handle K, like the reſt of the moveable circles; and has every three minutes of ſpace, by its vernier, placed on the plane of the equatorial circle. The teleſcope is of the Gregorian conſtruction, with a great ſpeculum of 18 inches focal length. In making the adjuſtments of this inſtrument for obſervation, the horizontal plates A, A, are firſt levelled by the joint aid of the two levels and ſcrews of adjuſtment that bear the whole fabrick; this adjuſtment is not perfect till the bubbles of the levels will remain ſtationary, in the middle of their tube, while the upper plate is carried quite round the ſubjacent one. In the next place the meridian circle D D is turned by its handle E, till the equatorial plates are parallel to the equator; that is, till they are raiſed equal to the complement of the latitude of the place of obſervation, and the inſtrument is ſaid to be fit for making obſervations; of courſe the placing of the circles relatively to each other, in regard to perpendicularity, and of the line of collimation of the teleſcope in regard to the points zero in the declination circle, are ſuppoſed to be immoveably adjuſted by the maker, ſo as to require no future rectification. As it will be of ſome importance to the developement of the progreſſive improvements of the different equatorial inſtruments, to confine ourſelves to the uſes that this inſtrument by Mr. Short was applied to, we cannot do better than confine ourſelves to the words of one of the early deſcriptions of its practical application.

"*To find the Hour of the Day, and Meridian of the Place;*—Firſt, find, from aſtronomical tables, the ſun's declination for the day, and for that particular time of the day; then ſet the declination-ſemicircle to the declination of the ſun, taking particular notice whether it is north or ſouth, and ſet the declination-ſemicircle accordingly.

"You then turn about the horizontal handle, and the equatorial handle, both at the ſame time, till you find the ſun preciſely concentrical with the field of the teleſcope. If you have a clock or watch at hand, mark the inſtant of time; and by looking upon the equatorial plate and vernier, you will find the hour and minute of the day, which comparing with the time ſhewn by the clock or watch, ſhews how much either of them differs from the ſun. In this manner you find the hour of the day.

"Now, in order to find the meridian of the place, and, conſequently, to have a mark by which you may always know your meridian again, you firſt move the equatorial plate, by means of the equatorial handle, till the meridian of the plate or hour-line of 12 is in the middle of the vernier; and then, by turning about the declination-handle till the teleſcope comes down to the horizon, you obſerve the place or point which is then in the middle of the field of the teleſcope; and a ſuppoſed line, drawn from the centre of this field to that point in the horizon, is your meridian line. The beſt time of the day for making this obſervation for finding your meridian is about three hours before noon, or as much after noon. The meridian of the place may be found by this method ſo exact, that it will not differ at any time from the true meridian above 10″ of time, and if a proper allowance be made for the refraction at the time of obſervation, it may be found much more exact. This line thus found will be of uſe to ſave trouble afterwards; and is, indeed, the foundation of all aſtronomical obſervations.

"*To find a Star or Planet in the Day-Time, even at Noon-Day.*—The inſtrument remaining as rectified in the laſt experiment, you ſet the declination-ſemicircle to the declination of the ſtar or planet you want to ſee; and then you ſet the equatorial plate to the right aſcenſion of the ſtar or planet at that time, and, looking through the teleſcope, you will ſee the ſtar or planet; and after you have once got it into the field, you cannot loſe it: for, as the diurnal motion of a ſtar is parallel to the equator, by your moving the equatorial handle ſo as to follow it, you will at any time, while it is above the horizon, recover it, if it be gone out of the field.

"The eaſieſt method for ſeeing a ſtar or planet in the day-time is this; your inſtrument being adjuſted as before directed, you bring the teleſcope down ſo as to look directly at your meridian mark; and then you ſet it to the declination, and right aſcenſion, as before-mentioned.

"By this inſtrument moſt of the ſtars of the firſt and ſecond magnitude have been ſeen even at mid-day, and the ſun ſhining bright; as alſo Mercury, Venus, and Jupiter: Saturn, and Mars are not ſo eaſy to be ſeen, upon account of the faintneſs of their light, except indeed when the ſun is but a few hours above the horizon.

"And in the ſame manner in the night-time, when you can ſee a ſtar, planet, or any new phenomenon, ſuch as a comet, you may find its declination and right aſcenſion immediately, by turning about the equatorial handle, and declination handle, till you ſee the ſtar, planet, or phenomenon; and then looking upon the equatorial plate, you find its right aſcenſion in time; and you find upon the declination-ſemicircle its declination in degrees and minutes.

"In order to have the other uſes of this inſtrument, you muſt make the equatorial plates become parallel to the horizontal plates; and then this inſtrument becomes an equal altitude inſtrument, a tranſit inſtrument, a theodolite, a quadrant, an azimuth inſtrument, and a level. The manner of applying it to theſe different purpoſes is too obvious to need any explanation.

"As there is alſo a box with a magnetic needle faſtened in the lower plate of this inſtrument, by it you may adjuſt the inſtrument nearly in the meridian; and by it likewiſe you may find the variation of the needle; if you ſet the horizontal meridian, and the equatorial meridian, in the middle of their verniers, and direct your teleſcope to your meridian mark, you obſerve how many degrees from the meridian of the box the needle points at: and this diſtance or difference is the variation of the needle."

Theſe are the uſes to which Mr. Short's inſtrument, before us, was principally applied, and had the circles been divided with verniers ſubdividing the diviſions more minutely, it would have been ſomething more than an aſtronomical play-thing, to which it cannot be conſidered as any thing ſuperior, when it comes to be contraſted with one of the moſt improved kind, even of thoſe that are equally portable. We cannot diſmiſs our notice, however, of the preſent inſtrument, without remarking further, that the manner in which the two pairs of plates A A, and F F, move over each other reſpectively, is by no means calculated to preſerve a ſteady undeviating motion, for want of a ſufficient length in the axis of motion. This is the principal objection we expreſſed to Dr. Wollaſton's circle made by Mr. Cary, and if the doctor borrowed his notion of ſuch a poſition of his circles from Mr. Short, he copied one of the worſt properties that this artiſt's inſtrument poſſeſſes.

This equatorial inſtrument has obtained the name of univerſal, from the circumſtance of its being applicable to uſe in any latitude; which name is equally due to its ſucceſſors.

Portable Equatorial Inſtrument by Mr. Ed. Nairne.—The imperfections of the preceding inſtrument were attempted to be removed by Mr. Nairne, whoſe conſtruction introduced a long axis of motion for the horizontal circle, thereby effecting a ſteadineſs in its performance, and placed the teleſcope on the axis of the declination-ſemicircle to obtain a leſs encumbered elevation of the teleſcope; but ſtill the circles were not graduated ſo minutely as to render them of real uſe in practical aſtronomy. A brief account of this inſtrument is contained in vol. lxi. part i. of the Philoſophical Tranſactions of London, and was read before the Society on Feb. 7, 1771. Its ſubſtance is this:—

The inſtrument conſiſts of the following parts, *Plate* XII. *fig.* 1. of *Aſtronomical Inſtruments*, a mahogany triangular ſtand A A A, and three adjuſting ſcrews B, B, B, a moveable azimuth circle C, which is divided into degrees, and by a vernier index into every ſix minutes; above this azimuth circle is the horizontal plate D, to the under part of which is faſtened the vertical conical axis E; on the middle of the upper ſurface of the horizontal plate is placed a ground glaſs level F, by which the plate D is ſet parallel, and the pillar E perpendicular to the horizon; from this plate riſe perpendicularly two quadrants G, G, one of which is divided for the latitude into half degrees, and has a vernier index to three minutes; the equatorial plate H, with its hour circle, is ſupported by the two quadrants G, G, its axis of motion, which is placed near the hours XII, XII, paſſes through the centres of the quadrants, and carries the index I, pointing to the divided quadrant; the equatorial plate is divided into half degrees, and has a vernier index ſhewing every three minutes of right aſcenſion, or 12 ſeconds of time; it is figured to ſhew both degrees and time. To prevent miſapprehenſion it may be right to remark that the hours XII, XII, ought properly to have been placed according to the meridian line; but they are here placed otherwiſe for the convenience of better ſeeing the meridian diſtance ſhewn by the vernier. On the upper part of the equatorial plate is the plate K; upon this plate K are fixed the two ſupporters M, M, which ſupport the axis N, *under* which is faſtened the ſemicircle of declination O, divided into half degrees with a vernier ſubdividing it into every three minutes. On the *upper* part of this axis is fixed an achromatic teleſcope P, which magnifies about 50 times; to the eye-end of this teleſcope is applied a ſmall reflecting ſpeculum, making an angle of 45° with the axis of the teleſcope, whereby objects that are in the zenith or in any other altitude may be obſerved without putting the body in an inconvenient poſition. To the under part of the axis N is faſtened a braſs arm carrying the weight Q, which counterbalances the teleſcope, and braſs-work annexed to it; whilſt the weights R, R, counterbalance in like manner the whole of the inſtrument that is moveable on the equatorial axis, ſo that whatever poſition the inſtrument is put in it will there remain, being perfectly balanced. The four motions of this inſtrument may, when required, be moved extremely ſlowly, by means of the indented edges of the circles and ſemicircles, and the ſcrews or worms of the handles S, T, V, and W, for the horizontal circle, the motion for latitude, the equatorial and declination motions reſpectively. The adjuſtments and uſes of this inſtrument are ſo ſimilar to thoſe of its predeceſſor, both in kind and extent, that it would be ſuperfluous to particularize them again. In this account it is not ſtated whether the axis of motion of the equatorial circle is prolonged,

longed, but as the height to which it is elevated above the horizon circle ſeems to admit of it, and as the axis of this is elongated, we are diſpoſed to believe that a ſimilar advantage belonged to the former; otherwiſe it would not have that ſtability that is neceſſary in this part of the inſtrument for making the moſt eſſential motion ſteady enough to be depended on. How far the mahogany legs were firm and ſteady enough for the purpoſe of affording a motionleſs pedeſtal is not ſaid; but the want of accuracy, or rather the want of minuteneſs in the diviſions and ſubdiviſions of the graduated circles, quadrant, and ſemicircle, made this conſideration of leſs importance than it would have been in an inſtrument poſſeſſing greater powers. We have been informed, from credible authority, that Mr. W. Ludlam, of St. John's college, Cambridge, was the principal contriver of Mr. Nairne's conſtruction.

Ramſden's portable equatorial inſtrument.—The principal parts of this inſtrument, ſays profeſſor Vince, (Treatiſe on Prac. Aſtr.) are, the azimuth circle G H, the equatorial, or hour circle E F, and the declination circle C D; (ſee *Plate* XI. *fig.* 2. of *Aſtronomical Inſtruments*,) to this latter there is fixed a teleſcope A B, having under it a rod *m n*, paſſing through two pieces π, ρ, in one of which, as π, are two ſcrews acting on the rod againſt each other, in order to adjuſt the rod perpendicular to the axis on which the declination circle turns. The azimuth circle G H lies on a braſs plate *t u*, ſupported by three feet, reſting on the ſcrews X, Y, Z, and on this plate it turns about an axis T, by means of a ſcrew S; upon this circle are placed two ſpirit levels *c d*, *a b*, at right angles to each other, ſupported at each end by a ſcrew, by which they may be adjuſted; the circle is divided into twice 180°, and has a vernier V fixed on the plate *t u*, by which the degrees are ſubdivided into minutes or half minutes, according to the ſize of the inſtrument; and by means of the ſcrew I the circle may be fixed to the plate *t u*. K K is a polar axis moveable about a centre L, ſuſtained by two ſupporters *q*, *i*, reſting on two pieces W, V, firmly connected to the plane of the circle G H; the lower end of this axis has an arc fixed to it, which runs againſt an arc *z y*, attached to G H, and to which it may be fixed by a key at *e*; and in this ſituation, if you apply the key to Q, it gives a motion to the axis, by which you may very accurately adjuſt the teleſcope to an object. To the centre L, and perpendicular to the polar axis, are fixed two ſtrong pieces of braſs, one of which is here repreſented by *x*, and the other is on the other ſide of the axis; theſe ſupport a circle $\alpha\ \beta\ \gamma\ \delta$; on the top of the polar axis, and perpendicular to it, is placed a braſs plate, moveable about a pivot on the top of the axis; to this are fixed four pieces, two of which are repreſented by *f*, *g*; theſe are connected to the hour circle E F, lying on $\alpha\ \beta\ \gamma\ \delta$, and carry it about; upon $\alpha\ \beta\ \gamma\ \delta$, at W, is fixed a vernier to the circle E F, which circle is divided into twice twelve hours. The declination circle C D is ſupported by its centre, on an axis reſting on two ſupporters *h*, *k*, on one ſide, and two others of the like kind on the other; theſe reſt upon the braſs piece on the top of the polar axis, and may be adjuſted by two pair of ſcrews at the feet of the two ſupporters, to ſet the plane of the declination circle perpendicular to the hour circle, which, by the maker, is placed perpendicular to the polar axis. This circle is divided from zero both ways to a little more than 90°, and a vernier is placed at R to ſubdivide, as at V. A ſmall quadrant is fixed to the eye-piece of the teleſcope, which turns round upon the piece, carrying two wires perpendicular to each other, for the parallel of declination and hour circle. The eye-piece carries two croſs wires to repreſent the circle of altitude and a parallel to the horizon. The quadrant has two radii *l*, *o*, perpendicular to each other, and move together; the former has a round or circular ſpirit level upon it, ſo that by turning about the eye-glaſs and the quadrant till the bubble reſts in the middle, the plane of the quadrant becomes perpendicular to the horizon; and the vernier on the latter ſhews the altitude to which the teleſcope is directed, and the correſponding refraction; and in this poſition the circle of altitude is perpendicular to the horizon. At P is a ſmall micrometer circle, called the refraction circle, (with a fixed index,) moveable by a finger ſcrew; this circle is divided into half minutes, and one revolution is equal to 3′ 18″; when moved it raiſes or depreſſes the centre of the croſs wires in a circle of altitude.

After this general deſcription of the parts of the inſtrument, let us conſider what motions it is capable of, and what the circles may be made to repreſent, before we proceed to its adjuſtments. And firſt, the azimuth circle G H, being ſet parallel to the horizon, will repreſent the horizon; ſecondly, if the polar axis K K be inclined to the horizon at an angle equal to the latitude of the place, the equatorial circle E H will be inclined to the horizon in an angle equal to the inclination of the equator to the horizon; therefore, if we turn about the azimuth circle, and conſequently the equatorial circle, the latter may be made to coincide with the equator; thirdly, if the declination circle be ſet perpendicular to the equatorial, then the conſequences muſt be, that if the line of collimation be adjuſted parallel to the plane of the declination circle, or perpendicular to its axis, and alſo parallel to the equatorial circle E F, when zero on the declination circle coincides with zero on the vernier R, then the teleſcope is directed to the equator in the heavens, and by turning about the declination circle the line of collimation will deſcribe a ſecondary to the equator; and by ſetting the declination circle to the declination of any body in the heavens, if we turn about the circle E F, and conſequently the circle C D with the teleſcope, on the braſs plate, on the top of the polar axis (which is kept fixed,) the equatorial circle, moving in its own plane perpendicular to the polar axis, muſt continue to coincide with the equator, and, conſequently, the teleſcope will deſcribe a parallel to the equator, and therefore muſt bring the body into the field of view. Theſe being the motions of the parts of the inſtrument, we may now proceed to deſcribe the neceſſary adjuſtments for them.

Adjuſtments.—1. *To adjuſt the azimuth circle parallel to the horizon.*—Turn it till one of its levels becomes parallel to a line joining two of the ſcrews at the feet, as X, Z, and then adjuſt that level with one of them; turn the circle half round, and if the bubble be not in the middle, adjuſt it half way, by one of the above-mentioned ſcrews, and half way by the ſcrew at one end of the level; repeat this operation till the bubble ſtands right in both theſe poſitions; then turn the circle at right angles to theſe poſitions, and, if neceſſary, ſet the bubble right by the other ſcrew Y at the foot, and the adjuſtment is made. If you previouſly adjuſt the other level by one of the ſcrews at the end, then the circle may be adjuſted horizontal by them, without turning it.

2. *To adjuſt the level* r s *parallel to the rod* m n.—Set the polar axis, as nearly as you can, perpendicular to the horizon, and turn about the declination circle C D by a pinion for that purpoſe, until the bubble of the level *r ſ* ſtands in the middle; reverſe the level, and if the bubble do not ſtand in the middle, adjuſt it half way by the ſcrew at S, under

one end of the level, and half way by turning the declination circle; and repeat the operation till the bubble ſtands in the middle in both poſitions.

3. *To adjuſt the rod* m n *perpendicular to the axis on which the declination circle turns.*—Set the polar axis as near as you can parallel, and conſequently the equatorial circle perpendicular to the horizon; ſet the declination circle to zero, and turn the hour circle till the bubble ſtands right; then ſet the declination circle to 90°, and adjuſt the bubble by the polar axis: then turn the declination circle to the oppoſite 90°, and if the level be not right, correct half the error by the polar axis, and the other half by the two ſcrews in the piece π, releaſing one and ſcrewing up the other; repeat this operation till the bubble ſtands right in both poſitions, and the adjuſtment is made. For theſe two adjuſtments tend, the former to ſet the axis of the declination circle, on the axis about which the rod revolves, perpendicular to the horizon: and the other to ſet the rod *m n* parallel to the horizon, and conſequently perpendicular to that axis; when, therefore, the bubble thus continues right, both circumſtances muſt have taken place.

4. *To ſet the axis of the declination circle perpendicular to the polar axis.*—The inſtrument remaining as in the laſt adjuſtment, that is, the declination circle at 90° and the bubble right, turn the equatorial circle half round, and if the bubble be not right, correct half the error by the polar axis, and the other half by the two pair of ſcrews at the feet of the two ſupporters *h, k*; and repeat this operation till the bubble is right in both poſitions, and the adjuſtment is completed. For the former adjuſtment tends to ſet the axis of the declination circle perpendicular to the horizon, and the latter to ſet it parallel to the equatorial circle, or perpendicular to the polar axis; conſequently, when the bubble is right in both the above poſitions both circumſtances muſt take place, that is, the polar axis muſt be parallel to the horizon, and the axis of the declination circle perpendicular to it. And as this adjuſtment is made by the level, which is horizontal when the axis of the declination circle is thus adjuſted perpendicular to the horizon, and which is previouſly adjuſted parallel to the rod, they muſt both be perpendicular to the axis, about which they turn; and, conſequently, they move in a plane paſſing through the polar axis, or perpendicular to the equatorial circle. Hence, alſo, the declination circle, being perpendicular to its own axis, becomes perpendicular to the equatorial circle.

5. *To make the centre of the croſs wires cut the ſame object whilſt you turn round the eye-glaſs by the pinion of the refraction apparatus.*—Set the index on the refraction circle to the beginning of the diviſions, and turn round the eye-glaſs, and if the centre of the wires do not continue to cut the ſame object, correct it by four ſmall ſcrews (which you will find by unſcrewing the neareſt end of the eye-tube which contains the firſt eye-glaſs), the two oppoſite at a time, and repeat the correction till the centre continues to cut the ſame object.

6. *To make the line of collimation deſcribe a great circle perpendicular to the equatorial circle.*—Set the declination circle to 90°, and the equatorial circle to VI, and bring the bubble to the middle by the polar axis. Then note ſome object covered by the centre of the croſs wires, repreſenting the parallel of declination and hour circle, and turn the equatorial circle half round, and if the ſame object be not now covered by the centre of the wires, move, if neceſſary, the declination circle in its own plane, until it is in the ſame vertical circle with the object, and then bring the centre half way to it by the upper and lower of the four ſmall ſcrews which move theſe wires, and turn the declination circle back through half the ſpace it was moved, and you get a new object, now covered by the centre of the wires; repeat this operation till the ſame object be covered in both theſe poſitions; then ſet the hour circle to XII, and bring the bubble to the middle by the declination circle, and if the centre do not now cover the ſame object, bring it to the object by the other two ſcrews, and the line of collimation is adjuſted parallel to the level, or to the rod *m n*, and, conſequently, it muſt be perpendicular to the axis of the declination circle. Hence as that circle is turned about in its own place, the line of collimation muſt deſcribe a ſecondary to the equator. The line of collimation for the centre of the croſs wires being thus adjuſted, it is, at the ſame time, in the centre of motion, on which the wires parallel and perpendicular to the horizon turn; hence, when the index of the refraction circle is ſet to the beginning of the diviſions, the interſections of the two ſets of wires coincide. The adjuſtment of the wire parallel to the equatorial circle may be examined by the paſſage of a ſtar through the teleſcope, (all the other adjuſtments being previouſly made, and the equatorial circle adjuſted to coincide with the equator in the heavens, and the declination circle ſet to the ſtar's declination;) for if the ſtar do not run upon the wire, it muſt be adjuſted till it does: or it may be done thus. Set the equatorial circle to XII, and having directed the line of collimation to ſome ſmall well defined object, turn the declination circle in its own plane, and obſerve whether the perpendicular wire continue to cut the ſame object as it paſſes through the field of view; if not, adjuſt till it does.

7. *To adjuſt the verniers of the equatorial and declination circles.*—Elevate the equatorial circle to an angle of about 45°, as moſt proper for this purpoſe, and ſet the declination circle to zero, and turn the equatorial circle in its own plane till the bubble ſtands right; then turn the equatorial circle half round, and if the bubble do not ſtand right, adjuſt half by moving the equatorial, and half by moving the declination circle; and repeat this operation till the bubble ſtands right in both poſitions, then, by moving the verniers, ſet zero on the vernier belonging to the equatorial circle to VI, and zero on the vernier belonging to the declination circle to zero, and the verniers are adjuſted. Thus the inſtrument is ready for obſervation, except that the azimuth circle is not adjuſted to ſhew azimuths, which will be done when we come to ſhew the methods of making obſervations.

The method here uſed ariſes out of the two diſtinguiſhing features of the inſtrument under our conſideration; namely, the poſition of the level near the teleſcope, and the want of graduations on the latitude arch, or arch for giving the polar axis its due inclination.

But the Hon. Mr. M'Kenzie's method appears to us more ſimple, as well as more intelligible, for elevating the equatorial circle to the co-latitude of the place, thus; "lower the teleſcope as many degrees, minutes, and ſeconds below zero, on the declination-ſemicircle, as the complement of your latitude is; then elevate the polar axis till the bubble be horizontal, and the equatorial circle will be elevated to the co-latitude of the place, as required; after which the level may be made to ſtand true in oppoſite poſitions, and the verniers be placed to zero, as above directed.

Mr. Atwood, in his Syllabus, has given another method of making this adjuſtment, which profeſſor Vince acknowledges to have the advantage over his in point of both eaſe and accuracy, the ſubſtance of which is as follows:

Having ſet the declination circle to 90° in either quadrant, direct the point of interſection of the croſs-wires to coincide with ſome diſtant object as a mark; turn the equatorial circle in its own plane 180°, and if the interſection does not now coincide with the diſtant mark, correct half the error in declination by moving the declination circle in its own plane, and half the error in right aſcenſion by the feet ſcrews of the ſupporters that adjuſt the axis of the declination circle; now if theſe adjuſtments be accurately made, the interſection will coincide with any diſtant mark, choſen anew, when the equatorial circle has been turned 180°; but if the coincidence is not perfect, the ſame adjuſtments muſt be repeated till the condition is fulfilled. The line of collimation being now directed to coincide with the diſtant mark, ſet the vernier of the declination circle to 90°, and turn this circle 180° in its own plane, turn alſo the azimuth circle, ſo that the line of collimation may be again directed to the ſaid diſtant mark, then turn the equatorial circle about in its own plane 180°, and if the diſtant mark be not now covered by the interſection, the quantity of deviation ſhews double the total error of dividing the two ſemi-circles of the declination circle, and alſo its excentricity, which errors cannot be allowed for by adjuſtment. The error in right aſcenſion, now diſcovered, muſt ariſe from the plane of the declination circle not being quite perpendicular to the equatorial, and alſo from the line of collimation not being exactly parallel to the plane of the declination circle; therefore correct $\frac{1}{4}$th of the error by the ſcrews of the declination axis, and $\frac{1}{4}$th by moving the line of collimation perpendicular to the plane of the declination circle: if the firſt trial of theſe adjuſtments be not attended with complete ſucceſs, when the diſtant mark is again examined in reverſed poſitions they muſt be repeated till they are correct. Hence it is manifeſt, when the above adjuſtments are properly made, 1ſt, that the line of collimation is parallel to the plane of the declination circle; 2dly, that the plane of the declination circle is perpendicular to the plane of the equatorial; 3dly, that the errors of diviſion are at the oppoſite points 90°, if any are diſcovered in the declination circle, and, 4thly, that when the declination circle is ſet to 90°, the line of collimation is perpendicular to the plane of the equatorial circle, or, when it is ſet to zero, it is parallel to it.

The azimuth circle being adjuſted horizontal, and the declination circle put to 90°, make the vertical wire parallel to it, turning the equatorial and azimuth circles in their reſpective planes; direct the point of interſection to a diſtant mark near the horizon, and move the azimuth and declination circles each in their own planes to 180°, ſo that the ſaid mark may appear ſomewhere in the vertical wire, and if there is an error in altitude, let the line of collimation biſect it, by moving the polar axis, and it will then be horizontal. Let this new biſected point or mark in the horizon be noted; then the declination circle being put to zero, turn the azimuth circle 90°, ſo as to bring the new mark upon the croſs wire, and direct the interſection to it by turning the equatorial circle in its own plane, and the declination is in that ſituation parallel to the horizon. The inſtrument remaining as before, turn the equatorial and azimuth circles in their reſpective planes 180°, and if each circle be accurately divided, the teleſcope muſt evidently be brought into a poſition exactly parallel to its former one, and therefore the interſection of the wires will again coincide with the new mark in the horizon. Otherwiſe the quantity each of thoſe circles muſt be moved further or back, will ſhew their reſpective errors of excentricity and alſo of diviſion. Laſtly, the declination circle being at zero, and the line of collimation or interſection made to coincide with the horizontal mark, by moving the equatorial and azimuth circles, ſet the equatorial vernier to VI, and the adjuſtment is finiſhed; for the line of collimation being parallel to the horizon, and to the plane of the declination circle when the vernier ſtands at VI, that plane, by revolving about the polar axis, muſt be perpendicular to the horizon when the vernier ſtands at XII, which is the thing required.

Methods of making Obſervations.

1. *To take the altitude of a body above the horizon.*—Set XII on the equatorial circle to zero on its vernier, and the plane of the declination circle is then perpendicular to the horizon; make, therefore, the line of collimation horizontal, by bringing the bubble to the middle of the level in the teleſcope, and obſerve what point of the declination circle ſtands againſt zero in its vernier, and then by moving the declination and azimuth circles in their own planes, bring the body to the centre of the croſs wires, and obſerve again what point of the declination circle ſtands againſt zero, and the arc intercepted between theſe two points gives the apparent altitude. If the declination circle had been ſet to zero, and the line of collimation been adjuſted horizontal by moving the polar axis, then, when the body had been brought to the centre of the croſs wires, the declination circle would have ſhewn its altitude at once. For Mr. Atwood's indirect methods of taking an altitude, ſee pages 163, 164, and 165 of Vince's "Treatiſe on Practical Aſtronomy."

2. *To meaſure very ſmall vertical angles.*—Let the elevation of the equatorial circle be a, the polar diſtance of the teleſcope (either more or leſs than 90°) be b, and ſet XII (correſponding to noon) on the equatorial circle to zero; then if that circle deſcribes an angle whoſe verſed ſine is v, and the line of collimation be brought (by moving the azimuth circle) back to the ſame vertical, it will have been depreſſed through a vertical arc equal to $\frac{v \times si.a \times si.b}{si.b - a}$, radius being unity. Or, if $b = 90°$, the depreſſion $= v \times \tan. a$. Hence if, for example, it ſhould be required to find the angle which the horizontal wire of the teleſcope ſubtends, ſelect ſome well defined diſtant object, ſet the declination circle to zero, and XII on the equatorial to zero, and elevate the equatorial ſo as to bring the object into the field of view, and make the upper edge of the wire coincide with it, then move the equatorial and azimuth circles in their own planes till the lower edge coincide with it, and read off the equatorial arc. *Ex.* If the elevation of the equatorial be 41° 3′, and the arc denoted by the equatorial vernier be 57′, the angle required = vec. ſin. $57' \times \tan. 41° 3' = 24'' 6'''$. Hence alſo the diameter of a planet may be meaſured. When the planet comes to the meridian (the two circles being fixed as before) alter the elevation of the equatorial circle, and bring the upper edge of the horizontal wire to be a tangent to the upper limb of the planet (or the apparent lower limb), and then by turning the azimuth and equatorial circles in their own planes, bring the lower edge of the wire to be a tangent to the lower limb of the planet (or the apparent upper limb), and the rule gives the ſum of the diameters of the planet and wire, from which ſubtract the diameter of the wire, and you get the diameter of the planet.

3. *To find the latitude of a place.*—Take the altitude of the ſun's upper or lower limb a little before noon, and continue your obſervation till he riſes no longer, and you get

his apparent meridian altitude; with which and his declination you may ſind the latitude by the common rule.

4. *To incline the equatorial circle ſo as to make any angle with the horizon.*—Set the declination-circle (in the ſouthern quadrant) to the given angle, and XII on the equatorial circle to zero on its vernier; then bring the line of collimation horizontal by moving the polar axis till the bubble in the level on the teleſcope ſtands in the middle, and the equatorial circle ſtands at the proper angle.

5. *To determine the poſition of the meridian.*—Elevate by the laſt article the equatorial circle, to make an angle with the horizon equal to the co-latitude of the place, and ſet the declination-circle to the declination of any known ſtar, then turn the equatorial and azimuth-circles in their own planes till the ſtar is brought to the centre of the croſs wires, and correct the poſition of theſe circles on account of refraction, by the ſmall quadrant and apparatus at the eye-piece of the teleſcope, and the equatorial circle will then coincide with the equator in the heavens, and the vernier will ſhew how far, in time, the ſtar is from the meridian; and hence, if we turn the equatorial circle till XII ſtands at zero on the vernier, the plane of the declination-circle will coincide with the meridian. Hence, if we direct the teleſcope to the horizon, the point which the centre of the wires will cut is the ſouth point of the horizon, and may ſerve for a meridian mark. If the point of the arc of the azimuth-circle lying againſt zero on its vernier be noted, the error in its poſition will be known; and if this be very ſmall, ſo that by moving the vernier till zero on it may be brought to zero on the arc, it may be adjuſted to ſhew azimuths. The poſition of the vernier of the azimuth-circle may alſo be verified thus. The equatorial-circle being ſet parallel to the horizon, and XII ſet to zero on its vernier, turn the azimuth-circle, and by moving the declination-circle, bring a ſtar on the eaſt ſide of the meridian to the centre of the croſs wires, and note the azimuth, then turn the azimuth-circle (the teleſcope remaining fixed) and do the ſame when the body comes to the weſt ſide; and if the azimuths at both obſervations be the ſame, the vernier is adjuſted right; if not, half their difference is the error. The inſtrument being ſet upon a moveable plane, if the points on which the three ſcrews at the feet reſt be marked, it will then always be eaſy to ſet the azimuth-circle very nearly in its proper poſition.

6. *To determine the apparent time of the day.*—Proceed as in the laſt article, only take the ſun inſtead of a ſtar, and bring its centre to the centre of the croſs wires, and correct for refraction, and the arc intercepted between XII and zero on the vernier ſhews the diſtance of the ſun, in time, from the meridian, or from apparent noon.

7. *To find a ſtar or planet in the day-time.*—Elevate the equatorial-circle to make an angle equal to the co-latitude, and adjuſt it to coincide with the equator in the heavens, and ſet the declination-circle to the declination of the body. Find by the uſual way the diſtance of the ſtar from the meridian at the time required, and reduce it to ſiderial time; then turn the equatorial-circle in its own plane, eaſt or weſt, as the ſtar lies, till the arc between XII and zero on the vernier be equal to that time, and the ſtar will be in the field of view. By this means Jupiter, Venus, and fixed ſtars of the firſt magnitude, may be obſerved in the day-time.

8. *To find the right aſcenſion and declination of a ſtar.*—Elevate the equatorial-circle to the co-latitude of the place, and previouſly ſet it to coincide with the equator in the heavens, and ſet XII on the equatorial-circle to zero on its vernier. After this ſet the declination-circle to the ſun's declination, and take the time of its tranſit; then ſet the declination-circle to the ſtar's declination and take the time of its tranſit, and the difference of the times will give the difference of their right aſcenſions; and the ſtar's tranſit being taken at the interſection of the wires, the declination-circle (corrected for refraction) will give its declination. Thus alſo you may compare two ſtars, or the moon and a ſtar. Or it may be done at any time, if you move the declination and equatorial-circles in their own planes till the ſtar is brought to the centre of the croſs wires, and correct the poſition of theſe circles on account of refraction, and the declination-circle will give you the declination required; and the vernier of the equatorial-circle will give you the ſtar's diſtance, in time, from the meridian, or your clock will give you the ſun's diſtance, the difference of which times gives the difference of their right aſcenſions, and, therefore, knowing the ſun's right aſcenſion, you have the right aſcenſion of the ſtar.

9. *To find the longitude.*—The equatorial-circle being ſet to coincide with the equator in the heavens, and XII to zero on its vernier, take the time of the tranſit of the moon's limb, and alſo of a proper ſtar as near as poſſible to the moon's parallel, and the longitude may be determined therefrom by the lunar method, in the uſual way.

10. *To meaſure horizontal angles.*—Adjuſt the equatorial-circle parallel to the azimuth-circle; and having directed the line of collimation to one of the objects, move the equatorial-circle in its own plane, and alſo the declination-circle, if neceſſary, and bring the line of collimation to the other, and the arc through which the equatorial-circle has moved gives the angle required.

As an appendage to this account, by profeſſor Vince, of Ramſden's portable equatorial inſtrument, we think it may be acceptable to our readers to have the Hon. S. M'Kenzie's account of Mr. Ramſden's new refraction apparatus much improved, which was publiſhed in his anonymous pamphlet, (dated in the year 1791, a year after the profeſſor's treatiſe was publiſhed), together with the explication of the principles on which the apparatus was conſtructed.—"Refraction or parallax," ſays our author, "by changing the apparent altitude of a planet, may alſo change its apparent right aſcenſion and declination; ſee *fig.* 2. of *Plate* XII. (of *Aſtron. Inſt.*) where H O repreſents the horizon; E Q, part of the equator; P, the pole of the equator; Z, the zenith; P E H, the meridian; Z V, an arc of a vertical drawn through I, the *apparent* place, and F, the *true* place of the planet; P A, a circle of declination, or hour-circle, drawn through the true place F; and P B, a circle of declination or hour-circle drawn through the apparent place I. The error in altitude from F to I alters the right aſcenſion of the planet as much as the arc of the equator A B, or its parallel F C, amounts to. It alſo alters its declination from A F to B L, that is, from C to I. If a planet be in the meridian at L, the error, in declination from L to K, will be the ſame as the error in altitude; but there will be no error in right aſcenſion, becauſe the ſame circle of declination P E H, (perpendicular to the horizon,) paſſes through the apparent place K, and the true place L. In like manner, if by the conſtruction of an inſtrument you have a vertical circle Z V, perpendicular to the horizon, it will paſs through the apparent place I and the true place F, and there will be no error in right aſcenſion; and if by the ſame inſtrument the error in altitude from F to I be determined, the true place F is found, and conſequently there will be no error in declination. With Mr. Ramſden's new refraction apparatus you have juſt ſuch a vertical circle as will appear from what follows.

In the focus of the teleſcope of the equatorial two *fixed* wires are placed at right angles to each other; one, E Q, (ſee *fig.* 4.) repreſents part of a parallel of the equator; the other, P A, part of a meridian, or hour-circle. There are alſo two moveable croſs wires at right angles to each other; one, H O, repreſents a portion of a parallel to the horizon; the other, Z V, a portion of a vertical circle. Theſe moveable wires have a motion round the axis of the teleſcope, by turning a pinion.

A ſmall quadrant (ſee *Plate* XI. *fig.* 2. and alſo *Plate* XII. *fig.* 2.) is fixed on the part that carries the moveable wires, with diviſions on each ſide; one expreſſing the degree of altitude of the object viewed, the other expreſſing the minutes and ſeconds of error occaſioned by refraction, correſponding to that degree of altitude. To the index of this quadrant is fixed a ſmall circular level, which being adjuſted by its own pinion, gives the altitude; while by another pinion it aſcertains the perpendicularity of one of the moveable wires, which gives the vertical circle abovementioned, whereby the true right aſcenſion may be determined, free from all error ariſing from refraction or parallax. Hence, in taking the moon's right aſcenſion with an equatorial inſtrument, fitted with this refraction apparatus, in order to determine longitudes at land, there is no occaſion to attend to her parallax, as the difference of her right aſcenſion, cauſed by parallax or refraction, will only depreſs or elevate her on the ſame vertical circle, but will not change her right aſcenſion from one hour-circle to another. In this refraction apparatus the centre of the fixed wires always remains in the line of collimation; whereas by the former conſtruction, on raiſing or depreſſing that centre, it was moved out of that line; and as it was very difficult to replace it exactly, an error in the obſervation was liable thereby to be produced. In all obſervations made with this refraction apparatus, firſt adjuſt the circular-level, then ſet the centre of the moveable wires, by the micrometer ſcrew, to the refraction correſponding to the altitude of the object viewed, as given by the ſmall quadrant; and let one of the moveable wires be ſet always perpendicular. Since copying the preceding extract from Mr. M'Kenzie's pamphlet, we have been aſſured that it was publiſhed previouſly to profeſſor Vince's treatiſe, and that the date 1791 is a typographical error for 1771; accordingly, we learn from Mr. Dollond, that Ramſden's inſtrument preceded his, but our inquiries to obtain the *preciſe time* of its origin have not been ſucceſsful. The two different ſizes of Ramſden's portable inſtrument were according to the following table of dimenſions.

	Rad. in In.	Limb divided to	Vernier of 30 gives	Divided to parts	By vernier into
Azim. or horizontal circle,	5.1 2.7	15' 30	0° 30" 1' 0"	45th of in. 42d ditto	1350th 1262
Equatorial or hour-circle,	5.1 2.7	15 or 1m 30 or 2	30" or 2s 1' or 4s	45th ditto 42d ditto	1350 1260
Vertical ſemicircle for declination or latitude,	5.5 2.75	15 30	30" 1'	42d ditto 41st ditto	1260 1230

Portable Equatorial Inſtrument by Meſſrs. P. and J. Dollond.—Mr. Dollond informs us that his father contrived the inſtrument, which now comes under our notice, in or about the year 1775, and the readineſs with which he communicated all the particulars we wiſhed for reſpecting it deſerves our grateful acknowledgment. This inſtrument, ſays the author, (in his quarto pamphlet,) which of all others is the moſt amuſing to lovers of aſtronomy, is now rendered, by the following improvements, greatly ſuperior to any hitherto produced. As the whole weight does not exceed thirty pounds, it may be ſaid to be truly portable, yet, by the ſteadineſs of all the parts, and the perfection of the achromatic teleſcope, the obſervations may be made to a very great exactneſs. The focal length of the achromatic object-glaſs is about 17 inches; it is compoſed of three glaſſes, and admits of an aperture of two inches. The tube being made as thin as poſſible, is eaſily balanced by the weight A, which is fixed in the ſemi-circle B B; (ſee *fig.* 3. of *Plate* XI.) then again all the parts above the horizontal axis (the end of which is ſeen as C) are balanced by the ſquare weight D. By means of theſe balances the centre of gravity is preſerved over the centre of the inſtrument in every poſition, and the different parts prevented from being ſtrained when the inſtrument is put into any oblique poſition, which may be required in its various uſes. This alſo tends to keep the teleſcope ſteady, which is of the greateſt advantage in making an obſervation. Beſides theſe very eſſential improvements, every part has been reduced to the moſt ſimple ſtate; and ſeveral, which in other inſtruments of this kind, were found ſuperfluous, have been entirely rejected.

The inſtrument is ſupported by three feet E, E, E; the ſcrews *a*, *a*, *a*, are to raiſe or depreſs the feet, in order to bring the plate G G into an horizontal poſition, which is determined by two ſpirit-levels *b*, *b*, that are fixed on it at right angles to one another. If theſe levels are well adjuſted, the plate will be horizontal when the air-bubbles come into the middle of the glaſs tubes. As this plate repreſents the horizon of the place, it is called the horizontal plate: it is divided into half-degrees, and by a vernier *c* of thirty diviſions is ſubdivided to every minute. This index is made to move round the centre of the horizontal plate in order to ſet it to zero, or point 0, when that point is found to be in the plane of the meridian. The plate is moved round by turning the handle *d*. The worm-ſcrew, which works in the part *e*, may be eaſily diſengaged from the plate, when any conſiderable quantity is required to be moved at once. Preſs the handle *d* outwards, and the worm will be diſengaged. The plate F F is called the equatorial plate, as it repreſents the plane of the equator; it turns on the horizontal axis C, ſo that it may be inclined according to the latitude of the place, which is ſhewn on the latitude arch *f f*, that paſſes through the ſquare weight D: this arch is divided into 90°, and by the vernier is ſubdivided into every minute. The tube *g* is fixed to the horizontal axis, cloſe under the centre of the equatorial plate. An axis is fixed to the middle of the plate, which paſſes through the tube *g*, into a centre fixed in the ſquare weight; this axis tends greatly to ſecure the equatorial plate from ſwinging, when put into different inclinations, or when the teleſcope is turned into any oblique poſition.

The horizontal axis is made parallel to the horizontal plate by turning the ſcrew *h*, which will raiſe or depreſs that end of it. When the equatorial plate is inclined nearly to the latitude of the place, the clamp *i* may be tightened by the ſcrew at the ſide; then, by turning the finger-ſcrew *k*, it may be adjuſted to the greateſt exactneſs: the vernier *l* may be adjuſted, (in caſe any error ſhould be found,) by the ſmall ſcrews at *m*.

The equatorial plate is divided into twice XII hours;

theſe are ſubdivided into every two minutes of time, and by the vernier *n* again ſubdivided to every four ſeconds. This plate is moved round by turning the handle O. The worm-ſcrew which works in the edge may be diſengaged from the plate, by preſſing the handle O outwards.

Above this plate is the ſemi-circle B B, which is called the declination ſemi-circle; this is divided into twice 90°, and ſubdivided as the other circles are; it is fixed to the axis H, which may be made parallel to the horizontal axis by the ſcrew *p*, in the ſame manner as the horizontal axis is made parallel to the horizontal plate. On this declination ſemi-circle the teleſcope I I is ſupported, and being balanced by the weight A, is moved with the greateſt eaſe, by means of the pinion fixed at *q*, which is turned with the fingers at *r*.

To ſet the line of collimation of the teleſcope at right angles to the axis H, the wires in the eye-tube *s* may be moved in an horizontal direction by the ſcrews, which will be diſcovered when the part of the eye-tube *t* is taken off; this piece carries the eye-glaſs, and is made to ſlide on the part that contains the wires, that diſtinct viſion may be obtained by eyes of different convexities. There are four eye-tubes, intended for different purpoſes, producing magnifying powers from 40 to 60, and an eye-piece with a diagonal ſpeculum is ſometimes added for gaining a convenient view of ſtars near the zenith. There is a combination of lenſes to the number of four in one of theſe eye-tubes, and the enlargement of the field of view thereby affords a pleaſing view of the heavens. Beſides theſe, there is a ſliding piece containing ſmoaked glaſſes to guard the eyes of the obſerver from the ſun's rays, which glaſſes are ſmoaked but faintly at one end, and have the ſhade of darkneſs gradually increaſed towards the other to ſuit all ſtates of illumination. There is alſo a ſemi-ring fitted by friction to the tube of the teleſcope, near the object end, which bears an arm holding a ſmall diagonal reflector to direct the light of a lamp or candle into the tube ſo as to enlighten the croſs wires contained in one of the eye-tubes.

The compaſs box, placed on one ſide of the horizontal plate, is uſeful in aſcertaining nearly the meridian line, and alſo in detecting the variation of the magnetic needle at any time. Theſe were the original parts compoſing the inſtrument before us; and the inſtrument viewed as a whole piece of mechaniſm preſents a ſightly compact figure, but the circumſtance of the declination-ſemicircle, not allowing the teleſcope to reach as high as the pole, is an objection in the conſtruction of this inſtrument, which, we are obliged to confeſs, renders it of leſs value in our eſtimation than it otherwiſe would have been. When the inſtrument is to be adjuſted for obſervation, the horizontal plate is levelled by the levels in the firſt place, and then the equatorial plate is made parallel to the equator itſelf, by moving the ſquare weight along the arc *f f* till the vernier *l* marks the latitude of the place. The directions given for the uſes of Mr. Short's inſtrument will equally apply here as far as they go, but as this inſtrument profeſſes greater accuracy in the readings than that and Nairne's, it uſes are more extenſive; for it will ſerve occaſionally for an equal altitude inſtrument, a tranſit inſtrument, a quadrant or ſextant, an azimuth circle, a theodolite, and a level.

When this inſtrument is to be uſed for obſerving equal altitudes, bring zero on the equatorial plate to zero on the vernier *z*, by the handle O, and zero on the vernier *l* to 90° on the latitude arch, taking care that the clamp *i* is made faſt by the ſcrew at the ſide; adjuſt the horizontal plate very nicely by the two levels and feet ſcrews, then by turning the handles *d* and *r* bring the teleſcope to the ſun for the morning obſervations: in the afternoon ſet again the horizontal plate level, and the declination-ſemicircle to the degree and minute ſhewn at the correſponding morning obſervation; then bring the teleſcope to the ſun by turning the handle *d* only. In this manner ſeveral correſponding altitudes may be obſerved on the ſame day, and the inſtrument uſed in the mean time for other purpoſes. For the methods of making equal altitudes ſerviceable in the practice of nautical aſtronomy, ſee problems X, XI, XII, and XIII, in our article CHRONOMETER.

To convert this equatorial into a tranſit inſtrument, bring zero on the vernier *l* to 90° on the latitude arch, and fix the clamp *i*; level the horizontal plate, and bring the teleſcope to the meridian mark, ſuppoſed to be aſcertained, by turning the handles *d* and *r*: turn now the handle *r* alone, and it will raiſe the teleſcope in the plane of the meridian, ſo that when the ſun or ſtars are ſeen to paſs the vertical wire, they will then be upon the meridian, and the time may be noted accordingly. This application ſuppoſes of courſe the axes of the declination-circle perfectly parallel to the horizon plate, and alſo the line of collimation perfectly parallel to the ſame plate, but at right angles to the former, when the vernier is at zero. Theſe verifications, however, we think, demand the levels to be applied nearer to the teleſcope than on the horizon plate only.

When the inſtrument is in the poſition juſt deſcribed, let the moveable vernier *c* be put to zero on the horizontal plate and be made faſt, then turn the handles *d* and *r* to bring any celeſtial object into the field of view of the teleſcope, and its azimuth will be ſhewn on the horizontal plate, while at the ſame time its altitude will be indicated on the declination ſemi-circle.

When uſed as a theodolite, let this inſtrument have its horizontal plate levelled as before; then bring zero on the equatorial plate to zero on the vernier *z*, and alſo zero on the vernier *l* to 90° on the arc of latitude, and fix the clamp *i*. Turn the horizontal plate and declination-ſemicircle, ſo as to gain a view of the object whence the angle is to be meaſured; then bring the teleſcope to the ſecond object, by moving the equatorial plate and declination-ſemicircle without the horizontal plate, and this laſt plate will then ſhew the meaſure of the ſaid angle; and if there is any elevation or depreſſion of the latter object compared with the firſt, the declination-ſemicircle will point it out. The bearings, alſo, will be ſhewn by the compaſs, as in the common theodolite.

When zero on the ſemicircle is brought to zero on the vernier *y*, the inſtrument then becomes a level; ſo that by turning the equatorial plate round, an obſerver may ſee what objects are level with the teleſcope. For this purpoſe alſo, our opinion is, that the level would be much better applied parallel to the teleſcope, on the declination-ſemicircle itſelf.

The late Mr. John Dollond had invented his object-glaſs micrometer previouſly to his arrangement of the circles and other parts of his equatorial inſtrument, ſeeing Dr. Maſkelyne gave a paper on it to the Royal Society, which was read Dec. 12, 1771, which micrometer was ſometimes made an appendage to his equatorial; but as this addition is not peculiar to the inſtrument in queſtion, but may be applied to any other aſtronomical inſtrument, or even a common teleſcope, we will deſcribe it hereafter, under our article EQUATORIAL *Micrometer*. We muſt not, however, omit a notice of the refraction apparatus belonging to the equatorial inſtrument, as made by the Dollonds, an account of which was read before the Royal Society on March 4, 1779, as drawn up by Mr. Peter Dollond, and preſented by the aſtronomer royal. *Fig.* 3. of *Plate* XII. of *Aſtronomical Inſtruments*, is a repreſentation of this apparatus, detached from the object end of a teleſcope. The account itſelf, being ſhort, will admit of being tranſcribed.

" The refraction of the atmoſphere," ſays the author, " occaſions the ſtars or planets to appear higher above the horizon than they really are; therefore a correction for this refraction ſhould be made in a vertical direction to the horizon. The equatorial inſtrument is ſo conſtructed, that the correction cannot be made by the arches or circles which compoſe it, when the ſtar, &c. is in any other vertical arch, except that of the meridian; becauſe the declination arch is never in a vertical poſition but when the teleſcope is in the plane of the meridian.

" To correct this error, a method of moving the eye tube, which contains the wires of the teleſcope in a vertical direction to the horizon, has been practiſed: but as the eye-tube is obliged to be turned round, in order to move it in that direction in the different oblique poſitions of the inſtrument, the wires are thereby put out of their proper ſituation in every other poſition of the inſtrument, except when it is in the plane of the meridian; for the equatorial wire ſhould always be parallel to the equator, that the ſtar in paſſing over the field of the teleſcope may move along with it, otherwiſe we cannot judge whether the teleſcope be ſet to the proper declination, except at the inſtant the ſtar is brought to the interſection of the wires, which is only a momentary obſervation.

" The method I have now put in practice for correcting the refraction of the atmoſphere, is, by applying two lenſes before the object-glaſs of the teleſcope; one of them convex, and the other concave; both ground on ſpheres of the ſame radius, which in thoſe I have made is thirty feet. The convex lens is round, of the ſame diameter as the object-glaſs of the teleſcope, and fixed into a braſs frame, or apparatus, which fits on to the end of the teleſcope. The concave lens is of the ſame width, but nearly two inches longer than it is wide, and is fixed in an oblong frame, which is made to ſlide on the frame that the other lens is fixed into, and cloſe to it. Theſe two lenſes being wrought on ſpheres of the ſame radius, the refraction of the one will be exactly deſtroyed by that of the other, and the focal length of the object-glaſs will not be altered by their being applied before it: and if the centres of theſe two lenſes coincide with each other, and alſo with that of the object-glaſs, the image of any object formed in the teleſcope will not be moved or ſuffer any change in its poſition. But if one of the lenſes be moved on the other, in the direction of a vertical arch, ſo as to ſeparate its centre from that of the other lens, it will occaſion a refraction, and the image will change its altitude in the teleſcope. The quantity of the refraction will be always in proportion to the motion of the lens, ſo that by a ſcale of equal parts applied to the braſs frame, the lens may be ſet to occaſion a refraction equal to the refraction of the atmoſphere in any altitude. If the concave lens be moved downwards, that is, towards the horizon, its refraction will then be in a contrary direction to that of the atmoſphere, and the ſtar will appear in the teleſcope as if no refraction had taken place.

" There is a ſmall circular ſpirit level fixed on one ſide of the apparatus, which ſerves to ſet it in ſuch a poſition, that the centres of the two lenſes may be in the plane of a vertical arch. This level is alſo uſed for adjuſting a ſmall quadrant, which is fixed to it, and divided into degrees, to ſhew the elevation of the teleſcope when directed to the ſtar; then the quantity of refraction anſwering to that altitude may be found by the common tables, and the concave lens ſet accordingly, by means of the ſcale at the ſide, which is divided into half minutes, and, if required, by uſing a vernier, may be divided into ſeconds.

" It muſt be obſerved, that when a ſtar or planet is but a few degrees above the horizon, the refraction of the atmoſphere occaſions it to be conſiderably coloured. The refraction of the lens acting in a contrary direction would exactly correct that colour, if the diſſipation of the rays of light were the ſame in glaſs as in air, but as it is greater in glaſs than in air, the colours occaſioned by the refraction of the atmoſphere will be rather more than corrected by thoſe occaſioned by the refraction of the lens. We may conclude this deſcription with the ſubjoined references to *fig.* 3. of *Plate* XII. which is a view of this apparatus:

" A A, the circular braſs tube which fits on to the end of the teleſcope.

" B B, the oblong concave lens, in its frame, which ſlides over the fixed convex lens.

" C, the circular ſpirit level, which ſhews when the oblong lens is in a vertical arch.

" D, the quadrant to which the ſpirit level is fixed, for ſhewing the angular elevation of the teleſcope.

" E, the milled head fixed to a pinion, by which the whole apparatus is turned round on the end of the teleſcope, in order to ſet the oblong lens in a vertical arch.

" F, another pinion for ſetting the quadrant to the angular elevation of the teleſcope. By means of theſe two pinions the air bubble muſt be brought to the middle of the level.

" *a a*, is the ſcale, with diviſions anſwering to minutes and half minutes of the refraction occaſioned by the concave lens."

The beſt portable equatorial inſtrument of the Dollonds, with a 17 inches achromatic teleſcope, is marked in their catalogue at 84*l.*; and their achromatic object-glaſs micrometer of the new conſtruction, at 21*l.*

Were we to be guided by a ſimple compariſon of this inſtrument and its refraction apparatus with Ramſden's, and to infer from thence which of the two was prior in point of time, we ſhould be induced to place this before the other for obvious reaſons, deduced from their comparative conſtructions, particularly the ſituation of the levels and refraction apparatus, and total elevation of the teleſcope, but, on minute inquiry, we found that Ramſden's was the firſt, and we can only account for the preference we are diſpoſed to give it, from the circumſtance of his having a patent, that precluded the latter, though his brother-in-law, from adopting his conſtruction. If there is any real comparative advantage in Dollond's, now that his achromatic teleſcopes are generally made, it is that which ariſes from the graduation of the latitude quadrant, and the lightneſs of the whole inſtrument; Ramſden's weighing 59 pounds, and Dollond's only 30.

Portable equatorial inſtrument by Fayrer.—We have already ſaid that Mr. Fayrer of White Lion ſtreet, Pentonville, has the poſſeſſion of a large engine for cutting clock wheels, &c. the property of his uncle Troughton, which we have deſcribed under our article Cutting-*engine* as originally made by Rehe: this artiſt, during ſome of his hours not occupied by his engine, makes mathematical and philoſophical inſtruments, and among others he has lately conſtructed a portable equatorial inſtrument for Mr. Lowe of Iſlington, which, we think, merits a place in our collection, as being not only an original one, but as poſſeſſing advantages likely to recommend it to public attention. This portable inſtrument differs from its predeceſſors chiefly in theſe reſpects; it has no azimuth circle fixed in a permanently horizontal poſition; it has its equatorial circle divided into degrees and alſo into time, with two verniers reading at oppoſite points, one vernier reads to the accuracy of 30″ of ſpace, and the other to 2″ of time; this circle has a long axis paſſing through a tube, like Troughton's large Coimbra inſtrument hereafter deſcribed, from which probably this part of the conſtruction was taken; it may, therefore, be placed in a horizontal direction by its axis being placed firmly vertical, in which ſituation it becomes an azimuth circle; the teleſcope is fixed on the end of the axis of the declination circle, which idea correſponds with, and may have been borrowed from, Nairne's conſtruction; this poſition allows any elevation of the teleſcope that may be required, and keeps the obſerver's eye at a diſtance from the other parts of the inſtrument, but injures the uniformity of the appearance of the inſtrument as a whole; the levels are applied, one on the common axis of the teleſcope and declination circle, and the other at right angles thereto, as a chord to the declination circle; and laſtly, the declination circle is complete, with oppoſite verniers reading, like the other oppoſite verniers, to an accuracy of twenty or thirty ſeconds, according to the dimenſions of the graduated circles, when nicely divided on Troughton's dividing engine. From ſuch conſtruction it is eaſy to perceive, that this little inſtrument poſſeſſes the advantage of having its teleſcope reverſed as well as its circles with reſpect to the oppoſite verniers, which property greatly enſures the accuracy of the adjuſtments. After theſe previous remarks it will ſuffice to give a brief detail of the parts of this inſtrument as repreſented in *fig.* 4. of *Plate* XI. *of Aſtronomical Inſtruments.*

A, A, A, are three adjuſtment-ſcrews for levelling the circular ſtand to which the feet are faſtened; B, B, are a pair of triangular frames fixed firmly to the ſaid circular ſtand, and ſupporting the pivots of the horizontal axis, round which the tube C, attached to the axis, moves; at the ſummit of the more viſible triangular frame B is an adjuſtable or ſliding part Y, like that of a tranſit-inſtrument, by which the teleſcope may be adjuſted into the meridian, when previouſly placed nearly ſo by the feet. The graduated circle D, which may be either an equatorial or azimuth circle, accordingly as its axis is inclined or vertical, has a ſteel axis nicely fitted to revolve in the tube C, in any poſition of this tube with reſpect to the horizon; but the double vernier bar is faſt to the inferior end of the tube, as may be ſeen in the figure: the poſterior pivot of the horizontal axis, borne by the triangular bars B, B, projects, and has firmly attached to it the quadrantal piece E, partly hidden from ſight in our view of the inſtrument; this quadrantal piece is graduated, and reads by a vernier as minutely as the other circles; it ſerves to ſet the equatorial axis parallel to the earth's axis, in which ſituation it may be clamped faſt, as well as in a vertical, or indeed any other poſition, by a clamping ſcrew out of ſight in the preſent poſition applying to the quadrantal arch; F F is the declination circle, with its horizontal axis reſting on a pair of vertical ſupports, carried by the upper end of the polar axis, that paſſes through the tube C, ſo that, when the teleſcope, attached to the axis of the declination circle, has any horizontal or rather oblique motion, the circle D moves with it, and indicates the diſtance moved along the equator, or in a circle parallel to it, when the polar axis is properly adjuſted and clamped faſt. The double vernier bar is on the poſterior plane of the declination circle, and may therefore be viewed after an obſervation without danger of altering the poſition of the teleſcope. The level on the declination axis may be conveniently adjuſted by turning the circle D half round, and by making the bubble keep the middle of the tube in both ſituations, which may be done, partly by the ſcrews A, A, A, and partly by the ſcrews of rectification of the level itſelf; and zero of the declination circle may be put to zero on the verniers when the circle D is truly placed in an horizontal poſition, in which ſituation alſo zero of the quadrant E muſt coincide with zero on its vernier. Under theſe circumſtances the levels will be competent to effect all that is required, and in the beſt way; and the inſtrument will poſſeſs all the various powers aſcribed to a portable equatorial inſtrument when converted into the other inſtruments.

Univerſal equatorial inſtrument by Mr. Ed. Troughton.— The equatorial inſtruments we have hitherto deſcribed are all, properly ſpeaking, portable, and conſequently of a ſize not profeſſing great accuracy in their readings. We now come to an inſtrument of larger dimenſions, and one having its parts ſo arranged and adjuſted, as to entitle it to rank among the firſt claſs of inſtruments employed in modern obſervatories. It is of the univerſal kind, and may be called moveable (in oppoſition to fixed) rather than portable, as it ſtands ſeven feet high, and is therefore too bulky to be carried by one man. It was finiſhed in the year 1788 for the late Mr. J. H. Magellan, and ſent by him to the univerſity of Coimbra in Portugal, where we have ſaid it has been unfortunately ſhut up in the dark. *Plate* XIV. *of Aſtronomical Inſtruments*, exhibits a perſpective drawing, ſhewing all the principal parts of this excellent inſtrument in its equatorial poſition, which we propoſe to deſcribe in the order of their aſcent from the ground.

It will not be neceſſary to give any letters of reference to this inſtrument, as it is preſumed the reader, who has made himſelf acquainted with the component parts of the preceding inſtruments, cannot be at a loſs to accompany us in our deſcription of the preſent inſtrument without the aid of alphabetical references. The baſis is of mahogany, conſiſting at the inferior part of a ſtrong tripod, and at the ſuperior of a circular table; theſe are connected by three pieces diverging from the table downwards, and connected by diagonal croſſing bars: this frame work is ſtill further united by three vertical pillars near the centre, one of which is omitted in the drawing, in order to expoſe to view a more eſſential part. Immediately above the table, and parallel to it, is a very ſtrong azimuth circle of braſs, 24 inches in diameter; this circle, however, is not in contact with the table, but reſts on its conical axis, that paſſes through a collar of braſs, attached to the centre of the table, and is ſupported on its conical point on a ſtud faſt to the centre of the tripod. This length of bearing, like that of Mr. Nairne's deſcending axis, keeps the azimuth circle ſteady in the horizontal line both in motion and at reſt, which is a circumſtance of the utmoſt importance. The tripod is furniſhed with three ſtrong feet ſcrews for the adjuſtment of the azimuth circle into a true horizontal poſition; and three handles, with each a Hook's joint, are attached reſpectively to thoſe ſcrews, that the adjuſtments may be made with the body in an upright poſition. or nearly ſo. The apparatus for quick or ſlow motion is ſcrewed faſt to the table, and clamps to the azimuth or horizontal circle. Two oppoſite verniers, reading to the accuracy of 10″, are attached to the edge of the table, but in ſuch a way that they are of ready adjuſtment to an exact biſection of the circle, in caſe the wood work of the table and frame ſhould alter its figure by warping in the leaſt degree; otherwiſe the wooden frame, as a pedeſtal, would have been objectionable. Upon the plane of the ſaid azimuth plate are erected two vertical ſupporters of frame work, ſomewhat reſembling the appearance of two chair backs; which ſupporters conſequently have a motion in azimuth whenever the circle is turned round; they are 19 inches apart from each other, and an horizontal axis of this length binds them together at their upper extremities;

the poſterior ſupporter has an adjuſtment apparatus for bringing the axis perfectly horizontal, which apparatus is hidden in the drawing behind the ſaid ſupporter. At the middle of the horizontal axis called alſo the axis of latitude, is a cubical part ſimilar to that in the axis of a tranſit inſtrument; to this the long braſs ſocket or tube, that embraces the polar ſteel axis, is made faſt, and is ſet exactly at right angles thereto by conſtruction. The polar axis, that paſſes down through this ſocket, has the equatorial or hour circle attached firmly to it, at right angles alſo by conſtruction, at its inferior end; and to its ſuperior end above the axis of latitude, is fixed a ſmall platform, of the ſhape of a parallelogram, to ſupport the ſuperſtructure not yet deſcribed. Any additional weight may be fixed to the lower end of the polar axis, that the ſuperincumbent materials may require to form an exact equipoiſe in any poſition; the ſiderial time, depending on the horary angles, is read by oppoſite verniers, fixed to the inferior end of the long polar ſocket; one of which only can be ſeen in the figure of the inſtrument, as it ſtands in the drawing: the equatorial circle is divided, ſo that a ſingle ſecond of time is diſtinctly read by the verniers; and if the application of three verniers had been thought of when this inſtrument was conſtructed, the inequality of the diviſions would have been corrected thereby ſtill more perfectly, as well as the excentricity of the circle, if any exiſts; which obſervation will equally apply to the azimuth and declination circles. Two quadrants are made faſt to the pivots of the axis of latitude, or horizontal axis already deſcribed, having their poſition juſt within the vertical ſupporters of the ſaid axis, and conſequently move with it, when it has any motion: theſe quadrants are divided, one of them agreeably to the uſual diviſions of the circle, and the other by particular deſire into 96 equal parts with its ſubdiviſions, and the two verniers are reſpectively placed on the contiguous ſupporters of the axis; the uſe of the quadrants is to fix the elevation or inclination of the polar axis agreeably to the latitude of the place of obſervation; that is, parallel to the axis of the earth; which poſition requires to be well verified when the inſtrument is uſed. Between the feet of the ſupporters, and at right angles to each other, are placed, on the plane of the azimuth circle, two nicely ground ſpirit levels, one of which is about half viſible, and the other ſtill leſs, which ſerve to place this circle perfectly horizontal in every direction, by the aid of the feet ſcrews: and near the centre of the ſame circle may be ſeen an apparatus for adjuſting and fixing the polar axis in any given degree of inclination from a horizontal to a vertical poſition, which it does with equal convenience, accuracy, and ſteadineſs: the lower end of this apparatus may be ſcrewed to any pair of the parallel holes made in the plate, farther from, or nearer to, the centre, as the quantity of inclination may require; while the upper end is attached to a broad ring embracing the ſocket of the polar axis; and about the middle is an adjuſtment ſcrew, juſt above a Hook's joint, that allows the ſcrew to act freely in any poſition of this apparatus. The ring that embraces the long ſocket of the polar axis will ſlide along it till the ſtem of the ſaid apparatus, into which the ſcrew acts, ſtands at right angles to the polar axis, in which ſituation its poſition will be firm and ſteady, as the axis can have no lateral or vibratory motion, by reaſon of its union with the axis of latitude. From this deſcription of the apparatus in queſtion it is eaſy to perceive that the nearer the polar axis approaches to a vertical ſituation, the farther from the centre of the azimuth plate muſt the fixing ſcrews be inſerted, and *vice verſâ*; alſo the lower towards the equatorial circle muſt the ſliding ring be, that embraces the ſocket; as well as the ſteadier the axis ſo fixed. Again, upon the platform on the ſuperior end of the polar axis, already noticed, are erected a ſecond pair of ſupporters, at the diſtance of 15 inches from each other at the bottom, and bound together at the ſame diſtance at top by the axis of the declination, which conſequently is 15 inches long; theſe ſupporters, which partake of any motion given to the equatorial circle, bear the declination or meridian circle, and teleſcope ſurmounted over all. At the upper end of one of theſe laſt named ſupporters is an adjuſtment for ſetting the declination axis at right angles to the polar axis, which is a very eſſential adjuſtment; the apparatus for producing quick or ſlow motion is faſt to the platform, the milled nuts of which apparatus may be ſeen under the declination circle; alſo the oppoſite verniers for reading off the angles of declination are attached to the ſaid platform, and both faces of the circle are divided, like the quadrants, one according to common uſage, and the other into 384 diviſions with their ſubdiviſions, which, at the time of the conſtruction, were conſidered by Mr. Magellan as the beſt check on the accuracy of the verniers that read off to 10″. The elevated ſituation of the teleſcope, which is $3\frac{1}{2}$ feet long, is ſufficiently explained by the drawing, where ſome of the ſupporters are ſeen attached to the declination axis, and ſome to the circle itſelf; this elevation was given, that the eye-tube might keep clear of the ſupporters and other parts of the mechaniſm, when a ſtar or planet is followed along the equator, or other circle parallel thereto; and as the declination circle is complete, the teleſcope will riſe to any degree of elevation that may be required, while the circle will meaſure that elevation. As a tangent to the upper edge of the circle, and parallel to the line of collimation of the teleſcope, is a very ſenſible ſpirit level with proper adjuſtment ſcrews: and on the upper ſide of the tube of the teleſcope are mounted two microſcopes, the uſe of which is to obſerve the coincidence of a fine plumb-line with points made on the tube, when placed in a vertical poſition for the purpoſe of levelling the declination axis; and indeed many of the adjuſtments of this inſtrument may be verified both by the plumb-line and levels. There are various eye-pieces to anſwer different purpoſes, both with and without diagonal reflectors for high altitudes, which it is not neceſſary to deſcribe here minutely, as they form no diſtinguiſhing feature of the inſtrument. Laſtly, the refraction apparatus placed at the eye end of the teleſcope, as made by Ramſden, was an appendage of this inſtrument, and by moving the adjuſtable croſs wire in the focus of the eye glaſs a quantity equal to the refraction or refraction and parallax taken together, rendered the calculations from the tables unneceſſary, by converting mechanically the apparent into the true altitude of any obſerved body. The reading of the ſubdiviſions of a circle by means of a microſcopic micrometer had not been adopted at the period this beautiful and uſeful inſtrument was conſtructed, otherwiſe its powers would have been made more extenſive than they now are by the verniers alone.

It is hardly neceſſary to add, that the powers of this univerſal inſtrument, as far as they go, may be readily and conveniently applied to almoſt all the purpoſes of practical aſtronomy, as well as of land-ſurveying and levelling; ſeeing it has all the properties aſcribed to the preceding inſtruments, but in a degree approaching nearer to perfection. This is the only inſtrument of the conſtruction here deſcribed that ever was made on ſo large a ſcale, but three or four others of an inferior ſize have ſince been made on the ſame plan; that, as portable inſtruments, can hardly be ſurpaſſed unleſs by the adoption of triple verniers, which are of recent origin.

Adjuſtments.—1. In the firſt place, the *teleſcope* muſt have its wire-plate turned round into ſuch a poſition, that the middle vertical wire will coincide with a diſtant mark throughout the whole field of view, as the teleſcope is elevated or depreſſed, and then the object-glaſs muſt be ſlided in or out, till a ſtar of the ſecond magnitude is ſeen as diſtinctly as poſſible, to prevent parallax at the wires.

2. In the next place, make the *azimuth circle horizontal* by means of two levels, adjuſting one half of the error, produced by turning the circle half round, by means of the feet-ſcrews, and the other half by the levels, as with the preceding inſtruments.

3. Make the *polar axis perpendicular;* clamp it nearly ſo, and turn the declination circle round till the bubble ſtands in the middle of its level, now turn the upper part half round on the polar axis, and, if there is an error, correct one-half of it by the apparatus acting on the polar axis, at the azimuth plate, and the other half by turning round the declination axis by the ſlow motion. When the error has diſappeared by a repetition of this proceſs, turn the declination circle round the polar axis juſt ſix hours, and bring the bubble to the middle by the adjuſtment at the top of one of the ſupporters of the latitude axis: when this is done the azimuth and equatorial circles will be parallel to each other, and their axes perpendicular to the horizon; and, of courſe, the level near the teleſcope will keep its bubble at the middle, as well as the other levels, while either or both of theſe circles revolve. Here the verniers of the latitude-quadrants may be ſet to their reſpective zeros.

4. The declination axis muſt be ſet *level*, or at right angles to the polar axis. In order to do this, ſet the teleſcope perpendicular by fixing the declination circle with its vernier at 90°, and put on the plumb-line; by the motion of one of the points, which is *adjuſtable*, and alſo by the proper motion of the plumb-line; make the latter biſect both the points under the microſcopes; reverſe now the teleſcope by turning the declination circle to the oppoſite 90°, ſuſpend the plumb-line from the contrary end of the teleſcope, and by the proper motion of the line make it biſect the *fixed* point; then half the error that appears at the adjuſtable point muſt be corrected by that adjuſtment, and the other half by that at the top of the ſupporter of the declination axis.

5. The line of collimation of the teleſcope muſt next be adjuſted, both as it regards the right aſcenſion and declination. In order to do this, let the upper end of the polar axis, and the object-end of the teleſcope, be pointed to ſome fixed object a little above the horizon, the declination circle being firſt put with 90° to the zero of its vernier, the hour index placed at XII, and the teleſcope above the polar axis; bring now the centre of the croſs-wires to the object fixed on, by raiſing or lowering the polar axis in conjunction with a motion in azimuth, and read off the degrees, minutes, and ſeconds ſhewn by the verniers of the azimuth circle and quadrants reſpectively; in the next place, ſet the polar axis nearly vertical, and place the hour circle at the oppoſite XII, and point the polar axis, as before, to the ſaid fixed object, the teleſcope being now below it; move the inſtrument as before, by a compound motion of the polar axis and azimuth circle till the interſection of the middle wires coincides with the object before fixed on and uſed, and read off, as before, the degrees, minutes, and ſeconds both on the azimuth circle and quadrants: in this ſituation of things, ſet the azimuth circle to the *mean* of the two obſerved azimuths by taking half their ſum, and alſo the polar axis to the *mean* of the two obſerved altitudes or inclinations of the polar axis; in this poſition of the inſtrument, let the teleſcope be carefully moved by altering the ſcrews that faſten it to the circle, until the vertical central wire coincides with the original object, and the adjuſtment for right aſcenſion is finiſhed. Again, move the teleſcope, by altering it in declination, till the horizontal wire cuts the ſame object, and adjuſt the verniers of the declination-circle to the points 90° and 96 parts reſpectively on its oppoſite planes. If, however, the object is not a very diſtant one, the above directed adjuſtment in declination will not be quite correct, becauſe the teleſcope ſtands *higher*, when *above* the pole than it is *below;* conſequently, when this adjuſtment is made by means of a near object, two marks ſhould be uſed on that object, the diſtance between which muſt be double the meaſure from the centre of the declination axis, to the line of collimation of the teleſcope; otherwiſe a ſmall angle will be formed at the object, by the two lines of ſight, which angle will be ſubtended by the double diſtance in queſtion; but when the object is at an infinite diſtance this ſmall ſubtenſe is reduced in effect to nothing, and the ſame mark therefore will do in both the poſitions of the teleſcope.

6. To adjuſt the hour index let the point 90° of the azimuth circle be turned to an object of ſmall altitude; let the polar axis be made horizontal; and the teleſcope be ſet to 0° of declination: in this poſition the hour circle becomes vertical, and the altitude of the object may be taken by it, which muſt be read off in time from VI hours: turn now the inſtrument half round in azimuth, and make the teleſcope look towards the object by turning round the polar axis; take another altitude in this poſition, and read off what is indicated from the oppoſite VI hours, and the mean of theſe two altitudes is the exact place where the adjuſtable index muſt have its zero placed to be in its true poſition.

The apparatus for correcting the horary angle on account of refraction conſiſts of a ſmall quadrant and level for taking altitudes, which are moveable round the axis of viſion, and therefore determine very readily the elevation of the teleſcope in any given poſition; alſo the eye-piece and wires of the teleſcope being moveable by means of a nice micrometer ſcrew, may be ſet with great accuracy to the refraction correſponding to the altitude of the obſerved body as determined by the ſmall quadrant and level.

The chief advantages reſulting from the conſtruction of the equatorial inſtrument juſt deſcribed, are, firſt, that it affords a firm ſupport to a very long, and, therefore, powerful teleſcope; and, ſecondly, that the great range of polar diſtance beyond 90° of declination renders an obſervation with the teleſcope below the polar axis unneceſſary.

As the rules we gave for uſing Ramſden's portable inſtrument, as extracted from profeſſor Vince's treatiſe, are not exemplified by actual obſervations, and as rules, however plain, are not always underſtood without the illuſtration of appropriate examples, we cannot finiſh our account of the preſent inſtrument better than by ſubjoining to the rules given by the Hon. Mr. M'Kenzie his examples given at full length, when adapted to our purpoſe, by which the reader will be led to have an idea of the practical application of the obſervations to the various purpoſes of aſtronomy. The rules were originally written as directions for the uſe of Ramſden's inſtrument, but after our account of the adjuſtments,

ments, they are equally applicable to the inſtrument under our immediate conſideration.

Obſervation 1. *To find the latitude of the place by the ſun, or any known fixed ſtar.*—The inſtrument being perfectly adjuſted in all its parts according to the directions given,—

Make the polar axis perpendicular to the horizon, and when the ſun approaches his meridian altitude, elevate the teleſcope to that altitude, and adjuſt the refraction apparatus as above directed: then follow the ſun by moving both the equatorial and declination circles (if neceſſary), and keeping the refraction piece always adjuſted till he is at his greateſt altitude; the vernier of the declination circle will then give you his meridian altitude; from which ſubtract his declination, if it be north, or add it if it be ſouth, the remainder if north, and the ſum if ſouth, is the height of the equator, that is, the complement of your latitude, which being ſubtracted from 90°, gives your latitude.

Example.

Sun's declination ſuppoſed - -	6°	57′	37″	North.
Meridian altitude of his centre obſerved	45	6	29	
Subtract his declination -	6	57	37	
Height of the equator or co-latitude	38	8	52	
Which ſubtracted from -	90	0	0	
Gives your latitude -	51	51	8	

If inſtead of obſerving the altitude of the centre, you obſerve that of the upper or lower limb of the ſun, you muſt allow for the ſemi-diameter of the ſun, which allowance you find in the Nautical Almanac. Alſo, if the refraction apparatus were not uſed, the tables for refraction and parallax in altitude muſt be uſed to reduce the apparent to the true altitude.

Obſervation 2. *To find the meridian by one obſervation only.*—Elevate the equatorial (or hour) circle to the co-latitude of the place, ſet the declination circle to the ſun's declination for the day and hour required; and adjuſt the refraction apparatus, then move the azimuth and hour circles both at the ſame time (either in the ſame or a contrary direction) till you bring the centre of the moveable wires (the vertical being truly perpendicular) exactly to cover the apparent centre of the ſun; that done, the centre of the fixed wires will be in the true centre of the ſun, the index of the hour circle will then give the apparent or ſolar time at the inſtant of obſervation. Thus you get the time though the ſun be at a diſtance from the meridian. Then turn the hour circle till the index points preciſely at 12 o'clock, and lower the teleſcope to the horizon to obſerve ſome mark in the centre of the teleſcope, and that is your meridian found by one obſervation only.

The beſt time for finding the meridian is, when the ſun is three hours diſtant from the meridian on either ſide of it.

Obſerve, that when you have once a true meridian fixed, you need make no uſe of the refraction apparatus in any obſervation, except to ſet one of the moveable wires perpendicular.

The meridian and ſolar time may be found in like manner by a fixed ſtar, whoſe declination and right aſcenſion are known.

Obſervation 3. *To obſerve a ſtar or planet in broad daylight, at any time when it is above the horizon.*—The table of right aſcenſions, declinations, &c. of Dr. Maſkelyne's 36 principal fixed ſtars, under the articles CHRONOMETER and DECLINATION, gives you the times of their tranſits over the meridian in ſiderial time.

Elevate the equatorial circle to the co-latitude of the place, and ſet the vernier of the declination-circle to the ſtar's declination, then adjuſt the refraction piece; look into the table for the time of its meridian tranſit or right aſcenſion; then take the time of the ſaid tranſit from the time of your obſervation as given by the ſiderial clock, borrowing 24 hours if neceſſary; this difference is the hour to which you muſt ſet the hour index of the equatorial circle, and the ſtar will then appear in the teleſcope.

Example 1.—Let it be required to place the teleſcope of the equatorial inſtrument to obſerve Capella on Sept. 30th 1809, exactly at $9^{h}\ 0^{m}\ 0^{s}$ by a ſiderial clock well regulated?

Declin. of Capella from Tab. III. under CHRONOMETER, 1806 -	45°	47′	5.″88	North.
$3\frac{3}{4}$ years of annual variation add from ditto - - -	0	0	17.14	
True declination -	45	47	23.02	North.
Right aſcenſion or ſiderial time of tranſit from ditto, 1806 -	5^{h}	2^{m}	22.ˢ62	
$3\frac{3}{4}$ years annual variation add -	0	0	16.55	
True time of tranſit -	5	2	39.17	
Which ſubtract from ſiderial time of obſervation - - -	9	0	00.00	
And there remains the interval ſince the tranſit for the index to be put to	3	57	20.83	

Note, if the clock ſhews ſolar time, it muſt be converted into ſiderial time by problem VI. under our article CHRONOMETER, and then the work may be done as here directed.

Example 2.—Let it be required to find Arcturus on April 1ſt, 1810, when the ſiderial time is $10^{h}\ 30^{m}$?

Declin. of Arcturus 1806 -	20°	11′	59.″41	North.
$4\frac{1}{4}$ years annual variation ſubtract	0	1	19.85	
True declination -	20	10	39.56	North.
Right aſcenſion or ſiderial time of tranſit - - -	14^{h}	6^{m}	48.ˢ83	
$4\frac{1}{4}$ years annual variation add -	0	0	11.59	
True time of tranſit -	14	7	0.42	
Which take from the time of obſervation, borrowing 24^{h} - -	34	30	0.00	
The remainder is the place of the index	20	22	59.58	

In this obſervation Mr. M‘Kenzie uſed a table of meridian paſſages given in ſolar time, which required the acceleration of ſiderial or ſolar time to be uſed; but as the principal catalogues give the paſſages in ſiderial time, we have adapted his rule thereto.

Obſervation 4. *To find the right aſcenſion and declination of a planet, comet, or fixed ſtar.*—The equatorial circle being elevated, as before, to the complement of the latitude of the place, move the declination and equatorial circles till the planet or comet is in, or near the centre of the field of the teleſcope, then adjuſt the refraction piece, and bring the centre of the moveable wires to cover the planet, the vernier of the declination circle will then give you the declination of the planet, and the vernier of the equatorial circle will give you the hour of the planet, &c.; then your regulator or clock will give you the ſun's time or hour of the day. Take the difference between the ſun's time and the planet's time; and if the planet's time be leſs than the ſun's time, add that difference to the ſun's right aſcenſion at the time of obſervation, (which you find in the Nautical Almanac,) the ſum (rejecting 24 hours, if it exceeds that number) is the right aſcenſion of the planet, &c. Again, if the planet's time exceeds the ſun's time, ſubtract the difference from the ſun's right aſcenſion; the remainder (adding 24 hours to the ſun's right aſcenſion, if neceſſary,) is the right aſcenſion of the planet, &c.

Example 1.

Obſerved a ſtar whoſe time by the equatorial circle is - -	2^{h}	18^{m}	3'	P.M.
Sun's time as given by the regulator, *viz.* - - - -	9	44	40	P.M.
Difference between the two	7	26	37	
As the ſtar's time is leſs than the ſun's, add that difference to the ſun's right aſcenſion - - -	20	57	9	
Reject 24 hours from	28	23	46	
Right aſcenſion of the ſtar is	4	23	46	

Its declination (by the vernier of the declination circle) is 16° 2′ 50″ north.

Example 2.

Obſerved a ſtar whoſe time by the equatorial circle is 10^{h} A.M. (that is, aſtronomically) - - -	22^{h}	0^{m}	0^{s}
Sun's time as given by the regulator, *viz.* 5° 55′ 4″ A.M. (that is, aſtronomically) - - -	17	55	4
Difference between the two	4	4	56
As the ſtar's time exceeds the ſun's, ſubtract that difference from the ſun's right aſcenſion - -	10	38	58
Remains the right aſcenſion of the ſtar	6	34	2

Its declination (by the vernier of the declination circle) is 16° 25′ 1″ ſouth.

Obſervation 4. To find the longitude at land by the right aſcenſion of the moon.

Obſerved the centre of the moon on the moveable wire ſet vertical, either in or out of the meridian; time given by the equatorial or hour circle, ſuppoſe - - -	2^{h}	28′	2″
Sun's apparent time by the regulator	6	0	0
Difference between thoſe times	3	31	58
Add that difference to the ſun's right aſcenſion at 6 hours (becauſe the moon's time is leſs than the ſun's time, for had it been greater, the difference muſt have been ſubtracted)	8	25	27
And you have the moon's right aſcenſion at the place of obſervation at 6 hours - - - -	11	57	25

Another method of making the above obſervation.—The centre of the moon being obſerved in the ſame manner at ſix hours P.M. as before directed, let the inſtrument remain in the ſame poſition it was in (only altering the declination) till a known ſtar comes to the vertical wire, which will happen (ſuppoſe) in one hour after, *viz.* at 7 hours, then ſubtract that one hour of difference in time of tranſits, with the addition of 9″ 86^{dec} for the acceleration correſponding to one hour, that is, ſubtract 1^{h} 0′ 9″ 86^{dec} from the AR of the ſtar, ſuppoſed to be 12^{h} 57′ 35″, the remainder is the moon's AR at ſix hours P.M. at the place of obſervation.

Star's right aſcenſion - - -	12^{h}	57′	35″
Difference in ſiderial time, (ſee CHRONOMETER, Tab. I.) - - - - -	1	0	9.86
Moon's right aſcenſion at 6 hours P. M. at the place of obſervation. - - -	11	57	25.14

Then find, by the Nautical Almanac, at what time at Greenwich the moon has the ſame right aſcenſion as that now obſerved.

Moon's right aſcenſion at Greenwich at noon is	11^{h}	43′	20″
Ditto at midnight - - -	12	10	36
Difference in thoſe 12 hours -	0	27	16

Moon's right aſcenſion at Greenwich at noon	11^{h}	43′	20′
Moon's right aſcenſion at 6 hours, at the place of obſervation - - - - - - -	11	57	25
Difference between them	0	14	5

Proportion for finding the time at Greenwich.

As 27^{m} 16^{s} : 14^{m} 5^{s} : : 12^{h} : 6^{h} 12^{m} 0′

So that the time at Greenwich, when the moon has 11^{h} 57′ 25″ of right aſcenſion, is 6^{h} 12^{m} 0,′ that is, 12^{m} later than at the place of obſervation, which is therefore 12^{m} of longitude weſt from Greenwich.

Sir George Shuckburgh's fixed equatorial inſtrument.—A B, C D, E F, G H, (*Plate* XV. *of Aſtronomical Inſtruments,*) are four columns, ſays ſir George Shuckburgh, compoſed of hollow braſs tubes $3\frac{1}{2}$ inches in diameter, and five feet ten inches long; theſe, with two others, one of which appears in part at I K, and the other partially hidden behind E F, are firmly fixed, at their upper ends, to a circle of bell metal B D F H, and, at their lower end, to an inverted truncated hollow cone, L L L, of braſs, in height two feet, and in diameter, at the baſe A G, one foot nine inches. The croſs pieces, or tubes P, P, as likewiſe O, O, and O, O, ſerve to connect the columns more ſtrongly together, and prevent their bending. Theſe ſeveral parts conſtitute the principal axis of the inſtrument, the lower end of which terminates in a ſteel point or cone, reſting in a hollow conoid of bell metal, in ſuch manner that the apex of the former does not reach to the bottom of the latter, but the place of bearing, or of friction, is (it may be) about two tenths of an inch from the extremity of the cone; the other end of this axis finiſhes in a cylindrical pivot N, of about $1\frac{1}{4}$ inch long, and one inch in diameter, turning in a Y of bell metal. The entire length of this axis is eight feet four inches, the lower end being ſupported by an iron frame 3, 4, 5, 6, 7, 8, which is firmly fixed below the floor, into brick-work, and by means of two iron bars, one of which is ſeen at 28, and the other on the oppoſite ſide, not viſible in the drawing, is kept ſecure from any motion, eaſtward or weſtward; the lower part of this frame, to about one foot high, is incloſed by a mahogany box or caſe 9, 10, the top of which is entirely covered up, and ſerves as a die or baſe to this end of the inſtrument. The other extremity of this long axis, *viz.* the pivot N, reſts upon the ſtrong iron ſupport 29, 30, 31, ſtanding 10 feet above the floor, made of maſſive pieces of caſt iron, $2\frac{1}{2}$ inches wide, and $\frac{1}{2}$ an inch thick, and held firmly by bolts and nuts as in the figure: 32, and 33, are the places where two iron bars, nearly at right angles to each other, and at $\frac{1}{2}$ right angles to the meridian, are ſcrewed, to connect this upright ſupport with the walls of the building, and going through the bricks, are held faſt by iron collars and nuts on the outſide of the wall; theſe bars, or braces, not in the figure, reſiſt any tendency from the weight or preſſure of the inſtrument, to puſh the ſupporter 29, 30, and 31, out of its upright poſition; and being at right angles to each other, ſerve to keep it ſteady with reſpect to any lateral force that may accidentally be applied. The lower part is continued below the floor, and firmly fixed with mortar and lead into the brick work of an arch. The bottom is ſhut up in a box or plinth of mahogany, 34, 35, as has been mentioned in the deſcription of the frame ſupporting the other end of the axis at 9, 10. Near the lower end of the principal axis L N, are inſerted 10 concentric braſs cones, or radii, *a a*, *b b*, *c c*, *d d*, *e e*, carrying on their extremities a graduated braſs circle, of $49\frac{1}{2}$ inches dimeter, at right angles to the principal axis already deſcribed; this circle has two ſets of diviſions, one of points, and one of lines, each into degrees, and every ten minutes, and the intermediate minutes and ſeconds are read off by the microſcopes W and X, with a moveable wire, and micrometer ſcrew, ſuch as has been deſcribed in general Roy's account of his inſtrument for meaſuring horizontal angles. (See Philoſophical Tranſactions, vol. lxxx. p. 145.) The circle juſt mentioned, is incloſed by a circular frame, or rail of mahogany, 14, 15, which is ſupported by ten baluſters, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, (17 and 24 being concealed) and ſerves to protect the braſs circle from any accidental injury in paſſing by it, without depriving it of expoſure to the general temperature of the room. It at the ſame time affords means of ſupport to a ſmall lamp, 13, which, by reflection from the perforated ſpeculum at the bottom of the microſcopes, to be ſeen in that marked X, throws light upon the diviſions by night: 26, 26, and 27, are iron rods that, by being attached to the wooden caſe, 9, 10, give ſteadineſs to the upright baluſters, and the circular frame that they ſupport: 1 and 2 are large ſtout braſs cones firmly fixed into the frame, 3, 4, 5, 6, 7, 8, before mentioned, and whoſe uſe is to carry the microſcopes W, X. Any degree of pliancy or flexure in theſe cones would be readily diſcernible in the microſcopes, and extremely detrimental to the obſervations; they are therefore made as ſtiff as poſſible: ∂ is a plane forming the upper ſide of the frame, 3, 4, 5, 6, &c. and conſiſting of three plates, two moveable in grooves; and one fixed, furniſhed with ſuitable ſcrews, one giving the extremity of the axis a motion upward or downward, and the other a motion to the right or left. This latter is procured by a rod paſſing through the cone. 2, one end ſcrewing into the plate below L, near the centre, and the other turned by an occaſional handle fixed on, near X, the former motion, *viz.* of elevating or depreſſing the axis, is procured by a handle fixed on to a ſcrew near ε: Q R is another circle of the ſame dimenſions with the former, graduated in the ſame manner, and held together by eight conical radii, *f f*, *g g*, *h h*, *i i*, firmly ſcrewed to a circular centre-piece, which ſerves as a baſe to a large conical axis, two feet three inches long, one ſide of which is ſeen at U, and its exterior extremity near V, with its ſliding plate and ſcrews for adjuſtment. Cloſe behind the graduated circle, and at right angles to this axis paſſing through it, lies the teleſcope T S, $5\frac{1}{2}$ feet long. This circle is likewiſe furniſhed with two microſcopes and micrometers, as in the equatorial circle, one of which is ſeen at full length at Y, and Z, the eye-tube being at Y, and the object-glaſs, with the perforated ſpeculum, to throw light at Z; the other microſcope, on the oppoſite ſide of the circle, is not ſo prominent in the drawing, being ſomewhat fore-ſhortened at Z. Near T, α, α, α, α, α, α, is an hexagonal lozenge, compoſed of ſix braſs rulers, firmly fixed to the columns A, B, and E, F, and ſupporting the lower end of the microſcopes, as the pieces β β, β β, in like manner ſuſtain the upper end. By theſe means, the wire in the field of the microſcopes becomes a fixed immoveable index, and after proper adjuſtment, an exact diameter of the circle, whilſt the teleſcope, together with the circle, turns round the conical axis beforementioned. At P is a ſpirit level, paſſing through the centre plate of the conical axis at right angles to the teleſcope, ſupported by a cock at each end, one of which appears at *k*; this cock is placed on the cone U; and by means of a ſmall-toothed wheel and pinion, the level is made to revolve round its own axis, ſo that the ſame ſide of the level may readily be brought uppermoſt, whatever poſition the circle be put into; it is alſo furniſhed with all neceſſary adjuſting ſcrews. It will readily be ſeen, that a teleſcope thus fitted up, will have all the properties of a tranſit inſtrument, while the graduated circle will poſſeſs thoſe of a meridian quadrant. For this purpoſe *l m* is a ſtout braſs tube, incloſing a ſtiff iron rod, turning upon two fine ſteel points, adjuſted by proper ſcrews, parallel to the line of ſight of the teleſcope: this rod is attached to a ſpirit level of great ſenſibility, lying below it, which, with the rod, turns round upon the ſteel points juſt mentioned, and is in fact a hanging level of the beſt conſtruction. At the eye-end of the teleſcope S is a peculiar apparatus, to correct the effects of refraction and parallax, when an obſervation is made out of the meridian: it is compoſed of two levels, a ſmall quadrant of altitude *n o*, and a ſemicircle divided with its vernier to every 5′ on the breech plate of the teleſcope, the exterior eye-tube having a circular motion by a wheel and pinion at *o*, independent of the tube that carries the croſs wires; by this means the angle of the horary and vertical circles may at any time be found, together with the altitude of the object, and then by the reſolution of two right-angled triangles the refraction and parallax in right aſcenſion and declination will be obtained: *t*, *u*, are two handles to a Hook's joint at *x x*, which turning an endleſs ſcrew at *w w*, give a gradual motion to the teleſcope in right aſcenſion or declination; and this motion can at any time be reſtrained by a clamp at *q*: 11, 12, (the latter not ſeen,) are two ſupporters to the clamp and endleſs ſcrew. The handles *t*, *u*, are hung on to any part of the inſtrument by means of the line and wire *v*, *v*, and are thus kept within the obſerver's reach. Near *r* and *s* are two microſcopes, placed on oppoſite ſides of the circle Q R, and at right angles to the line of ſight of the teleſcope, but are hidden by the columns in our figure; they are of uſe only when the plumb-line, ſuſpended from the roof of the obſervatory, is uſed in preference to the level *l m* above deſcribed, either for adjuſting the inſtrument, or obſerving a meridian altitude, in which caſe the line muſt biſect the centres of both microſcopes: *y*, and *z*, are thin perforated braſs plates, attached to the cover that goes on the object-glaſs, and by occaſionally turning them over it, change the aperture to $\frac{1}{2}$ or $\frac{1}{4}$. The croſs wires, of which there are three vertical and one horizontal, within the eye-tube S, have all the requiſite adjuſtments by ſcrews, &c. as in a common tranſit inſtrument, and are enlightened at night by a lamp fixed near to one end of the declination axis U, *viz.* that oppoſite the end V ; but this part of the apparatus is hidden behind the axis and the teleſcope, except the weight *i*, which is a counterpoiſe. This lamp throws a light through the conical axis, which is perforated at that end on purpoſe, on a ſpeculum in the centre of the teleſcope, placed at $\frac{1}{2}$ right angles to the axis of the object-glaſs, and from thence reflected to the croſs wires. This ſpeculum, which is an elliptical diaphragm, is perforated to permit all the rays from the object-glaſs to paſs unobſtructed to the eye. The contrivance has been mentioned by Mr. Vince (Practical Aſtronomy, p. 80.) From what has been already deſcribed, it muſt now be evident that if the principal, or polar axis, as it has been called, L N, be elevated to the latitude, and adjuſted to the meridian of the place, if the line of ſight of the teleſcope be at right angles to the axis V U, and this latter at right angles to the polar axis L N, the braſs circle 14 and 15 will correſpond with the equator in the heavens, and the circle Q R will become an horary circle ; that is, if the centre of the wires in the field of the teleſcope be directed to any celeſtial object, on Q R will be had its declination, and on 14 and 15 its diſtance from the meridian, from whence, by knowing the hour, the right aſcenſion will be obtained, and conſequently its true place in the heavens.

Beſides the preceding parts of this expenſive inſtrument, there are ſome neceſſary appendages, as a ſtool marked 36, and ſome others deſcribed in the original account, with references to the accompanying plates, a minute detail of all which would lengthen this article too much ; we will therefore briefly enumerate them, and refer the more curious reader to the Tranſactions themſelves for the particulars. The appendages are, 1ſt, a lamp to illuminate the croſs-wires ; 2dly, the refraction-piece hereafter deſcribed ; 3dly, the plumb-line ; 4thly, the moveable roof of the obſervatory ; 5thly, a regulator or ſiderial clock which indicates degrees, minutes, and ſeconds of ſpace on the equator ; and, 6thly, the meridian mark, conſiſting of a ſmall adjuſtable light-houſe, placed on a brick pier at the diſtance of 2970 feet, which can be ſeen as well by night as day.

After a very rigorous examination of the two divided circles of this inſtrument, it ſeems that the greateſt error, including both the inequalities of the diviſions and the excentricity, never amounts to more than 2″ in either of them, and the author calculates that an obſervation of right aſcenſion, taken *out of* the meridian, may be depended on to the accuracy of 5″, allowing an error of 2″ for counting the beat of the clock, 1″ for the deviation of the meridian mark, and $\frac{1}{2}''$ for the error in reading the microſcope ; but that the error in polar diſtance may amount to 7″, including all the errors of the inſtrument, of the adjuſtments, and of the readings. This inſtrument, it will have been obſerved, has no azimuth circle, like moſt of the portable inſtruments, but if its axis were fixed perfectly vertical, its equatorial circle would then become an azimuth circle, and the inſtrument altogether would greatly reſemble Piazzi's great circular inſtrument made by Ramſden. From what we apprehend alſo from ſir George Shuckburgh's account of the variableneſs of the errors of adjuſtment, in different degrees of temperature, we are diſpoſed to attribute much of the imperfection of this inſtrument, in this reſpect, to the metallic ſupport of the upper pivot of the polar axis, which ſupport muſt naturally elongate and contract its dimenſions alternately, by changes of temperature ; and as it is compoſed of various parts differently placed, it affords no data for aſcertaining by calculation either the quantity or direction of deviation from the truth. Before we proceed to the adjuſtments of this inſtrument, it may be proper to deſcribe the refraction apparatus which is attached to it, and which is neceſſary to be underſtood in uſing the appended tables. *Fig.* 2. of *Plate* XI. exhibits a perſpective view of this apparatus on a larger ſcale than is exhibited in *fig.* 1. where "A B is a portion of the teleſcope ; C the eye-tube ; *a b c* a divided ſemicircle, *d* its vernier fixed to A B, ſhewing the angle of the horary and vertical circles ; *e* a ſmall ſpirit-level, attached to the plate on which this ſemicircle is engraved, and moving with it by means of the ſcrew *f*, which turns a pinion, that works in a toothed wheel, that turns the whole plate, together with the exterior eye-tube round its centre, but without moving the tube that carries the croſs-wires. From hence it may be underſtood, that by turning the ſcrew *f* till the level *e* ſtands true, the index *d*, which repreſents a point in the horary circle, will mark how much the diviſion zero, which repreſents the vertical, is inclined thereto : *l k* is a ſmall quadrant of altitude, that, by means of the level *g*, and ſcrew and pinion *h*, turning on a centre at *m*, gives the elevation above the horizon of any object in the field of the teleſcope : *i* is a ſmall aperture through which a key is fixed on, to give a lateral motion to the wires to adjuſt them ; and near *f* is another ſcrew, to adjuſt them parallel to the equator and declination-circle."

This apparatus, it will be ſeen, has not the refraction-circle, or micrometer and divided nut, to elevate or depreſs the horizontal wire, a quantity correſponding to the data thereby determined, in order to convert the apparent to the true place of a heavenly body ; it therefore indiſpenſably requires the aid of ſuch tables as we have ſubjoined to our preſent article ; but Ramſden's portable inſtrument deſcribed by the Hon. S. M'Kenzie, and by profeſſor Vince, whoſe accounts we have adopted, has the addition of the micrometer ſeen in miniature at P, in the figure of that inſtrument. To that inſtrument, therefore, as well as to Dollond's, the tables are otherwiſe unneceſſary, than as they ſerve as a check on the accuracy of the mechanical contrivances in queſtion.

Adjuſtments.— The three principal adjuſtments, according to ſir George Shuckburgh's account, are, 1ſt, to adjuſt the level P *k* parallel to the declination axis U V ; 2dly, to adjuſt this axis at right angles to the line of collimation of the teleſcope ; and, 3dly, to make this axis at right angles to the polar axis. The polar axis is placed nearly in the meridian, by means of a meridian mark previouſly verified, and elevated pretty nearly to the latitude of the place. This is to be done more accurately afterwards, by the ſliding plates and ſcrews at the bottom of the polar axis. The axis of the declination-circle is then brought nearly horizontal, by its proper level, *viz.* is turned round about the polar axis, till the bubble of the level ſtands true between the indexes ; the inſtrument is then turned half round about the polar axis, = 180°, ſhewn by the microſcope W. If the bubble then ſtand true it requires no correction, but if it do not, correct half the error, by moving the equatorial circle by its handle *t*, and the other half by the (inviſible) capſtan ſcrew, which we will call *a*, or end-ſcrew ; then turn the inſtrument back again to its firſt poſition, and ſee if the level ſtands true ; if not, repeat this operation till it does, correcting one half of the error by the equatorial handle, and the other half by the ſcrew *a*. The declination-axis will then be parallel to the level, and both of them to the horizon. It muſt be remarked that in this operation it will be neceſſary to move the declination-circle round its own axis a little, in order to bring the ſame ſide of the level uppermoſt; but this in no degree affects the reſult, for the imaginary line, round which this axis revolves, is what is meant all along by the axis, and is the line to which the parallelifm of the level is referred.

The declination axis remaining in an horizontal poſition, with the level above the axis, as in the *fig.* turn the declination-circle 180°, *viz.* till the level become below the axis; then, by means of the pinion for this purpoſe, reſtore the tube of the level to an upright poſition, and ſee if the bubble ſtand true; if not, correct $\frac{1}{2}$ the error by the ſide ſcrew, and the other $\frac{1}{2}$ by *a*, the end ſcrew. Now turn the declination-circle 90° each way from its laſt ſituation, and repeat the examination of the bubble, and correct as before, $\frac{1}{2}$ by the ſide ſcrew, at the oppoſite end of the tube, at right angles to the other ſide ſcrew; and $\frac{1}{2}$ by the end ſcrew, near the ſide ſcrew in queſtion; and if after all theſe corrections in every part of an entire revolution of the declination-circle round its axis, and of the level round its axis, the bubble ſtand true, it follows that the axis of the declination-circle, and of the level, are in every direction parallel to each other, both of them to the tangent of curvature, in the middle of the level, and all three to the horizon. This adjuſtment is therefore complete.

It remains to be ſeen whether the line of ſight of the teleſcope be at right angles to the declination-axis, and the latter to the polar axis.

Take the error of the collimation of the teleſcope in right aſcenſion, by a ſtar in the equator, *viz.* let the tranſit of a ſtar on the equator over the aſſumed meridian be obſerved with the declination-circle turned towards the eaſt, and alſo towards the weſt. If there be any difference in theſe obſervations, it will denote double the error of collimation in right aſcenſion, and half of it will be the deviation of the line of ſight from a line at right angles, to the axis of the declination-circle, and is correſpondent to a ſimilar adjuſtment of a tranſit inſtrument. The amount of this error being thus aſcertained, let it be corrected by the ſcrews, at the eye-end of the teleſcope, that move the wires to the eaſt and weſt. The declination-axis, by means of its level being reſtored to an horizontal poſition, let the centre wire of the teleſcope, (by which is always underſtood the line of collimation,) be brought to biſect the meridian mark, by means of the ſliding plate, and adjuſting ſcrew, below the polar axis; the teleſcope will then become a complete tranſit inſtrument; for, by the firſt operation, the declination axis is made parallel to the level and its axis, and both to the horizon; by the ſecond, the line of ſight is put at right angles to this axis; and, thirdly, it is adjuſted to the meridian.

Now, let the error of collimation in right aſcenſion in the ſame manner be obſerved with any ſtar out of the equator, by a circumpolar ſtar, (the nearer the pole the better,) ſuppoſe the pole ſtar. If any difference in minutes and ſeconds of a great circle, as aſcertained by the micrometer, ſhould be noticed in its paſſage with the circle eaſt or weſt, halve that difference, and it will be equal to the angle that the plane of the declination circle makes with the polar axis, if the obſerved ſtar were actually in the pole; if not, divide it by the ſine of its declination, and the true angle of the plane of this circle, (or of the line of collimation,) with the polar axis will be had. Again, if this operation be repeated with any other ſtars, and the error ſo found be divided by the ſine of their declination, the error of the plane of the declination circle at the pole, *viz.* its greateſt error, or angle with the polar axis, will be had. And note, if theſe obſervations are made with ſtars on each ſide of the equator, theſe quantities will be had in oppoſite directions. Finally, the ſame may be done by two land objects, one to the north, and the other to the ſouth, the north and ſouth meridian marks, for inſtance, proper conſideration being had to their declination; by this means the error will be thrown in contrary ſenſes or doubled, and from a variety of ſuch reſults a very correct mean quantity may ultimately be deduced; and when found muſt be corrected by the ſcrews at one end of the declination axis.

It has now been ſeen, that, 1ſt, the level and its axis are parallel to the axis of the declination circle: 2dly, the line of ſight is at right angles to this axis, and parallel to the polar axis; and, conſequently, the declination axis is at right angles to the polar axis: 3dly, the polar axis parallel to that of the earth. Theſe are the chief requiſites in the adjuſtment of this inſtrument. Thoſe that remain are ſecondary, and we ſhall take them in the following order: 1ſt, the adjuſtment of the croſs wires to the focus of the teleſcope: 2dly, the hanging level: 3dly, the line of collimation north and ſouth, as well as eaſtward and weſtward: 4thly, the index wires in the microſcopes: 5thly, the refraction apparatus: and, 6thly, the power and ſcale of the microſcopes.

Firſt, *the croſs wires.* Let the eye-tube be adjuſted to diſtinct viſion for parallel rays by ſome diſtant object, ſuch as Jupiter, Saturn, or Venus, by day-light; that done, obſerve, while one limb of either of theſe planets appears running along the equatorial wire, whether any motion of the eye, upwards or downwards before the eye-glaſs, alters the relative place of the image and the wire; if a motion of the eye upwards moves the planet in the *ſame* direction, the wires are too near the eye-glaſs, and muſt be puſhed in; and *vice verſâ*, till the image becomes fixed upon the wire, whatever be the motion of the eye. When this point is obtained, the eye ſtop, with its wires, muſt then be fixed, for that is their true place, *viz.* the correct focal point of the object-glaſs; and whatever indiſtinctneſs may be found from the diverſity of eyes of different obſervers, muſt be corrected by the motion of the eye-glaſs only. Another point to be ſecured is the permanency, as far as may be, in the poſition of the object-glaſs; for if this be not correctly centered, which is very rarely the caſe, and, indeed, never to be expected, that is, if its axis be not concentric with the axis of the cell, in which it is fixed, any motion of this latter, by ſcrewing or unſcrewing it, may not only change the place of the focus to which the wires are adjuſted, but will neceſſarily move the line of collimation both in right aſcenſion and declination. To obviate this, therefore, two correſponding marks ſhould be made with a graver, both upon the cell into which the glaſs is burniſhed, and alſo upon the tube of the teleſcope into which the cell is ſcrewed, or otherwiſe inſerted, that in caſe the object-glaſs ſhould ever be taken out to clean it, &c. it may be reſtored very nearly, if not exactly, to its former poſition.

The eye-glaſs, object-glaſs, and wires being thus ſettled in their reſpective places to each other, it will not be an improper time to meaſure the interval between the wires, which cannot be too accurately done, being of ſuch conſtant uſe; this may be either, 1ſt, by obſerving the paſſage of a ſtar in the equator, and making proper allowances for the rate of the clock, or by a ſtar out of the equator, and making proper allowances for the declination in the proportion of the radius to the coſine, or, 2dly, by means of the equatorial circle, and a fixed land object; and here the quantity muſt be diminiſhed in the ſame ratio as the radius to the ſine of the polar diſtance. We have made uſe of both methods as a confirmation of each other, and find the interval, which is equal in the three wires of my teleſcope, to be $7' \, 34''.5 = 30''.3$ ſiderial time; and theſe three wires divide the diameter of the field very nearly into four equal parts.

Second and third adjuſtments: *the hanging level.* By means of its proper handle *u*, move the declination circle about its axis, till the bubble of the hanging level *l m* reſts true between the indexes; there fix it by the clamp *w*, reverſe the level by taking it out of its pivots, and turning it end for end; if the bubble now ſtand true, the level is adjuſted; if not, correct $\frac{1}{2}$ the error by the declination handle, and the other $\frac{1}{2}$ by the ſmall ſcrew at the bottom of the level; then reverſe the level and repeat this operation till it does. The level, or rather a tangent to its curvature at its middle, will be parallel to the axis on which it ſwings, and both will be horizontal. At this time look through the teleſcope, and ſee what land object is covered by the horizontal wire; now invert the teleſcope by turning it 180° round the declination axis, and 180° round the polar, and bringing the level true, it will then point to nearly the ſame place; and if exactly the ſame object as before be now covered by the horizontal wire, the axis of the level is adjuſted parallel to the line of collimation in a vertical direction, if not, correct half the error by the little capſtan ſcrew at the bottom of the cock, or arm, that ſupports one end of the axis of the level, and the other half by the declination handle; invert the teleſcope, and repeat the operation, till the ſame object is covered in both poſitions, and the level is found true, then will the level and its axis be parallel to the line of collimation, and the object covered by the wire may be concluded to be in the horizon.

Fourth. *The index wires of the microſcopes.*—The line of collimation, with reſpect to eaſt and weſt, has been already adjuſted as above. Let then the declination axis, by its level, be reſtored to an horizontal poſition; at this time adjuſt the index wires in the two equatorial microſcopes W, X, to biſect the two oppoſite diviſions 360° and 180°, then will theſe wires be rectified to their proper place. That being done, bring 90°, or the diviſion that repreſents the equator on the declination circle, under its reſpective microſcope, and turn the whole inſtrument one quarter round on the polar axis, *viz.* till 90° on the equatorial circle be biſected by the micrometer; and, if at this time the bubble of the hanging level appear true, the index wire of the declination microſcope is correct; if not, correct $\frac{1}{2}$ the error by the declination handle *u*, and $\frac{1}{2}$ by the little ſcrews at the ſide of the hanging level, then reverſe the teleſcope, *viz.* turn it till 270° on the equatorial circle come under the micrometer wire, and if the level then reſt true the adjuſtment is complete; if not, repeat the operation, as before, till it does; then by its proper ſcrew bring the index wire of the declination micrometers to biſect the points 90° and 90°. The indexes of both circles will be then adjuſted, and the axis of the hanging level brought parallel to the line of collimation, with reſpect to eaſt and weſt, as well as with reſpect to north or ſouth. Note, this paralleliſm of the axis of the level, to the line of collimation in a direction eaſt and weſt, does not appear to be a very important rectification, but on ſome occaſions may have its uſe.

Fifth. *The refraction piece.*—After what has been done, this apparatus will be adjuſted. Bring the teleſcope, by means of its two levels P *k*, and *l m*, to point to the horizon, and in the meridian; then by the two points, *f*, *h*, *Plate* XI. *fig.* 2, of the refraction piece, bring its two levels *e* and *g* to reſt true; move the nonius *d*, of the little ſemicircle of the horary and vertical angles, *a*, *b*, *c*, to the middle of the diviſions, or 0°, 0′, and alſo that of the little quadrant of altitude, *l k*, to 0°, 0′, and this part is adjuſted.

Sixth. *The microſcopes.*—The magnifying power and ſcale of the microſcopes is all that remains to be conſidered. The magnifying power of a compound microſcope, as is well known, depends on the proportion between the diſtance of the object, and of its image from the object-glaſs, together with the proportion between the focus of the eye-glaſs and the ordinary focus of the eye looking at a ſmall object (ſuppoſe) of $\frac{1}{50}$th or $\frac{1}{100}$th inch. Theſe two ratios compounded give the power of the microſcope. The former is called magnifying by diſtance, and is a material part in the conſtruction of theſe microſcopes; the ſcale of the micrometer being regulated by this part of the magnifying power. For example, let the diſtance of the object from the glaſs be = 1, and the diſtance of its image = 4, its power will be 4; and conſequently the ſcale of the micrometer or motion of its ſcrew, to anſwer to 10′, (ſuppoſe) muſt be 4 times as great as the ſpace occupied by 10′, on the limb of the circle; and if the radius of the circle be two feet, an arc of 10′ will be equal to 0.07 inch nearly on the limb, and = 0.28 inch on the ſcale, *viz.* = to the ſame arc on a circle of 8 feet radius; and if each revolution of the micrometer ſcrew be intended to deſcribe 1′, the ſcrew muſt contain about 35 threads in an inch. But as it would be difficult to adjuſt the ſcrew exactly to the ſcale, the advantage of the conſtruction of theſe micrometers is, the ſcale may at any time be adjuſted to the ſcrew; for let the interval between any two neareſt diviſions = 10′ on the limb, be meaſured by the ſcrew, and, ſuppoſe, inſtead of being = 10′ or 600″, it appears only = 570″; it is evident that the ſcale is bigger than it ſhould be, or, which is the ſame thing, that the image is leſs by $\frac{30}{600}$ or $\frac{1}{20}$. In this caſe, increaſe the diſtance between the micrometer wires and the object-glaſs = $\frac{1}{20}$, by unſcrewing or drawing out the tube that carries the micrometer and eye-glaſſes, and the ſcale is adjuſted. It will, at the ſame time, however, be right to re-adjuſt the object-glaſs of the microſcope to diſtinct viſion, by the ſcrew of the cell that contains it, until the image and the wires have no relative change of place by any motion of the eye. This will again occaſion ſome ſmall alteration in the ſcale, and muſt be corrected by repeated trials, and the ſcale adapted to the diviſions on the arc; and if the moveable wire of the microſcope be now brought to coincide exactly with the fixed one, and the moveable index brought to zero on the ſcrew-head, the micrometer is completely adjuſted. This having been done with all the microſcopes, and the oppoſite ones being made to agree, each with the other, in ſuch manner, that the fixed wires may become a correct diameter, the whole inſtrument will have been completely adjuſted.

Before taking an obſervation of right aſcenſion and declination, the teleſcope muſt be adjuſted to the meridian mark, ſo as that the centre wire may exactly biſect it, in which ſituation care muſt be taken to make the index wires of the equatorial micrometers biſect the points of 360° and 180°, by means of the adjuſting ſcrew of the polar axis; and when an obſervation is made out of the meridian the altitude and angle of the horary and vertical circles muſt be taken by the refraction apparatus; then with theſe arguments, the refraction and parallax, in north polar diſtance, and in right aſcenſion, may be found by inſpection in the ſubjoined tables, by which any obſervation may be readily reduced to the meridian.

In this account of ſir George Shuckburgh, the reader may have obſerved, that the *order* of the adjuſtments propoſed is not that which is beſt in practice; as ſome of the *leading* adjuſtments muſt neceſſarily be deranged by the ſubſequent ones as he has deſcribed them, and indeed ſo as to tender new adjuſtments neceſſary; but we were unwilling to transform the baronet's directions that have met with the approbation of the Royal Society, though we cannot diſmiſs the account without this remark for the reader's conſideration; *viz.* the rectification of the teleſcope, levels, &c. ought certainly to *precede* the adjuſtments of the circles, that depend on *their* accuracy of poſition.

The Armagh equatorial inſtrument by Mr. Ed. Troughton.— The inſtrument which now claims our attention is repreſented in *Plate* XVI. of *Aſtronomical Inſtruments*, and, though ſimilar to its predeceſſor ſhewn in *Plate* XV, as to its uſe and properties, yet forms a ſtriking contraſt with it, in regard to compactneſs and beauty; too evident a contraſt indeed to be overlooked at the firſt glance of comparative inſpection. The arrangement of its principal parts is ſo novel, and at the ſame time ſo natural, as well as the connection of its ſmaller ones effected with ſuch ſymmetrical preciſion, that the mind is ſtruck with the contemplation of it, and ſpontaneouſly conſiders it as an inſtrument of a ſuperior order, that ſeems to place at a diſtance every other individual of its kindred: we therefore feel a peculiar pleaſure in concluding our article with the account of an inſtrument, which, though it comes laſt, ought in our eſtimation to ſtand firſt, as a model for future imitation. As the different component parts of the equatorial inſtrument are now become familiar to the reader, who has peruſed the preceding deſcriptions, we ſhall ſatisfy ourſelves with a brief detail, unaccompanied by alphabetical references to the drawing, which preſents a perſpective view of all the leading features.

The horary or equatorial circle, without centre or radii, occupies the middle part of the inſtrument; and is held in its proper place by eight conical tubes of braſs, four above and four below, which converge reſpectively towards the upper and lower poles, and which ſtand at the diſtance of a quadrant from each other. A ſtrong and light frame is thus formed of the ſhape of two ſimilar cones joining their baſes at the horary circle, and connected near their ſummits by two pieces of metal that terminate each with a hollow cylinder of about two inches diameter; this frame is further braced by croſs connecting tubes, as well as by ſide braces, or props, in the manner ſufficiently explained by the figure; and the whole frame, thus firmly united, ſupplies the place of a revolving axis, and carries the horary circle round with it, when it is made to turn on its cylindrical pivots. On theſe pivots the horary circle was finally turned true, after the frame was united and made faſt in all its parts, ſo that the excentricity of the circle, if it had any previouſly, was done away, by being turned on its own pivots. The inferior end of the polar axis or frame is ſupported by a ſolid ſtone, about 30 inches above the floor, with which it has no connection to produce unſteadineſs; this ſtone is capped by an apparatus of ſtrong braſs work, in which is produced the adjuſtment for bringing the inſtrument into the plane of the meridian, as well as that for giving the polar axis its proper elevation. This lower end of the axis terminates in a hemiſpherical button of hardened and finely poliſhed ſteel, which preſſes endwiſe againſt a plane of agate, and is kept centrical by two rollers that form an angle to receive it on the lower part of the apparatus; all which contrivances may be readily conceived without more minute deſcription. The ſupport for the elevated pole conſiſts principally of a ſtone pier, reaching from the ground to the centre of the inſtrument; but on it is firmly fixed a ſtrong frame of wrought iron, ſo conſtructed as to turn its edges towards the teleſcope hereafter deſcribed, in every direction; otherwiſe it would obſtruct the field of view in elevations below the upper pole. The upper gudgeon is received between two rollers ſimilar to thoſe below, except that theſe are perforated, as well as the gudgeons, in order that as little light as poſſible may be intercepted when the teleſcope is pointed to the pole. At about ſix feet diſtance from each other, in the eaſt and weſt line, upon the ſame ſolid foundation that ſupports the bearing ſtone and pier, are firmly fixed two pillars of ſtone, each nearly three feet high; and on the tops of theſe are placed faſt two ſtrong cones of braſs to ſupport the microſcopes for reading off the horary angles. The length of theſe two cones of braſs is ſo proportioned as to correſpond to the effective length of one half of the frame, or polar axis, in its inclined ſtate, in all changes of temperature, by which means the microſcopes preſerve their relative ſituations at the horary circle. This circle is divided into 5′ ſpaces, or ſpaces of 20 ſeconds of time, upon its extreme or exterior edge, which was made broad for this purpoſe, and the heads of the equatorial micrometers are ſo divided as to ſubdivide the ſaid ſpaces into tenths of a ſecond of time. The axes of the microſcopes of courſe are horizontal. At the tops of the conical parts of the pillars are adjuſtments for moving the microſcopes; one with reſpect to perpendicular height, another with reſpect to the diſtance of the exterior edges of the horary circle, and a third along its plane. An apparatus alſo for quick or ſlow motion is attached to each of the cones in queſtion, by means of which the inſtrument may be ſecurely fixed, either in the meridian, or in any other given poſition, as it regards the meridian. The declination circle likewiſe occupies the middle of the frame, and has its centre preciſely in the ſame point that is the centre alſo of the horary circle, theſe two circles being concentric, but having their planes exactly at right angles to each other, after the manner of the meridian and equatorial circles of a common ring-dial, when put into a ſtate for uſe. The declination circle is double, or compoſed of two complete circles united in ſeveral places by connecting pillars, and having each eight radii alſo connected in the ſame manner, after being inſerted into the common axis, which is of the ſhape of a double cone. The teleſcope paſſes through the baſes of the united cones of the axis, and has an aperture of 2¾ inches, conſequently the connecting pillars are long enough to admit ſuch a teleſcope between the united circles, in which ſituation it is not very eaſily diſtinguiſhable in the figure. Its eye-piece, however, is diſcernible juſt under the declination circle. It is 44 inches long, and revolves within the horary circle; conſequently requires a diagonal or reflecting eye-piece when directed to the equator, in which ſituation the aperture admits light enough, notwithſtanding the interpoſition of the horary circle. When the elevation is great, the head of the obſerver muſt neceſſarily be admitted between two out of the four lower conical pillars of the frame, which circumſtance points out the ſcale of magnitude on which an inſtrument of this conſtruction ought to be made, to be uſeful at all degrees of elevation of the teleſcope. The teleſcope has various magnifying powers, which may be uſed according to circumſtances. Two oppoſite quadrantal arcs of the horary circle have chord-bars parallel to each other, at the middle points of both which are ſockets for the gudgeons of the declination axis to work in as their ſupports: which bearings made the braces of the frame and horary circle eſſentially neceſſary to give ſtrength and firmneſs to the whole. The declination axis, which is about three feet long, has an adjuſtment at one end for ſetting it at right angles to the polar axis, and carries alſo a very ſenſible ſpirit-level parallel to itſelf; with another of which the teleſcope is likewiſe furniſhed, which it cannot be neceſſary to particularize further, after our former deſcriptions of ſpirit-levels, except that in thoſe the adjuſtment ſcrews had divided heads, whereas in theſe there are divided ſcales of ivory, by means of which the half differences can be accurately eſtimated to the *fraction of a ſecond.* The declination circle is divided into ſpaces of 5′, which are again ſubdivided by the microſcopic micrometers into minutes and ſingle ſeconds. One of theſe microſcopes is ſeen above the horary circle and the other below, but both are ſupported by it, and point horizontally to oppoſite points of the declination circle, as one of the others is ſeen at the top of one of the pillars pointing to the exterior edge of the horary circle. The apparatus for quick or ſlow motion, to govern the declination circle, is attached to the lower part of the frame, or polar axis, as repreſented in the figure. The excellence of this inſtrument has been fully eſtabliſhed in public eſtimation, by the uſe that has been made by Mr. Pond of the Armagh obſervations, taken with it in 1797, when he formed his catalogue of ſome of the principal ſtars, as we have already ſtated; in which catalogue (ſee our article DECLINATION,) it will be ſeen that the accuracy of its meaſures accord very nearly with the reſults derived from an average of the beſt modern inſtruments: and we may add, that the coincidence would doubtleſs have been ſtill more remarkable, had not the diviſions, which are by dots, been injured by an accident. An intenſe froſt, to which the inſtrument was expoſed at the top of the maker's houſe, covered it with black ſpots, and corroded its ſurface ſo as almoſt to obliterate the dividing points, which were neceſſarily enlarged by hand, and of courſe might be altered a little by this manual operation, however carefully performed. The diviſions of the other circle met alſo with an accident at the other ſide of the water, which, though of a different nature, has rendered the diviſions leſs correct than they were at firſt. Beſides which, two other circumſtances ought alſo to be named as drawbacks in this inſtrument, when compared with the circular inſtruments with which it has been contraſted, namely, its verifications were not made with a plumb-line; and its polar poſition may be conſidered as ſomewhat unfavourable for taking declinations with the utmoſt nicety; but notwithſtanding all theſe deductions, the accurate performance of the inſtrument has ſtood the teſt of a rigid compariſon with the inſtruments of three modern obſervatories.

Adjuſtments.—1. Turn the *wire-plate* round, if neceſſary, ſo as to make the middle vertical wire continue, throughout the whole field of view, on ſome diſtant and well defined point, while the teleſcope is elevated or depreſſed as it turns on the axis of the declination circle, to which the wire will in that caſe be perpendicular.

2. Slide the *object-glaſs* of the teleſcope in or out, while you view a ſtar of the ſecond magnitude, until the parallax of the wires is taken off, that is, until the viſion is as diſtinct as poſſible.

3. To adjuſt the *level* of the *declination axis.* By the motion round the polar axis bring the bubble of the level to the middle of the tube, and in this ſituation make its ſcales or indices to coincide with both its ends; turn the level, end for end, and if it now ſtand in the middle, as before, the axis is level; if not, alter one half of the deviation from the truth by a ſlight motion round the polar axis, and the other half by the ſcrews of the level itſelf; and repeat theſe rectifications till the bubble will ſtand always in the middle of the tube when its ends are reverſed. But the bubble of a hanging level may alſo require a lateral adjuſtment; to examine it in this reſpect, turn it round on its own axis a little, and if the bubble has a tendency to go to either end of the tube it muſt be rectified by the ſide ſcrews till this tendency is removed, and then if the bubble will yet bear reverſing, the level is properly adjuſted.

4. To adjuſt the *pivot-holes* of the level *parallel* to the *axis* of the declination-circle, and the *axis horizontal;* bring the bubble of the level to the indices on the tube, with the level above the axis, by moving the inſtrument round the polar axis; then turn the declination-circle half round till the level is under its axis, and if the bubble now ſettles to the middle, as pointed out by the indices, the level is right; if not, alter one half of the error by turning the polar axis round, and the other half by the two ſcrews that govern the pivot-hole; in the next place turn the teleſcope 90° round the declination-axis, and by the ſcrews that govern the other pivot-hole, bring the bubble to the indices, and the axis will be horizontal, as well as the pivot-holes parallel to it in all directions; for when the level itſelf is adjuſted, as above directed, it is evident that if the bubble keeps its place at the indices during a revolution of the declination-circle, the axis itſelf muſt neceſſarily be horizontal.

5. To ſet the *declination-axis* at *right angles* to the *polar axis*, we may uſe the level itſelf inſtead of the declination-axis, after it has been ſet parallel thereto as juſt directed; for this purpoſe, bring the bubble to the indices by moving round the polar axis, and biſect oppoſite points of the equatorial circle by the two wires of the microſcopes; turn the inſtrument exactly half round by the help of the microſcopes ſo adjuſted, and if the bubble now ſettles to the indices, the two axes are at right angles to each other; if not, alter one half of the error by the ſlow motion of the polar axis, effected by the equatorial tangent ſcrew, and the other half by the two ſcrews at one end of the declination-axis adapted for this purpoſe.

6. To ſet the *line of collimation* true in *right aſcenſion*, let the bubble be brought to the middle of the tube, or to the indices as in the laſt adjuſtment, and look at any well-defined ſmall object near the horizon, as biſected by the middle vertical wire; then having noted this mark, turn the inſtrument half round the polar axis, as indicated either by the level or equatorial microſcopes, which are now adjuſted to do the ſame thing; and when the teleſcope is turned back round the declination-axis, note if the ſame object or mark be interſected as before, if not, alter one half of the deviation by the equatorial tangent ſcrew, and the other half by moving the wires of the eye-piece in the teleſcope; thus when the ſame mark is biſected by the middle vertical wire, in reverſed poſitions of the teleſcope, the line of collimation will be right with reſpect to right aſcenſion.

7. To place the *indices* of the declination-circle to read *polar diſtances* truly. Before we deſcribe this adjuſtment, it may be proper to remark, that the microſcopes themſelves of this circle have each three ſeparate adjuſtments, the firſt, that which alters the power by altering the diſtance of the object lens, ſo as to make one minute on the circle equal to a revolution of the micrometer ſcrew; the ſecond, that which produces diſtinct viſion by varying the diſtance of the entire microſcope from the diviſions of the circle; and the third, that which places zero on the ſcale of minutes to agree with zero on the declination-circle, and alſo zero on the ſcale of ſeconds, to agree with zero on the ſcale of minutes, as effected by the head of the micrometer being made to turn independently of the ſcrew. Theſe minor adjuſtments being underſtood, point the teleſcope to any diſtant land object, and let the middle horizontal wire biſect it, and read off the polar diſtances ſhewn by the indices, and take half their ſum; make

the ſame obſervation when the inſtrument is turned half round the polar axis, and take another mean of the angles now ſhewn by the oppoſite indices; ſubtract the former mean from 180°, and add the difference to the latter mean, and *half of this ſum* is the angular diſtance from the pole of the inſtrument, to which quantity the indices muſt be put within the exactneſs of a minute or ſo, as this proceſs muſt hitherto be conſidered as an approximation only: repeat the operation we have deſcribed of obtaining two means of polar diſtances more accurately by uſing the ſcales of minutes and ſeconds; thus, read off by the indices the quantity to the diviſion next below the ſub-diviſions to be meaſured by the ſcales; then turn the micrometer head till the wire of the microſcope biſects the next following point, taking care to count the notches paſſed over as minutes, and the ſeconds and parts on the micrometer ſcale to be added to the quantity given by the indices alone; and the *ſupplement* of the mean of the two meaſures by the microſcopes, added to the mean read off in the ſame way, when turned half round the polar axis, being divided by two, will give the *true* angle from the pole of the inſtrument; and the ſcale of minutes, as well as ſcale of ſeconds on the micrometer head, muſt be finally adjuſted thereto.

8. To place the *declination-level parallel to the line of collimation* of the teleſcope, bring the declination-axis level, or nearly ſo, and let the bubble of the declination-level be brought to the middle of its tube, by the motion round the polar axis, and let the indices be put to its ends; turn the level a ſmall quantity round its own axis, and try if the bubble has any tendency to either end; if it has, adjuſt it laterally by the ſcrews that move one of its pivots ſideways, till it is right in this reſpect; now reverſe the level, and if the bubble does not ſtand in the middle, alter one half the error by moving the teleſcope in declination, by means of its ſcrew for ſlow motion, and the other half by the ſcrews that govern the pivots of the level, and the level itſelf will then be adjuſted. In this ſituation of things look for ſome object in the centre of the field of the teleſcope, and note it; turn the inſtrument half round the polar axis, and as much round the declination axis as to bring the teleſcope exactly to the ſame object again; if the bubble now ſtands in the middle, the adjuſtment is right, but if otherwiſe, one half of the error muſt be altered by the motion of the teleſcope in declination, and the other half by altering the pivot-hole of the level. Laſtly, turn the inſtrument the ſpace of *ſix hours* round the polar axis, and adjuſt the other pivot hole till the bubble ſtands in the middle of its tube, and the adjuſtments are all complete, provided the polar axis of the inſtrument be exactly parallel to the axis of the earth, which we have all along taken for granted, and which may be effected by its own adjuſtments as pointed out by an obſervation of a circum-polar ſtar, agreeably to our directions given under our article EQUATORIAL *Sector*.

EQUATORIAL.

Nº I. TABLE of the Effect of Refraction in North Polar Distance.

This correction is always +

Angle of the vertical with the horary circle.	Degrees of Altitude.															Angle of the vertical with the horary circle.
	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°	24	26°	28°	30°	
°	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	°
0	18 1	11 42	8 25	6 30	5 15.6	4 24.0	3 46.4	3 17.5	2 54.7	2 36.3	2 20.9	2 8.0	1 57.2	1 47.6	1 39.0	90
2	18 0	11 42	8 24	6 30	5 15.3	4 23.8	3 46.3	3 17.4	2 54.6	2 36.2	2 20.8	2 7.9	1 57.1	1 47.5	1 38.9	88
4	17 58	11 40	8 24	6 29	5 14.7	4 23.4	3 45.9	3 17.0	2 54.3	2 35.9	2 20.6	2 7.7	1 56.9	1 47.3	1 38.8	86
6	17 55	11 37	8 22	6 28	5 13.8	4 22.5	3 45.2	3 16.4	2 53.7	2 35.4	2 20.1	2 7.3	1 56.6	1 47.0	1 38.5	84
8	17 50	11 35	8 20	6 26	5 12.6	4 21.4	3 44.2	3 15.6	2 53.0	2 34.8	2 19.5	2 6.8	1 56.1	1 46.6	1 38.0	82
10	17 44	11 31	8 17	6 24	5 10.8	4 20.0	3 43.0	3 14.5	2 52.0	2 33.9	2 18.8	2 6.1	1 55.4	1 46.0	1 37.5	80
12	17 37	11 27	8 14	6 21	5 8.7	4 18.2	3 41.4	3 12.8	2 50.9	2 32.9	2 17.8	2 5.2	1 54.6	1 45.2	1 36.8	78
14	17 29	11 21	8 10	6 18	5 6.1	4 16.2	3 39.7	3 11.6	2 49.5	2 31.7	2 16.7	2 4.2	1 53.7	1 44.4	1 36.1	76
16	17 19	11 15	8 5	6 15	5 3.3	4 13.7	3 37.6	3 9.8	2 47.9	2 30.4	2 15.2	2 3.4	1 52.7	1 43.1	1 35.2	74
18	17 8	11 7	8 0	6 11	5 0.1	4 11.1	3 35.2	3 7.8	2 46.1	2 28.7	2 14.0	2 1.7	1 51.5	1 42.3	1 34.1	72
20	16 56	11 0	7 54	6 7	4 56.7	4 8.1	3 32.8	3 5.6	2 44.1	2 26.9	2 12.4	2 0.3	1 50.1	1 41.1	1 33.0	70
22	16 41	10 51	7 46	6 1	4 53	4 4.8	3 29.9	3 3.2	2 42.0	2 24.9	2 10.6	1 58.7	1 48.7	1 39.7	1 31.8	68
24	16 28	10 41	7 41	5 56	4 48	4 1.2	3 26.9	3 0.5	2 39.6	2 22.8	2 8.7	1 56.9	1 47.1	1 38.3	1 30.4	66
26	16 12	10 31	7 34	5 50	4 44	3 57.2	3 23.5	2 57.6	2 37.0	2 20.3	2 6.6	1 55.0	1 45.4	1 36.7	1 29.0	64
28	15 55	10 20	7 26	5 44	4 39	3 53.1	3 20.0	2 54.5	2 34.[illegible]	2 18.[illegible]	2 4.4	1 53.0	1 43.5	1 35.8	1 27.4	62
30	15 36	10 8	7 17	5 38	4 33	3 48.6	3 16.1	2 51.1	2 31.[illegible]	2 15.3	2 2.0	1 50.8	1 41.5	1 33.1	1 25.7	60
32	15 17	9 55	7 8	5 31	4 28	3 43.9	3 12.0	2 47.6	2 28.1	2 12.6	1 59.5	1 48.5	1 39.4	1 31.2	1 24.0	58
34	14 56	9 42	6 58	5 23	4 22	3 38.9	3 7.8	2 43.8	2 24.8	2 9.6	1 56.8	1 46.1	1 37.2	1 29.1	1 22.1	56
36	14 34	9 28	6 48	5 16	4 15	3 33.6	3 3.2	2 39.9	2 21.3	2 6.5	1 54.0	1 43.6	1 34.9	1 27.0	1 20.1	54
38	14 12	9 13	6 38	5 7	4 9	3 28.0	2 58.4	2 35.6	2 17.6	2 3.2	1 51.0	1 40.9	1 32.4	1 24.7	1 18.0	52
40	13 48	8 58	6 27	4 59	4 2	3 22.2	2 53.4	2 31.3	2 13.7	1 59.8	1 47.9	1 38.0	1 29.8	1 22.3	1 15.5	50
42	13 2[illegible]	8 41	6 15	4 50	3 55	3 16.1	2 48.2	2 26.7	2 9.7	1 56.1	1 44.7	1 35.1	1 27.1	1 19.6	1 13.5	48
44	12 58	8 25	6 3	4 40	3 47	3 9.9	2 42.9	2 22.1	2 5.6	1 52.4	1 41.4	1 32.1	1 24.4	1 17.4	1 11.2	46
46	12 31	8 7	5 51	4 31	3 39	3 3.4	2 37.3	2 17.1	2 1.4	1 48.6	1 37.9	1 28.9	1 21.5	1 14.7	1 8.8	44
48	12 3	7 49	5 38	4 21	3 31	2 56.6	2 31.5	2 12.1	1 56.9	1 44.6	1 34.3	1 25.6	1 18.5	1 12.0	1 6.2	42
50	11 35	7 31	5 24	4 11	3 23	2 49.7	2 25.6	2 6.9	1 52.3	1 40.5	1 30.6	1 22.3	1 15.4	1 9.1	1 3.6	40
52	11 6	7 12	5 11	4 0	3 14	2 42.5	2 19.3	2 1.7	1 47.5	1 36.6	1 26.8	1 18.8	1 12.2	1 6.2	1 1.0	38
54	10 35	6 52	4 57	3 49	3 6	2 25.2	2 13.8	1 56.6	1 42.7	1 34.9	1 22.9	1 15.2	1 9.0	1 3.2	0 58.2	36
56	10 4	6 33	4 42	3 38	2 57	2 27.6	2 6.6	1 50.5	1 37.7	1 27.4	1 18.8	1 11.6	1 5.6	1 0.1	0 55.4	34
58	9 33	6 12	4 27	3 27	2 47	2 19.9	2 0.0	1 44.7	1 32.6	1 22.9	1 14.7	1 7.8	1 2.2	0 57.0	0 52.[illegible]	32
60	9 0	5 51	4 12	3 15	2 38	2 12.0	1 53.2	1 38.7	1 27.3	1 18.1	1 10.4	1 4.0	0 58.6	0 53.8	0 49.5	30
62	8 27	5 30	3 57	3 3	2 28	2 3.9	1 46.3	1 32.7	1 22.2	1 13.3	1 6.2	1 0.1	0 55.0	0 50.5	0 46.5	28
64	7 54	5 8	3 41	2 51	2 18	1 55.7	1 39.3	1 26.6	1 16.6	1 8.5	1 1.8	0 56.1	0 51.4	0 47.1	0 43.4	26
66	7 19	4 46	3 25	2 39	2 8	1 47.4	1 32.1	1 20.3	1 11.1	1 3.5	0 57.3	0 52.1	0 47.7	0 43.7	0 40.3	24
68	6 45	4 23	3 9	2 26	1 58	1 38.9	1 24.9	1 14.0	1 5.5	0 58.5	0 52.8	0 47.9	0 43.9	0 40.3	0 37.1	22
70	6 10	4 0	2 52	2 13	1 48	1 30.3	1 17.5	1 7.6	0 59.8	0 53.5	0 48.2	0 43.8	0 40.1	0 36.7	0 33.9	20
72	5 34	3 37	2 36	2 1	1 37	1 21.6	1 9.9	1 1.1	0 54.0	0 48.3	0 43.6	0 39.6	0 36.3	0 33.2	0 30.6	18
74	4 58	3 13	2 19	1 47	1 27	1 12.8	1 2.1	0 54.5	0 48.1	0 43.1	0 38.9	0 35.3	0 32.6	0 29.6	0 27.3	16
76	4 22	2 50	2 2	1 34	1 16	1 3.9	0 54.8	0 47.8	0 42.1	0 37.8	0 34.1	0 31.0	0 28.4	0 26.0	0 24.0	14
78	3 45	2 26	1 45	1 21	1 5	0 54.9	0 47.1	0 41.1	0 36.1	0 32.5	0 29.3	0 26.6	0 24.3	0 22.4	0 20.6	12
80	3 8	2 2	1 27	1 7	0 55	0 45.8	0 39.3	0 34.3	0 30.2	0 27.1	0 24.[illegible]	0 22.2	0 20.3	0 18.6	0 17.2	10
82	2 30	1 38	1 10	0 54	0 44	0 36.7	0 31.6	0 27.5	0 24.5	0 21.7	0 19.6	0 17.8	0 16.3	0 14.9	0 13.8	8
84	1 53	1 13	0 53	0 41	0 33	0 27.6	0 23.5	0 20.7	0 18.4	0 16.3	0 14.7	0 13.4	0 12.2	0 11.4	0 10.3	6
86	1 15	0 49	0 35	0 27	0 22	1 8.4	0 15.8	0 13.7	0 12.3	0 10.9	0 9.8	0 8.9	0 8.2	0 7.5	0 6.9	4
88	0 38	0 25	0 17	0 13	0 11	0 9.3	0 7.9	0 6.9	0 6.2	0 5.5	0 4.9	0 4.5	0 4.1	0 3.8	0 3.5	2
90	0 0	0 0	0 0	0 0	0 0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0

Refraction in Right Aſcenſion × Sec. of Declination.

This correction is − on the Eaſt, and + on the Weſt ſide of the Meridian.

EQUATORIAL.

Nº I. TABLE of the Effect of Refraction in North Polar Diſtance—*continued.*

This correction is always +

Angle of the Vertical with the Horary Circle.	Degrees of Altitude.																					Angle of the Vertical with the Horary circle.
	32°		34°		36°		38°		40°		42°		44°	46°	48°	50°	52°	54°	56°	58°	60°	
°	′	″	′	″	′	″	′	″	′	″	′	″	″	″	″	″	″	″	″	″		°
0	1	31.5	1	24.7	1	18.7	1	13.2	1	8.2	1	3.6	59.3	55.3	51.6	48.1	44.9	41.7	38.7	35.8	33.1	90
2	1	31.4	1	24.6	1	18.7	1	13.2	1	8.2	1	3.6	59.3	55.3	51.6	48.1	44.9	41.7	38.7	35.8	33.1	88
4	1	31.3	1	24.5	1	18.5	1	13.2	1	8.0	1	3.4	59.2	55.2	51.5	48.0	44.8	41.6	38.6	35.7	33.0	86
6	1	31.0	1	24.2	1	18.3	1	12.8	1	7.8	1	3.3	59.0	55.0	51.3	47.8	44.7	41.5	38.5	35.6	32.9	84
8	1	30.6	1	23.9	1	17.9	1	12.5	1	7.5	1	3.0	58.7	54.8	51.1	47.6	44.5	41.3	38.3	35.5	32.8	82
10	1	30.1	1	23.4	1	17.5	1	12.1	1	7.2	1	2.6	58.4	54.5	50.8	47.4	44.2	41.1	38.1	35.3	32.6	80
12	1	29.5	1	22.8	1	17.0	1	11.6	1	6.7	1	2.2	58.0	54.1	50.5	47.0	43.9	40.8	37.8	35.0	32.4	78
14	1	28.8	1	22.2	1	16.4	1	11.0	1	6.2	1	1.7	57.5	53.7	50.1	46.7	43.6	40.5	37.5	34.7	32.1	76
16	1	28.0	1	21.4	1	15.6	1	10.4	1	5.6	1	1.2	57.0	53.2	49.6	46.2	43.2	40.1	37.2	34.4	31.8	74
18	1	27.0	1	20.5	1	14.8	1	9.6	1	4.9	1	0.5	56.4	52.6	49.1	45.7	42.7	39.6	36.8	34.0	31.5	72
20	1	26.0	1	19.7	1	13.9	1	8.8	1	4.1	0	59.8	55.7	52.0	48.5	45.2	42.2	39.2	36.3	33.6	31.1	70
22	1	24.9	1	18.5	1	12.9	1	7.9	1	3.2	0	59.0	55.0	51.3	47.9	44.6	41.6	38.6	35.9	33.2	30.7	68
24	1	23.6	1	17.4	1	11.9	1	6.9	1	2.3	0	58.2	54.2	50.5	47.1	43.9	41.0	38.1	35.3	32.7	30.2	66
26	1	22.3	1	16.1	1	10.7	1	5.8	1	1.3	0	57.2	53.3	49.7	46.4	43.2	40.3	37.4	34.8	32.2	29.8	64
28	1	20.9	1	14.8	1	9.5	1	4.7	1	0.2	0	56.2	52.4	48.9	45.6	42.5	39.6	36.8	34.2	31.6	29.2	62
30	1	19.3	1	13.3	1	8.1	1	3.4	0	59.1	0	55.2	51.4	47.9	44.8	41.6	38.9	36.1	33.5	31.0	28.7	60
32	1	17.7	1	11.7	1	6.7	1	2.1	0	57.9	0	54.0	50.3	46.9	43.8	40.8	38.1	35.3	32.8	30.3	28.1	58
34	1	15.8	1	10.2	1	5.2	1	0.7	0	56.6	0	52.7	49.2	45.9	42.8	39.9	37.2	34.5	32.0	29.6	27.5	56
36	1	14.0	1	8.5	1	3.6	0	59.3	0	55.2	0	51.5	48.0	44.8	41.8	38.9	36.3	33.7	31.3	28.9	26.8	54
38	1	12.1	1	6.7	1	1.9	0	57.7	0	53.8	0	50.1	46.8	43.6	40.7	37.9	35.4	32.8	30.4	28.2	26.1	52
40	1	10.1	1	4.8	1	0.2	0	56.1	0	52.3	0	48.8	45.5	42.4	39.6	36.9	34.4	31.9	29.6	27.4	25.4	50
42	1	8.0	1	2.8	0	58.4	0	54.4	0	50.7	0	47.3	44.1	41.2	38.4	35.8	33.3	30.9	28.7	26.5	24.6	48
44	1	5.9	1	0.8	0	56.5	0	52.7	0	49.1	0	45.8	42.7	39.9	37.2	34.6	32.3	29.9	27.8	25.7	23.8	46
46	1	3.4	0	58.7	0	54.6	0	50.9	0	47.4	0	44.2	41.3	38.5	35.8	33.4	31.2	28.9	26.8	24.8	23.0	44
48	1	1.1	0	56.7	0	52.7	0	49.0	0	45.7	0	42.5	39.8	37.0	34.5	32.2	30.0	27.8	25.9	23.9	22.2	42
50	0	58.8	0	54.4	0	50.6	0	47.1	0	43.9	0	40.9	37.8	35.5	33.2	30.9	28.8	26.8	24.9	22.9	21.3	40
52	0	56.3	0	52.1	0	48.4	0	45.1	0	42.1	0	39.2	36.5	34.1	31.8	29.7	27.6	25.7	23.8	22.0	20.4	38
54	0	53.8	0	49.7	0	46.2	0	43.1	0	40.2	0	37.4	34.9	32.5	30.4	28.3	26.4	24.5	22.7	21.0	19.5	36
56	0	51.2	0	47.3	0	44.0	0	41.0	0	38.2	0	35.6	33.2	31.0	28.9	26.9	25.1	23.3	21.6	19.9	18.0	34
58	0	48.4	0	44.9	0	41.7	0	38.9	0	36.2	0	33.7	31.5	29.4	27.4	25.5	23.8	22.1	20.5	18.9	17.0	32
60	0	45.8	0	42.3	0	39.3	0	36.6	0	34.1	0	31.8	29.6	27.6	25.8	24.0	22.5	20.8	19.3	17.9	16.5	30
62	0	42.9	0	39.7	0	36.9	0	34.4	0	32.1	0	29.9	27.9	26.0	24.2	22.5	21.1	19.5	18.1	16.8	15.5	28
64	0	40.1	0	37.1	0	34.4	0	32.1	0	30.1	0	27.9	26.1	24.3	22.7	21.0	19.7	18.2	16.9	15.7	14.5	26
66	0	37.2	0	34.4	0	31.9	0	29.8	0	27.8	0	25.9	24.2	22.6	21.0	19.5	18.3	16.9	15.7	14.5	13.4	24
68	0	34.3	0	31.6	0	29.4	0	27.4	0	25.6	0	23.8	22.2	20.8	19.4	18.0	16.9	15.5	14.4	13.4	12.4	22
70	0	31.3	0	29.0	0	26.9	0	25.1	0	23.4	0	21.7	20.4	18.9	17.6	16.4	15.4	14.3	13.2	12.2	11.3	20
72	0	28.3	0	26.2	0	24.3	0	22.7	0	21.1	0	19.7	18.3	17.1	16.0	14.8	13.9	12.9	12.0	11.0	10.2	18
74	0	25.3	0	23.3	0	21.7	0	20.2	0	18.8	0	17.6	16.4	15.3	14.3	13.2	12.4	11.5	10.6	9.8	9.1	16
76	0	22.2	0	20.5	0	19.0	0	17.8	0	16.6	0	15.4	14.4	13.4	12.5	11.6	10.9	10.1	9.3	8.6	8.0	14
78	0	19.0	0	17.6	0	16.3	0	15.3	0	14.2	0	13.2	12.4	11.5	10.8	10.0	9.4	8.6	8.0	7.4	6.9	12
80	0	15.9	0	14.6	0	13.6	0	12.8	0	11.9	0	11.0	10.3	9.6	8.9	8.3	7.8	7.2	6.7	6.1	5.7	10
82	0	12.8	0	11.7	0	10.9	0	10.3	0	9.6	0	8.9	8.3	7.8	7.2	6.7	6.3	5.7	5.4	5.0	4.6	8
84	0	9.6	0	8.8	0	8.2	0	7.7	0	7.2	0	6.7	6.3	5.8	5.4	5.0	4.7	4.4	4.0	3.8	3.4	6
86	0	6.5	0	5.8	0	5.4	0	5.2	0	4.8	0	4.5	4.2	3.9	3.7	3.4	3.1	2.9	2.6	2.5	2.3	4
88	0	3.2	0	2.9	0	2.7	0	2.6	0	2.4	0	2.3	2.1	2.0	1.9	1.7	1.6	1.5	1.4	1.3	1.2	2
90	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0

N° I. TABLE of the Effect of Refraction in North Polar Diſtance—*continued.*

This correction is always +

Angle of the Vertical with the Horary circle.	Degrees of Altitude.															Angle of the Vertical with the Horary circle.
	62°	64°	66°	68°	70°	72°	74°	76°	78°	80°	82°	84°	86°	88°	90°	
°	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	°
0	30.5	28.0	25.5	23.2	20.9	18.7	16.5	14.4	12.3	10.2	8.1	6.1	4.0	2.0	0.0	90
2	30.5	28.0	25.5	23.2	20.9	18.7	16.5	14.4	12.3	10.2	8.1	6.1	4.0	2.0		88
4	30.4	27.9	25.4	23.1	20.8	18.7	16.5	14.4	12.3	10.2	8.1	6.1	4.0	2.0		86
6	30.3	27.8	25.4	23.0	20.8	18.6	16.4	14.3	12.2	10.1	8.1	6.1	4.0	2.0		84
8	30.2	27.7	25.2	23.0	20.7	18.5	16.3	14.3	12.2	10.1	8.0	6.0	4.0	2.0		82
10	30.0	27.6	25.1	22.8	20.6	18.4	16.2	14.2	12.1	10.0	8.0	6.0	3.9	2.0		80
12	29.8	27.4	24.9	22.7	20.4	18.3	16.1	14.1	12.0	10.0	7.9	6.0	3.9	2.0		78
14	29.6	27.2	24.7	22.5	20.3	18.1	16.0	14.0	11.9	9.9	7.9	5.9	3.9	1.9		76
16	29.3	26.9	24.5	22.3	20.1	18.0	15.9	13.8	11.8	9.8	7.8	5.9	3.8	1.9		74
18	29.0	26.6	24.2	22.1	19.9	17.8	15.7	13.7	11.7	9.7	7.6	5.8	3.8	1.9		72
20	28.7	26.3	24.0	21.8	19.6	17.6	15.5	13.5	11.6	9.6	7.6	5.7	3.8	1.9		70
22	28.3	26.0	23.6	21.5	19.4	17.3	15.3	13.3	11.4	9.5	7.5	5.7	3.7	1.8		68
24	27.8	25.6	23.3	21.2	19.0	17.1	15.1	13.1	11.2	9.3	7.4	5.6	3.6	1.8		66
26	27.4	25.2	22.9	20.8	18.8	16.8	14.8	12.9	11.1	9.2	7.3	5.5	3.6	1.8		64
28	26.9	24.7	22.5	20.5	18.4	16.5	14.6	12.7	10.9	9.0	7.1	5.4	3.5	1.8		62
30	26.4	24.2	22.1	20.1	18.1	16.2	14.3	12.5	10.6	8.8	7.0	5.3	3.5	1.7		60
32	25.8	23.7	21.6	19.7	17.7	15.9	14.0	12.2	10.4	8.6	6.9	5.2	3.4	1.7		58
34	25.3	23.2	21.1	19.2	17.3	15.5	13.7	11.9	10.2	8.5	6.7	5.1	3.3	1.7		56
36	24.7	22.6	20.6	18.8	16.9	15.1	13.3	11.6	9.9	8.2	6.5	4.9	3.2	1.6		54
38	24.0	22.1	20.1	18.3	16.5	14.7	13.0	11.3	9.7	8.0	6.4	4.8	3.1	1.6		52
40	23.4	21.4	19.5	17.8	16.0	14.3	12.6	11.0	9.4	7.8	6.2	4.7	3.1	1.5		50
42	22.7	20.8	18.9	17.2	15.5	13.9	12.3	10.7	9.1	7.6	6.0	4.5	3.0	1.5		48
44	22.0	20.1	18.3	16.7	15.0	13.4	11.9	10.4	8.8	7.3	5.8	4.4	2.9	1.4		46
46	21.1	19.4	17.7	16.1	14.5	13.0	11.5	10.0	8.5	7.1	5.6	4.2	2.8	1.4		44
48	20.4	18.7	17.1	15.5	14.0	12.5	11.0	9.6	8.2	6.8	5.4	4.1	2.7	1.3		42
50	19.6	18.0	16.4	14.9	13.4	12.0	10.6	9.3	7.9	6.6	5.2	3.9	2.6	1.3		40
52	18.8	17.2	15.7	14.3	12.9	11.4	10.2	8.9	7.6	6.3	5.0	3.8	2.5	1.2		38
54	17.9	16.5	15.0	13.6	12.3	11.0	9.7	8.5	7.2	6.0	4.8	3.6	2.3	1.2		36
56	17.1	15.7	14.3	13.0	11.7	10.5	9.2	8.0	6.9	5.7	4.5	3.4	2.2	1.1		34
58	16.2	14.8	13.5	12.3	11.1	9.9	8.7	7.6	6.5	5.4	4.3	3.2	2.1	1.1		32
60	15.2	14.0	12.7	11.6	10.4	9.3	8.2	7.2	6.1	5.1	4.0	3.0	2.0	1.0		30
62	14.3	13.1	12.0	10.9	9.8	8.8	7.7	6.8	5.8	4.8	3.8	2.9	1.9	0.9		28
64	13.4	12.3	11.2	10.2	9.2	8.2	7.2	6.3	5.4	4.5	3.5	2.7	1.7	0.9		26
66	12.4	11.4	10.4	9.4	8.5	7.6	6.7	5.9	5.0	4.1	3.3	2.5	1.6	0.8		24
68	11.4	10.5	9.5	8.7	7.8	7.0	6.2	5.4	4.6	3.8	3.0	2.3	1.5	0.7		22
70	10.5	9.6	8.7	7.9	7.1	6.4	5.6	4.9	4.2	3.5	2.8	2.1	1.4	0.7		20
72	9.4	8.6	7.9	7.2	6.5	5.6	5.1	4.4	3.8	3.1	2.5	1.9	1.2	0.6		18
74	8.4	7.7	7.0	6.4	5.8	5.1	4.5	4.0	3.4	2.8	2.2	1.7	1.1	0.5		16
76	7.4	6.8	6.2	5.6	5.1	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.5		14
78	6.3	5.8	5.3	4.8	4.3	3.9	3.4	3.0	2.6	2.1	1.7	1.3	0.8	0.4		12
80	5.3	4.9	4.4	4.0	3.6	3.2	2.9	2.5	2.1	1.8	1.4	1.1	0.7	0.3		10
82	4.3	3.9	3.5	3.2	2.9	2.6	2.3	2.0	1.7	1.4	1.1	0.8	0.6	0.3		8
84	3.2	2.9	2.7	2.4	2.2	1.9	1.7	1.5	1.3	1.1	0.8	0.6	0.4	0.2		6
86	2.2	1.9	1.8	1.6	1.5	1.3	1.1	1.0	0.9	0.7	0.6	0.4	0.3	0.1		4
88	1.1	1.0	0.9	0.8	0.7	0.6	0.6	0.5	0.4	0.4	0.3	0.2	0.1	0.1		2
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0

EQUATORIAL.

N° II. TABLE of the Effect of Parallax in North Polar Diſtance and Right Aſcenſion.

The horizontal Parallax = 8″.6 This correction is always −

Angle of the vertical and horary.	Degrees of Altitude.										Angle of the vertical and horary.
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	
°	″	″	″	″	″	″	″	″	″	″	°
0	8.60	8.47	8.08	7.45	6.59	5.53	4.30	2.94	1.49	0.0	90
10	8.47	8.34	7.96	7.34	6.49	5.45	4.23	2.90	1.47	0.0	80
20	8.08	7.96	7.60	7.00	6.19	5.20	4.04	2.77	1.40	0.0	70
30	7.45	7.34	6.99	6.45	5.71	4.79	3.72	2.55	1.29	0.0	60
40	6.59	6.49	6.18	5.70	5.05	4.23	3.29	2.26	1.15	0.0	50
50	5.53	5.44	5.19	4.79	4.28	3.55	2.76	1.89	0.96	0.0	40
60	4.30	4.23	4.04	3.72	3.30	2.76	2.15	1.47	0.74	0.0	30
70	2.94	2.90	2.77	2.55	2.26	1.89	1.47	1.01	0.51	0.0	20
80	1.49	1.47	1.40	1.29	1.14	0.95	0.75	0.50	0.26	0.0	10

Parallax in Right Aſcenſion, × Sec. of Declination.

This correction is + on the Eaſt, and − on the Weſt ſide of the Meridian.

N° III. TABLE of the Effect of Parallax in North Polar Diſtance and Right Aſcenſion

The horizontal Parallax being = 10″. This correction is always −

Angle of the vertical and horary.	Degrees of Altitude.										Angle of the vertical and horary.
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	
°	″	″	″	″	″	″	″	″	″	″	°
0	10.00	9.85	9.40	8.66	7.66	6.43	5 00	3.42	1.73	0.0	90
10	9.85	9.70	9.26	8.53	7.54	6.33	4.92	3.37	1.70	0.0	80
20	9.40	9.25	8.83	8.14	7.20	6.04	4.70	3.21	1.63	0.0	70
30	8.66	8.53	8.14	7.51	6 64	5.57	4.33	2.96	1.50	0.0	60
40	7.66	7.54	7.20	6.63	5.87	4.93	3.83	2.62	1.32	0.0	50
50	6.43	6.33	6.04	5.56	4.92	4.13	3.21	2.21	1.11	0.0	40
60	00	4.92	4.70	4.33	3.83	3.21	2.50	1.71	0.86	0.0	30
70	42	3.37	3.21	2.96	2.62	2.20	1.71	1.17	0.59	0.0	20
80	73	1.71	1.63	1.50	1.33	4.11	0.87	0.59	0.30	0.0	10

Parallax in Right Aſcenſion, × Sec. of Declination.

This correction is + on the Eaſt, and − on the Weſt ſide of the Meridian.

N° IV. TABLE of Natural Secants.

Deg.	Nat. Sec.	Deg.	Nat. Sec.	Deg.	Nat. Sec.	Deg.	Nat. Sec.	Deg.	Nat. Sec.	Deg.	Nat. Sec.
1	1002	16	10403	31	11666	46	14396	61	20627	76	41336
2	1006	17	10457	32	11792	47	14663	62	21301	77	44454
3	1014	18	10515	33	11924	48	14945	63	22027	78	48097
4	1024	19	10576	34	12062	49	15243	64	22812	79	52408
5	1038	20	10642	35	12208	50	15557	65	23662	80	57588
6	10055	21	10711	36	12361	51	15890	66	24586	81	63925
7	10075	22	10785	37	12521	52	16243	67	25593	82	71853
8	10098	23	10864	38	12690	53	16626	68	26695	83	82055
9	10124	24	10946	39	12868	54	17013	69	27904	84	95668
10	10154	25	11034	40	13054	55	17434	70	29238	85	114737
11	10187	26	11126	41	13250	56	17883	71	30716	86	143356
12	10223	27	11223	42	13456	57	18361	72	32361	87	191075
13	10263	28	11326	43	13673	58	18871	73	34203	88	286537
14	10306	29	11434	44	13902	59	19416	74	36280	89	572987
15	10353	30	11547	45	14142	60	20000	75	38637	90	Infinite.

N° V. TABLE of the Correction of the Time ſhewn by an Equatorial on account of Refraction, when the Inſtrument is not previouſly adjuſted to the true Meridian.

Angle of the Vertical with the Horary Circle.	Degrees of Altitude.												
	7°	10°	15°	20°	25°	30°	35°	40°	45°	50°	60°	70°	80°
°	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.
5	338.	241.	161.3	118.9	94.2	74.9	62.0	51.7	43.7	36.8	25.3	16.1	8.0
10	169.	120.	80.7	59.4	47.0	37.4	31.0	25.9	21.9	18.4	12.6	8.1	4.0
15	114.	81.	54.3	40.0	31.8	25.2	20.9	17.4	14.7	12.4	8.5	5.4	2.7
20	86.	61.	41.0	30.4	24.1	19.1	15.8	13.2	11.2	9.4	6.5	4.1	2.1
25	70.	50.	33.4	24.6	19.5	15.5	12.8	10.7	9.1	7.6	5.2	3.3	1.7
30	59.	42.	28.2	20.6	16.4	13.0	10.8	9.0	7.6	6.4	4.4	2.8	1.4
35	51.	36.	24.4	18.0	14.3	11.4	9.4	7.8	6.6	5.6	3.8	2.4	1.2
40	46.	33.	21.8	16.0	12.7	10.1	8.4	7.0	5.9	5.0	3.4	2.2	1.1
45	41.	30.	19.9	14.6	11.8	9.2	7.6	6.3	5.4	4.5	3.1	2.0	1.0
50	38.	27.	18.3	13.4	10.7	8.5	7.1	5.9	5.0	4.2	2.9	1.8	0.0
55	36.	26.	17.1	12.6	10.1	7.9	6.6	5.5	4.6	3.9	2.7	1.7	0.9
60	34.	24.	16.2	11.9	9.5	7.5	6.3	5.2	4.4	3.7	2.5	1.6	0.8
65	32.	23.	15.5	11.4	9.1	7.2	6.0	4.9	4.2	3.5	2.4	1.5	0.8
70	31.	22.	14.9	11.0	8.8	6.9	5.8	4.8	4.0	3.4	2.3	1.5	0.7
80	30.	21.	14.2	10.5	8.3	6.6	5.5	4.6	3.9	3.2	2.2	1.4	0.7
90	29.	21.	14.0	10.3	8.2	6.5	5.4	4.5	3.8	3.2	2.2	1.4	0.7

× Secant of Declination.

This Equation is − on the Eaſt, and + on the Weſt ſide of the Meridian.

N° VI. TABLE ſhewing the Correction of the Meridian Line found by an Equatorial, ariſing from the Effect of Refraction, in Minutes and Decimals.

Angle of the Vertical with the Horary circle.	Degrees of Altitude.												
	7°	10°	15°	20°	25°	30°	35°	40°	45°	50°	60°	70°	80°
°	′	′	′	′	′	′	′	′	′	′	′	′	′
5	84.5	60.3	40.0	29.8	21.9	18.3	15.5	12.6	10.9	9.2	6.3	4.0	2.3
10	41.7	29.7	19.8	14.8	11.4	9.1	7.7	6.2	5.4	4.5	3.1	2.0	1.1
15	27.3	19.5	13.1	9.7	7.5	5.9	5.0	4.1	3.5	3.0	2.0	1.3	0.7
20	20.1	14.4	9.6	7.2	5.5	4.4	3.7	3.0	2.6	2.2	1.5	1.0	0.5
25	15.8	11.4	7.6	5.6	4.3	3.4	2.9	2.4	2.0	1.7	1.2	0.8	0.4
30	12.7	9.1	6.1	4.5	3.4	2.8	2.3	1.9	1.6	1.4	0.9	0.6	0.3
35	10.2	7.5	5.0	3.7	2.8	2.3	1.9	1.6	1.3	1.1	0.8	0.5	0.3
40	8.7	6.2	4.2	3.1	2.4	1.9	1.6	1.3	1.1	0.9	0.6	0.4	0.2
45	7.3	5.2	3.5	2.6	2.0	1.6	1.3	1.1	0.9	0.8	0.5	0.3	0.2
50	6.1	4.4	2.9	2.2	1.7	1.3	1.1	0.9	0.8	0.6	0.4	0.3	0.2
55	5.1	3.7	2.4	1.8	1.4	1.1	0.9	0.8	0.7	0.5	0.4	0.2	0.1
60	4.2	3.0	2.0	1.5	1.1	0.9	0.8	0.6	0.5	0.4	0.3	0.2	0.1
65	3.4	2.4	1.6	1.2	0.9	0.8	0.8	0.5	0.4	0.3	0.2	0.2	0.1
70	2.7	1.9	1.3	0.9	0.7	0.6	0.5	0.4	0.3	0.3	0.2	0.1	0.1
80	1.3	0.9	0.6	0.5	0.4	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.0
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

× Secant of the Altitude.

Note. If the obſervation is on the $\left\{\begin{matrix}\text{eaſt}\\\text{weſt}\end{matrix}\right\}$ ſide of the Meridian, then is the true Meridian ſo many minutes to the $\left\{\begin{matrix}\text{eaſt}\\\text{weſt}\end{matrix}\right\}$ of that found by the Inſtrument.

Nº VII. TABLE of the Effect of Refraction in Right Aſcenſion in Time, when the Equatorial is adjuſted to the Meridian.

Angle of the vertical with the horary Circle.	Degrees of Altitude.														
	3°	5°	7°	10°	15°	20°	25°	30°	35°	40°	45°	50	60°	70°	80°
°	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	Sec.	
5	5.1	3.5	2.5	1.8	1.2	0.9	0.7	0.6	0.5	0.4	0.3	0.3	0.2	0.1	0.1
10	10.1	6.9	5.1	3.7	2.5	1.8	1.4	1.1	0.9	0.8	0.7	0.5	0.4	0.3	0.1
15	15.0	10.3	7.6	5.4	3.6	2.7	2.1	1.7	1.4	1.2	1.0	0.8	0.6	0.4	0.2
20	19.9	13.5	10.0	7.2	4.8	3.5	2.8	2.2	1.9	1.4	1.2	1.1	0.7	0.5	0.2
25	24.5	16.6	12.3	8.8	5.9	4.3	3.4	2.7	2.3	1.9	1.6	1.3	0.9	0.6	0.3
30	29.0	19.7	14.6	10.5	7.0	5.2	4.1	3.3	2.7	2.3	1.9	1.7	1.1	0.7	0.3
35	33.4	22.7	16.8	12.0	8.0	5.9	4.7	3.7	3.1	2.6	2.2	1.8	1.3	0.8	0.4
40	37.4	25.4	18.6	13.5	9.0	6.7	5.2	4.2	3.4	2.9	2.4	2.1	1.3	0.9	0.4
45	41.3	28.0	20.7	14.9	9.9	7.3	5.7	4.6	3.9	3.2	2.7	2.3	1.5	1.0	0.5
50	44.7	30.3	22.5	16.1	10.7	7.9	6.2	5.0	4.1	3.5	2.9	2.5	1.7	1.1	0.5
55	47.7	32.4	24.0	17.2	11.5	8.5	6.7	5.3	4.4	3.7	3.1	2.7	1.8	1.1	0.5
60	50.3	34.2	25.3	18.1	12.1	8.9	7.0	5.7	4.7	3.9	3.3	2.8	1.8	1.2	0.6
65	54.8	35.9	26.5	19.0	12.8	9.3	7.4	5.9	4.9	4.2	3.5	2.9	2.0	1.3	0.6
70	54.6	37.0	27.5	19.7	13.1	9.7	7.7	6.1	5.1	4.3	3.5	3.0	2.1	1.3	0.6
80	57.6	39.1	28.9	20.7	13.8	10.1	8.0	6.5	5.3	4.5	3.8	3.2	2.2	1.4	0.7
90	58.4	39.6	29.3	21.0	14.0	10.3	8.2	6.5	5.4	4.5	3.8	3.2	2.2	1.4	0.7

× Secant of Declination.
This Correction is − on the Eaſt, and + on the Weſt ſide of the Meridian.

Nº VIII. TABLE of the Effect of Refraction in Declination when the Equatorial is adjuſted to the Meridian.

Angle of the vertical with the horary Circle.	Degrees of Altitude.														
	3°	5°	7°	10°	15°	20°	25°	30°	35°	40°	45°	50°	60°	70°	80°
°	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	″	″	″	″	″
0	14 36	9 54	7 20	5 15	3 30	2 35	2 2	1 38	1 21	1 8	57	48	33	21	10
10	14 24	9 46	7 14	5 11	3 27	2 32	2 0	1 37	1 20	1 7	57	48	33	21	10
20	13 39	9 16	6 52	4 56	3 17	2 26	1 55	1 32	1 16	1 4	53	45	31	20	9
25	13 12	8 59	6 38	4 45	3 10	2 20	1 50	1 29	1 14	1 2	52	44	30	19	9
30	12 35	8 33	6 20	4 32	3 1	2 14	1 45	1 25	1 10	0 59	49	42	29	18	9
35	11 55	8 6	6 0	4 18	2 52	2 7	1 40	1 20	1 6	0 56	46	39	27	17	8
40	11 11	7 35	5 37	4 1	2 40	1 59	1 33	1 15	1 2	0 52	43	37	25	16	8
45	10 19	7 0	5 11	3 43	2 28	1 50	1 26	1 9	0 58	0 48	40	34	23	15	7
50	9 22	6 21	4 42	3 22	2 15	1 40	1 18	1 3	0 52	0 44	36	31	21	14	6
55	8 21	5 40	4 12	3 0	2 0	1 29	1 10	0 56	0 46	0 39	33	27	19	12	6
60	7 16	4 56	3 39	2 37	1 45	1 18	1 1	0 49	0 40	0 34	29	24	16	11	5
65	6 7	4 9	3 4	2 12	1 28	1 5	0 51	0 41	0 34	0 28	24	20	14	9	4
70	4 58	3 22	2 30	1 48	1 12	0 53	0 42	0 33	0 28	0 22	19	16	11	7	3
75	3 45	2 34	1 54	1 21	0 54	0 40	0 32	0 25	0 21	0 18	15	12	9	6	3
80	2 32	1 43	1 16	0 55	0 37	0 27	0 21	0 17	0 14	0 12	10	8	6	4	2
85	1 16	0 52	0 38	0 27	0 18	0 13	0 11	0 9	0 7	0 6	5	4	3	2	

Explication and Uſe of the Tables.

The three firſt tables are particularly calculated for the uſe of a large equatorial inſtrument, for the purpoſe of clearing obſervations made with it from the effects of refraction and parallax, when neither Dollond's refraction apparatus is uſed, nor the micrometer circle of Ramſden's for adjuſting the wire uſed in taking altitudes; but the four laſt are adapted more peculiarly for portable inſtruments. They are copied from ſir George Shuckburgh's account in the Philoſophical Tranſactions, and, being adapted for all latitudes, are a ſuitable appendage to the deſcriptions we have given of the different inſtruments.

Table I. gives the correction of the refraction in north polar diſtance, by entering it with the altitude at the top, and the angle of the horary and vertical circles on the left hand ſide; and in the common point of meeting is found a quantity in ſeconds and decimal parts, that is in all caſes to be *added* to the *apparent* polar diſtance to give the *true*; but if it be entered with the angle of the horary and vertical circle in the right hand column, it will give the refraction in right aſcenſion, by multiplying the quantity here found by the ſecant of the declination to be found in Tab. IV., which is a readier operation than dividing by the coſine, and amounts to the ſame thing.

Table II. gives the effect of the ſun's parallax in right aſcenſion and north polar diſtance, and is to be entered with the ſame arguments as Tab. I.; and the parallax in right aſcenſion is to be multiplied by the ſecant of the declination as before; the ſun's horizontal parallax being aſſumed = 8.″6.

Table III. is a ſimilar table, only calculated to an horizontal parallax of 10″; ſo that whatever be the parallax of the ſun or planets, this correction may readily be found, almoſt by inſpection, *viz.* by multiplying the tabular number by the exact quantity of parallax of the body obſerved, and cutting off the decimal quantity.

Table IV. contains the natural ſecants to each degree, extracted from Sherwin's tables, to be ready for the operations required above.

Table V. gives the correction of the *time*; *viz.* of the ſun or ſtar's diſtance from the meridian, as aſcertained by a portable inſtrument not previouſly adjuſted to the meridian; this quantity alſo is to be multiplied by the ſecant of the declination.

Table VI. gives the correction of the meridian line in minutes and decimals, which may be near enough for portable inſtruments; but the quantity here found muſt be multiplied by the ſecant of the altitude.

Table VII. (like Table I.) is adapted to ſeconds of *time*, and gives the refraction in right aſcenſion in terms ſuited to ſuch inſtruments as have the equatorial circle divided into hours and minutes.

Table VIII., in like manner, gives the refraction in declination. The arguments are the ſame in all the tables.

Theſe tables were conſtructed by ſir G. S. in the year 1774, for his own uſe, and were founded on the principles explained by the Hon. S. M'Kenzie in *fig.* 4. of *Plate* XIII., where I F is a portion of a vertical circle = the refraction in altitude; C F a parallel to the equator; I C a portion of an horary circle = the refraction in declination, found by Tab. I and Tab. VIII., the angle C I F, the angle of the horary and vertical circle; C F the refraction in right aſcenſion, found by Tab. I. and Tab. VII.; D I (a parallel to the horizon) the correction of the meridian, found by Tab. VI.; and D F the correction of the time, found by Tab. V; and as I F will hardly ever be found to exceed 30′, theſe triangles have been conſidered all as plane; making due allowance, in the proportion of the ſine to the radius, for the diſtances of the arcs D I, F C, and D F, from their reſpective poles, which has been noticed at the foot of each table. The refraction in altitude was taken from Mayer's Tables, 1770, London; which is calculated for a denſity of the air expreſſed by 29.6 inches of the barometer, and 50° of Fahrenheit's thermometer.

EQUATORIAL *Micrometer*, is an apparatus applied to a teleſcope, that has an equatorial motion, for the purpoſe of meaſuring ſmall differences of right aſcenſion and declination of any two heavenly bodies, that paſs either ſucceſſively, or at the ſame time nearly, through the field of view, ſo as to be both viſible at the ſame elevation of the teleſcope. This method requires no graduated circles with verniers or compound microſcopes, and yet is capable of great accuracy within certain limits of difference between the relative ſituations of the bodies to be compared together; and if the right aſcenſion and declination of one of the two obſerved bodies be previouſly known with ſufficient accuracy, the place of the other can be determined therefrom by the obſerved differences. The common wire micrometer has been long in uſe as an appendage to the eye-piece of a teleſcope, and was uſed by Dr. Bradley in making aſtronomical obſervations, his manner of doing which was communicated to the Royal Society in the year 1772 (vol. lxii.) by Dr. Maſkelyne; but as the teleſcopes then in uſe were from ten to fifteen feet long, for want of the achromatic object-glaſſes, an equatorial motion was given, not from one centre, but by means of ſupporters at each end of the wooden tubes, ſo contrived as to be manageable both in altitude and azimuth; which apparatus is ſtill preſerved at the Royal Obſervatory. The wires of the micrometer have been adapted differently by different makers, ſome making only one moveable, and ſome more; but they all agreed in placing them in the focus of the eye-piece of the teleſcope. It is not, however, our intention to enter into a detail in this place of all the different conſtructions of the micrometer, as applied to various purpoſes, but to confine ourſelves to a notice of thoſe that have been more particularly applied to teleſcopes having an equatorial motion. For the other conſtructions, we refer to the article MICROMETER.

Soon after the diſcovery of the properties of the achromatic object-glaſs of a teleſcope had reduced the length of the aſtronomical teleſcope to a portable ſize, without diminiſhing either its power or ſize of its field of view, not only were equatorial inſtruments contrived of various conſtructions, as we have already deſcribed, but equatorial ſtands for ſimple teleſcopes were invented, and continue to be in uſe with the beſt teleſcopes to the preſent day. To theſe teleſcopes the micrometers are a very neceſſary and uſeful appendage, inaſmuch as they render it capable of being applied with advantage in aſcertaining the right aſcenſion and declination of a comet, planet, or other body out of the meridian, when they happen to be near enough to a known body to admit of being taken into the ſame field of view without altering the elevation. Though the wire micrometer was firſt invented, as applied to the focus of the eye-piece, and continues to be uſed in many inſtruments, yet ſince the invention of the achromatic object-glaſs, Dollond's object-glaſs micrometer has by ſome aſtronomers been preferred, or at leaſt deemed equally uſeful, particularly when the croſs wires are alſo uſed in conjunction, as deſcribed by Dr. Maſkelyne in his paper on this ſubject read to the Royal Society of London on Dec. 12, 1771, which was the year after Smeaton finiſhed his wire micrometer, that had been begun about forty years before. If we give an account of theſe two kinds of micrometers in ſucceſſion, the reader will perceive the varieties that may ariſe from them by ſlight deviations of conſtruction. We will begin with Smeaton's, as being of prior origin.

We are not aware that Mr. Smeaton has left behind him any perſpective drawing of his equatorial micrometer, though we have heard that there is an undeſcribed ſketch of one among his papers, at preſent in the poſſeſſion of Mr. Lloyd; but there is a ſection of one accompanying his paper read to the Royal Society of London on June 7, 1787, which is ſufficient for explaining the principle of its application. *Fig.* 3. of *Plate* XIII. of *Aſtronomical Inſtruments*, is the ſaid ſection, as viewed from the eye-end of the teleſcope. "This micrometer," ſays the author, "is furniſhed with five horary wires, denominated in their order, *a*, A, B, C, D, (B being the middle horary wire,) and the two declination wires are denominated A, B, each moveable by a ſeparate and independent micrometer-ſcrew, from the outſide of the field to the centre, and a little beyond it; ſo that each wire can be moved into the place of the other, when at or near the centre." The field of view was only 1° 17′, and the magnifying power as low as 20, with an eye glaſs of $1\frac{3}{4}$ inch focus, and a double object-glaſs of $34\frac{2}{3}$ focal length; notwithſtanding the author calculates that a difference of only $2\frac{1}{2}''$ may be read by ſuch apparatus, which he concluded was near enough for any inſtrument to read out of the meridian. In the conſtruction of the ſtand every thing was done to enſure ſtability of poſition at any given elevation, and the fruſtum of an hexagonal ſtone was uſed as a pedeſtal, detached from the floor of the obſervatory. With an apparatus ſo ſteady, it was not neceſſary to confine the obſervations to two bodies, to be compared, whoſe difference of right aſcenſion was only a few minutes, but even hours could be admitted of for the interval of the ſucceſſive tranſits, provided the difference of the declinations did not exceed the interval between the two adjuſtable croſs wires. The difference of the right aſcenſions was eaſily aſcertained by a regulator or chronometer, meaſuring the interval between the tranſits, and the diſtance between the bodies as meaſured by the interval between the croſs wires, gave the difference of the declinations. The firſt trial of the ſteadineſs and accuracy of this apparatus was made with Saturn and γ Capricorni, from which it was found that the ſtar had the ſame right aſcenſion and declination, determined on two ſeparate evenings, at the diſtance of 48 hours, though the inſtrument had not been touched during the interval. But the principal obſervations noticed in the memoir, are thoſe relating to the elongation of Mercury, as taken from Sep. 23, to Oct. 13, 1786, the reſult of which was, that at $5^h\ 22^m\ 35^s$ mean time on Sep. 23, A.M. Mercury's right aſcenſion, deduced from a compariſon with *a* Orionis, was 163° 59′ 21″, and his declination north 7° 44′ 25″. For the particulars of the calculations and the tables of the obſervations, ſee the Phil. Tranſ. of 1787. Alſo for the manner in which a ſimple teleſcope may be made to move in an equatorial direction, ſee our article Equatorial *Stand* of a teleſcope.

The object-glaſs micrometer of Dollond, of his moſt improved conſtruction, is repreſented by *fig.* 4. of *Plate* XII. agreeably to a drawing given in Mr. Dollond's pamphlet that accompanies his equatorial inſtrument. By the improvement, ſays the author, this micrometer has received, it is rendered capable of being applied to teleſcopes of ſmall aperture; the focal length of the object-glaſs being conſiderably increaſed, the ſcale by which the angles are meaſured is much enlarged. By this increaſe in the focal length of the object-glaſs of the micrometer, the perfection of the teleſcope is leſs injured; but the greateſt advantage that is derived from the improvement, is the length of the ſegments, which admit of the whole aperture of the teleſcope, even in meaſuring the largeſt diameters of the ſun or moon, and the object retains the ſame brightneſs in meaſuring the largeſt angles as in meaſuring the ſmalleſt.

Notwithſtanding theſe ſeveral advantages, the inſtrument is greatly reduced in ſize, as will appear by inſpecting the figure repreſenting the micrometer on the end of the teleſcope; the deſcription of which is as follows:—

a and *b* are two long ſegments of an achromatic object-glaſs, divided into ſeparate pieces by a diametrical line, and fitted into ſeparate frames, ſo that by ſliding one or both the ſegments, they may be made to form in effect either one object-glaſs or two, it being the property of half a well ground glaſs to give as diſtinct an image as the whole would do; the ſegment *a* is moved by turning the milled head *c*, and the ſegment *b* is moved by turning the handle *d*. When an obſervation is to be made, it is generally known what number of minutes the angle will contain nearly; ſuppoſe, for example, the diameter of the ſun were to be meaſured, which is known to be about 32′; move the ſegment *a* till the index *c* comes to 32 on the ſcale *ff*, then looking through the teleſcope, move the ſegment *b*, by turning the handle *a* till the circumferences of the two images, formed reſpectively by the two ſegments, are brought to touch one another externally, and the quantity that the ſegments have moved will be meaſured by the ſcale *gg*, and vernier *h*, by which an inch is divided into five hundred parts: the greateſt exactneſs is required in this ſcale, as the angle is abſolutely to be determined by the meaſure taken with it; the ſcale *ff* being only of uſe to ſet the ſegment *a*, ſo that in meaſuring the angle by moving the ſegment *b*, they may be both moved nearly the ſame quantity.

The handle *i* is to turn the micrometer round, to bring the line dividing the two ſegments of the object-glaſs into the plane paſſing through the two objects, whoſe diſtance is to be meaſured. It is neceſſary, in making obſervations with the micrometer, that the teleſcope, when the micrometer is on, be adjuſted to the *moſt perfect viſion* of the object to be obſerved, as a ſmall error in this reſpect may occaſion a conſiderable difference in the obſervation. To find if there is any error in the adjuſtment of the micrometer ſcale *gg*, turn the handle *d*, ſo as to make the two images perfectly unite, and the number ſhewn by the ſcale and vernier will be the error of adjuſtment, if there is any; this error may either be allowed for in the obſervations, or be corrected by the vernier ſcrews at *k*. The object proper to be uſed for adjuſting the focus of the teleſcope with the micrometer on, may be any of the celeſtial bodies, or ſome diſtant well defined land object; but for adjuſting the micrometer ſcale, the object may be nearer, ſuch as a printed paper at two or three hundred feet diſtance, provided the focus be firſt well adjuſted to this object. A table is uſually given with the micrometer, which ſhews the number of minutes and ſeconds anſwering to the diviſions on the ſcale. When the micrometer is on the end of the tube of the teleſcope, it is neceſſary that the ſcrew at the centre of motion be tight, otherwiſe, which is better, that there be a counterpoiſe at the eye-end to preſerve the equilibrium in any elevation. Alſo, as the object-glaſs of the micrometer is concave, the common focus of the object-glaſs of the teleſcope end of it is lengthened, which circumſtance requires the tube of the eye-glaſs to be longer than when the teleſcope is uſed without the micrometer.

The properties peculiarly aſcribable to the two kinds of micrometers we have deſcribed are, that the one at the focus of the eye-glaſs is adapted for meaſuring the differences of right aſcenſions and declinations of two bodies, one of which has its plane known; but the one placed at the object end of the teleſcope is calculated, by means of its graduated ſcale, to meaſure abſolute ſmall diſtances; and the accuracy of its ſcale may be brought to the teſt by a compariſon with a known interval between two ſtars or other diſtant bodies. Dr. Maſkelyne, in the paper we have already noticed, has however ſhewn how, by the addition of two croſs-wires in the focus, the differences of right aſcenſions and declinations may alſo be meaſured by Dollond's micrometer, thus: "Suppoſe it be required to meaſure the difference of right aſcenſion and declination of two ſtars, whoſe difference of declination does not exceed the extent of the ſcale of the micrometer, and the diſtance of the meridians paſſing through the ſtars does not exceed the ſemi-diameter of the field of view, turn the wires about till the weſtern ſtar runs exactly along the croſs-wire by the diurnal motion; then ſeparate the two ſegments of the divided object-glaſs to a convenient diſtance, and turn the micrometer about, by means of its proper handle, till the two images of the ſame ſtar, formed by the two ſegments of the object-glaſs, paſs the horary or vertical wire at the ſame inſtant. Laſtly, partly by the feet-ſcrews of the ſtand, and partly by the handle that ſeparates the ſegment, cauſe the ſouthermoſt image of the northermoſt ſtar, and the northermoſt image of the ſouthermoſt ſtar to appear both upon and run along the croſs or horizontal wire: the numbers ſtanding upon the ſcale of the micrometer will then ſhew the difference of declination of the ſaid ſtars; and if the times be noted when they paſs ſucceſſively the horary or vertical wire, the difference of the two times will give the difference of their right aſcenſions alſo." (See Phil. Tranſ. vol. lxi. article xlix.) It was one of Dollond's object-glaſs micrometers, attached to an 18 inch reflecting teleſcope by Short, and another attached to a two feet reflector, that lieutenant (afterwards captain) J. Cook, of the Endeavour, and Mr. Charles Green, formerly aſſiſtant at the Royal Obſervatory, uſed in obſerving the tranſit of Venus over the ſun's diſc on June 3, 1769, in King George's iſland, or Otaheite, in the South ſea, as recorded in the ſame volume of the Philoſophical Tranſactions.

For an account of the hiſtory of the micrometer, and its various conſtructions by different artiſts and ingenious men, ſee the article MICROMETER.

EQUATORIAL *Sector*, an inſtrument ſometimes uſed in *Practical Aſtronomy*. This inſtrument was invented by Mr. George Graham, F. R. S. for meaſuring greater differences of right aſcenſion and declination of a heavenly body, as compared with another body, than the equatorial micrometer alone will give, and may be made of any convenient dimenſions. One of theſe inſtruments made by Mr. Graham, is yet preſerved at the Royal Obſervatory at Greenwich, and is occaſionally employed to determine the right aſcenſions and declinations of a comet or other body out of the meridian, for doing which it is ſtill found to be ſerviceable. Doctor Robert Smith has deſcribed the principle and conſtruction of Graham's ſector, in the year 1738, and Mr. B. Martin copied the account verbatim in his magazine, from one or other of which authors the different dictionaries have their deſcription tranſcribed.

Graham's Equatorial Sector.—In juſtice to the contriver of the equatorial ſector, we propoſe to deſcribe it agreeably to its original conſtruction; but as we have cauſed the different parts of the drawings, as given by Dr. Smith, to be thrown into one perſpective inſtrument, it becomes neceſſary to vary the detail accordingly. *Fig.* 1. of *Plate* XIII. (of *Aſtron. Inſtr.*) is a perſpective view of the principal parts of the ſector lying in its inclined ſtand or bed, which we have ſuppoſed to be firmly fixed to a ſloping pedeſtal, exactly parallel to the earth's axis. This inclined bed, A B, is a ſtrong brazen plate or bar, turned up at the ends in a perpendicular direction at C and D; the lower end C has a ſcrew, entering it from below, ſtrong enough to bear the inferior end of the ſector's axis E F G, the conical hole made in the end of the latter at E, reſting on the conical point of the former; the upper end D has a ſlit in it, into which the axis is demitted at the cylindrical part F, below the circular plate H attached to the axis. The whole length of the axis is 18 inches, of which the ſquare part E F is 12. On the poſterior part of the bent end D of the inclined ſupporting plate A B, is a clamp I, turning on two pivots, ſo that it may be elevated or depreſſed without turning round in an equatorial direction; this clamp fixes the circular plate H, in any given place on its edge from turning round, but adapts itſelf to the plate, ſo as to preſs equally on both ſurfaces, by means of its vertical motion on pivots; conſequently the axis E F G, to which the plate H is attached, may have a motion like the polar axis of the earth when wanted, and may be firmly fixed by the clamp acting on its plate in any given ſituation. At the ſuperior end G of the axis is fixed another circular brazen plate K L on one of the flat ſides of the ſquared axis, and having a motion round a pin with ſcrews and a tightening collar; on this plate a croſs of braſs is ſcrewed faſt, compoſed of four bars at right angles to each other, two of which bars conſtitute an inverted cock, on the bent parts of this the long radial bar M N is fixed, which is made ſtrong by an edge-bar on its under ſide. Whenever, therefore, the circular plate K L moves round its central pin at G, the radial bar, carried by it, partakes of its motion, and *vice verſâ;* this plate has alſo a clamp O, ſimilar to the clamp I in every reſpect, by which it may be made ſteady in any given ſituation. The length of the radial bar is $2\frac{1}{2}$ feet, and its breadth at M and N $1\frac{1}{2}$ and 2 inches reſpectively: at N is a ſmall arch of a circle, 6 inches long and $1\frac{1}{2}$ broad, graduated into 10°, and ſubdivided into quarters, that read and are figured both ways. Upon this radial bar is mounted a teleſcope P, of $2\frac{1}{2}$ feet in length, moveable on the point M, as an axis of motion, near the object-end, and having a vernier near the eye-end with 16 quarters of a degree divided into fifteen equal parts, ſo as to read off exact minutes. This vernier is moved by the nut of an endleſs ſcrew Q, that is adapted as an apparatus for faſt or ſlow motion, in the uſual way. The diameters of the two circular plates are each 5 inches, and the plates are ſtrong enough to hold the teleſcope in any given poſition that an obſerved body may require.

The polar axis E F G of this inſtrument muſt be placed *truly* in the meridian and parallel to the earth's axis, which may be done by bringing the teleſcope parallel to the axis itſelf, and, after fixing it, by following a circumpolar ſtar therewith, and noting the apparent path as it reſpects the interſection of the croſs-wires of the teleſcope: the deviation above or below the croſs-wire will point out the error of elevation of the axis, and the difference in the times of the ſtar's paſſage through the two ſemicircles, eaſt and weſt reſpectively, will diſcover the deviation from the meridian line; then half theſe errors may be corrected by the ſcrews that fix the inclined bar A B to the pedeſtal, and the other half by altering the poſition of the teleſcope, till, after ſeveral ſucceſſive trials, the ſtar will accompany the interſection of the wires through its entire circle. It is neceſſary, however, that the polar axis be placed, by means of a ſmall quadrant or other ſuch contrivance, very nearly in its proper degree of elevation, as well as nearly in the meridian on the pedeſtal previouſly to the adjuſtment by a circumpolar ſtar. It is alſo neceſſary that the line of collimation of the teleſcope be parallel to the plane of the ſector, as well as the latter at right angles to the circular plate H, which repreſents the equator; the former may have its truth examined by a diſtant plumb-line ſuſpended in a vertical poſition; for if the interſection of the croſs-wires of the teleſcope will paſs along this line, when the plane of the ſector is vertical, and when the teleſcope derives its motion from the ſcrew of the vernier alone, it may be concluded that the line of collimation is parallel to the plane of the ſector; but the plane of the ſector itſelf muſt be previouſly ſet right, as it regards the equatorial plate H, by the ſcrews that fix it to the inverted cock of the croſs, attached to the circular plate K L. From a conſideration of this inſtrument, as we have deſcribed it, it is obvious, that, provided the teleſcope, thus having a polar motion and bearing a graduated ſector, be made perfectly ſteady, and placed in the true direction of an hour circle in the heavens, the difference of declination of any two bodies in the celeſtial regions, that does not exceed the extent of the ſector's limb, may be meaſured to the accuracy of a minute of ſpace, and that whether the two bodies paſs the teleſcope together or ſucceſſively, provided the elevation of the teleſcope does not vary in the mean time; and alſo the difference of right aſcenſion of any two bodies, ſimilarly ſituated, may be had by noting the difference of ſiderial time, (by a regulator,) of their paſſages over the horary wire; provided the ſituation of the ſector itſelf does not alter while the teleſcope is raiſed or depreſſed; but much of the accurary of the reſults will depend on the ſteadineſs of the parts that are clamped. Were the equatorial ſector to be conſtructed at this time, the reading by a microſcopic micrometer would greatly enlarge the powers of this inſtrument.

"But however well adapted this inſtrument may be to the purpoſes for which it was intended," ſays profeſſor Vince (Treatiſe on Pract. Aſtron. p. 141, and ſec. 7.) "yet it will not conveniently admit of a large teleſcope; Dr. Maſkelyne, therefore, thought of a conſtruction which would admit of one of a larger ſize, and which has, beſides, ſeveral other advantages in reſpect to the adjuſtments, as will be evident when we come to deſcribe them. The inſtrument was made by Mr. Siſſon, the conſtruction of which we will firſt deſcribe, and then proceed to its adjuſtments."

Equatorial ſector by Mr. Jonathan Siſſon.—A B, in *fig.* 1. of *Plate* XVII. (of *Aſtron. Inſt.*) is a polar axis, H I a circle fixed upon, and at a ſmall diſtance from it, on the centre of which is an axis, about which the teleſcope C D turns, carrying the indices *a*, *b*, each having a vernier which ſubdivides to minutes, and the circle is graduated to ſhew north polar diſtances; this, which is called the croſs axis, goes through A B into a fixed caſe E on the other ſide, and is moveable by a ſcrew *q* in order to fix it perpendicular to the polar axis: L M is an arc of 22° fixed upon A B, and concentric with H I; *v w* is a vernier whoſe arm K may be ſcrewed to the axis on which the teleſcope turns, and conſequently in that caſe will turn with it, but if the ſcrews be releaſed, the teleſcope will turn without it. N O P Q is a braſs frame, the two ends of which, O N, P Q, conſiſt of two pieces, one of which goes over the arc L M, and the other under, ſo that by means of two ſcrews at *y* and *x* to preſs them together, the frame may be fixed to the arc, in which caſe the ſcrew *c d*, paſſing through a nut at *s* on the arm K, will move the vernier *v w*; V is a braſs circle graduated on the edge, and moveable with the ſcrew *c d*, againſt which is fixed a piece of braſs *r* as an index; W is a piece of braſs fixed on an immoveable piece of wood, on which is another piece not ſeen to receive the end of the axis B, and in which it turns, and this piece is moveable eaſt or weſt by a ſcrew of adjuſtment; the end turns in a braſs ſocket *e f*, moveable by a ſcrew T in order to alter the inclination of the axis A B, and thence adjuſt it to the latitude; R S is an equatorial circle fixed perpendicular to A B, having a vernier *m n*; this circle is divided into 24 hours, and each hour into minutes, and the vernier ſubdivides into ſeconds.

The adjuſtments are three; firſt, to ſet A B parallel to the earth's axis; ſecondly, to adjuſt the line of collimation parallel to the circle H I; thirdly, to adjuſt the croſs axis perpendicular to the polar axis. The firſt adjuſtment conſiſts of two parts, to ſet the axis at the proper angle, and to place it in the plane of the meridian. Now to adjuſt the axis to an angle equal to the latitude of the place, the inſtrument is ſuppoſed to be at firſt fixed as nearly as poſſible to the true angle, and then the error is to be corrected by adjuſtment; to do which, turn about the polar axis until the circle H I becomes perpendicular to the horizon, and direct the horizontal wire of the teleſcope to the pole ſtar, or any other whoſe polar diſtance is known, when it comes above or below the pole; then turn the axis half round (which is ſhewn on the equatorial circle); in which caſe the circle becomes perpendicular to the horizon again; then if the axis be at the proper angle, it is manifeſt that the teleſcope is now directed to a point as much below or above the pole as it was above or below before, that is, to the polar diſtance of the ſtar increaſed or diminiſhed by the refraction of the ſtar at the firſt obſervation; hence, if we turn the teleſcope till the ſtar be again obſerved at the ſame wire, the indices *a*, *b*, will have moved over twice the refraction, ſuppoſing the ſtar to be ſo near to the pole, that the refraction may be conſidered the ſame both above and below; for if the ſtar be firſt obſerved above, its apparent place is above the true, and therefore if the teleſcope and ſtar revolve about the axis till they come below, the teleſcope is now directed to a point below the true place by the refraction, and as the apparent place is now above the true place by refraction, the teleſcope is directed to a point diſtant from the apparent place of the ſtar by twice the refraction; but if it do not move over twice that diſtance, then half the difference is the error of the angle of the elevation of the axis; move the teleſcope therefore through twice the diſtance which the indices *a* or *b* will ſhew, then turn the teleſcope, and bring it half way to the ſtar, and by the ſcrew T bring the ſtar to the wire, and the axis is adjuſted to an angle equal to the latitude of the place; in the ſame manner we determine whether the axis be in the plane of the meridian, by obſerving the ſtar in the equator, either in the eaſt or weſt, and then turning the axis half round, if the axis be rightly adjuſted to the meridian, the teleſcope muſt be moved 180° in order to bring the ſtar to the ſame wire; hence if the teleſcope do deſcribe 180° the axis is right; if not, half the difference is the error; move, therefore, the teleſcope through 180, and then by turning it bring it half way to the ſtar, and by the ſcrew at top out of ſight bring it the other half, and the polar axis is truly adjuſted. Secondly, to adjuſt the line of collimation parallel to the circle H I. Obſerve a ſtar in the equator, and note the time of its tranſit over the middle wire of the teleſcope by a clock, adjuſt it to ſiderial time, and note alſo the time ſhewn by the vernier $m n$ on the hour circle R S; turn the polar axis half way round according to the order of the figures on the hour circle R S, and the vernier ſhews a difference of 12 hours; now as the line of collimation is firſt directed to the equator, it muſt be perpendicular to the polar axis, and therefore by turning the polar axis about, it muſt continue to be directed to the equator, whether or not it be parallel to the plane of the circle H I; and if this could be done, and the teleſcope turned about, and the obſervation repeated without loſs of time, the ſtar would appear on the ſame wire, provided the line of collimation were parallel to the plane of the circle H I, for then the line of collimation in the ſecond obſervation being parallel to what it was in the firſt, it muſt be directed to the ſame point in the heavens, the teleſcope being turned half round; but as this operation will take up ſome time, the polar axis muſt be turned a little more than half round in order to bring the ſtar to the ſame wire, and the vernier would point out the ſame difference of times as the clock ſhews in the interval of the obſervations; but if theſe differences of times ſhewn by the clock and the hour circle be not equal, the line of collimation is not parallel to the plane of the circle, and half that inequality of times is the error, which muſt be corrected by the adjuſtment for that purpoſe. Thirdly, to adjuſt the croſs axis perpendicular to the polar axis, or to the line of collimation. By the laſt adjuſtment, the line of collimation was made to move in a plane; therefore, if that plane be adjuſted to the polar axis, the line of collimation will deſcribe a ſecondary to the equator. On this ſuppoſition, if we take a ſtar of any declination, and note the time of its tranſit over the middle wire by the clock, and alſo the hour on the hour circle; then turn the polar axis half round, and obſerve again as in the laſt poſition, and the differences of the times of the two obſervations ſhewn by the clock, and on the hour circle diminiſhed by 12, muſt be equal; but if the line of collimation do not deſcribe a ſecondary, the differences will not be equal. To correct, therefore, this error, let E Q, *fig.* 2. *Plate* XVII. be the equator, E P Q a great circle paſſing through the pole P, E F Q the great circle deſcribed by the line of collimation, and let the teleſcope be directed to a ſtar at b, and let $d b y$ be a portion of its parallel, take $a d = a b$, and draw the ſecondaries P $d m$, P $b c$. Now it is manifeſt, that if we turn the polar axis half round, the plane E F Q will then lie as much on the contrary ſide of E P Q; and, therefore, when the teleſcope is directed to the ſtar's parallel, it will cut it at d, and half m C, or E c, is the error of right aſcenſion. Note the time on the hour circle, and continue to turn (in the preſent inſtance) the polar axis until the ſtar, now at x, on account of its motion, be again brought to the middle wire, and note again the time on the hour circle, and we have the difference $m r$ ſhewn by the hour circle, from which ſubtract the time $c r$, ſhewn by the clock between the obſervations, and we have m C, the half of which is E c. Now the ſtar being on the middle wire, move the polar axis ſo as to cauſe the hour circle to move through an arc $r s$ equal to E c, and by the ſcrew q, *fig.* 1, alter the poſition of the croſs axis, and conſequently of the plane E F Q till the ſtar appears again on the ſame wire, moving, if neceſſary, the teleſcope on the circle H I to bring the ſtar into the field; and then as $y x = a b$, the line of collimation would have been corrected ſo as to make it paſs through P, and the adjuſtment would have been truly made, provided the ſtar had not moved in the time of this laſt operation. Correct again, therefore, and you will get the line of collimation to deſcribe a ſecondary to the equator, when the teleſcope is moved on the circle H I. Thus the inſtrument is adjuſted for uſe.

To find any object in the heavens, whoſe right aſcenſion and declination are known.—Find its diſtance, at the time required, from the meridian in the uſual way, and reduce it to ſiderial time, and turn about the polar axis, that way the object lies from the meridian, until the hour circle points out that diſtance of the teleſcope from it; then turn the teleſcope till the indices a, b, ſhew the polar diſtance, and the object will be in the field of view. By this means we direct the teleſcope to a comet, or any other body whoſe place is known, which is inviſible to the naked eye.

To find the true place of a body, and trace out its path in the heavens.—Screw the index K to the croſs axis of the teleſcope; bring the body upon the wire parallel to the equator, and take the time of its tranſit over the middle wire perpendicular to it, and note the degrees on the arc L M, pointed out by the vernier $v w$; then if there be any known fixed ſtar near its parallel, move the teleſcope on the circle H I (the polar axis remaining fixed) to the ſtar's parallel, wait till the ſtar enters the field of view, and make it run along the ſame wire as the body did, and take the time of its tranſit at the middle wire, and the difference of theſe times will give the difference of their right aſcenſions, and the difference of the arcs on L M, pointed out by the vernier $v w$ at the times of the tranſits, gives the difference of their declinations; hence the right aſcenſion and declination of the body is known. Continue theſe obſervations as long as the body is viſible, and you will get its path in the heavens. The utility and convenience of this method is, that we can at any time determine the place of a body without waiting for its coming to the meridian; where, beſides the inconvenience of waiting, an obſervation might be hindered by the badneſs of the weather, or the body might come to the meridian in the day-time, when it could not be ſeen.

An inſtrument, ſomewhat ſimilar in conſtruction, but with conſiderable improvements, was begun by Mr. Bird in the laſt year of his life, or the year preceding, for the obſervatory at Oxford, and was finiſhed by Mr. Troughton (the ſenior) about the year 1773, by order of Mr. Bird's executors. We regret that we have not had the means, in due time, of obtaining a perſpective drawing of this inſtrument, that we might have gratified our readers with a deſcription of it.

EQUATORIAL *Stand* of a teleſcope is a contrivance for making a common teleſcope follow a celeſtial body in its apparent path along, or parallel to, the equator; and anſwers the purpoſe of a polar axis of motion, while it adds but little to the expence of a ſimple ſtand for horizontal and vertical motions only. The thing required to be done to a common ſtand, was to give the horizontal motion an equatorial direction, and then the vertical motion, of itſelf, becomes a motion in declination, or in an horary circle, as well out of, as in the meridian. Various methods have been deviſed of effecting this purpoſe in the ſimpleſt way; but the contrivance invented by Mr. Smeaton, uſually called Smeaton's Block, and which has all the advantages of cheapneſs, ſtability and ſimplicity, has been preferred to all others, and in our opinion merits a place in our collection of aſtronomical inſtruments.

Fig. 5. of *Plate* XIII. of *Aſtron. Inſt.* is a repreſentation of an equatorial ſtand of Smeaton's conſtruction, in which the three legs are of mahogany, well braced together, and ſhortened at the lower extremities for the purpoſe of bringing them within the plate. The part *a b*, at the top of the legs, in the ſhape of a blunt wedge, is of mahogany, and is faſt to the legs; the other ſimilar part *c d*, above it, is alſo mahogany, and ſloped exactly like the part *a b*; the two parts taken together are called the *block*, the lower half of which is fixed, and the upper moveable on a ſtrong cylindrical piece of braſs fixed to the piece *c d*, at right angles to the line of ſection, or plane of contact, and paſſing through the piece *a b* ſo as to be fixed, when neceſſary, by a finger ſcrew below the block, and within the junction of the three legs. The plane of contact of the two halves of the block is ſo ſloped as to make an angle exactly equal to one half of the co-latitude of the place of obſervation, with a horizontal line, in which the under-face of the block is ſuppoſed to be by its poſition; but as the upper half of the block is exactly ſimilar to the under one, its face, when in the preſent equatorial poſition, makes an angle with the horizon equal to the whole co-latitude of the place; *i. e.* when in the meridian, is coincident with the plane of the equator. When the part *c d* is turned half round, ſo that the point *d* may coincide with the point *a*, and the point *c* with the point *b*, the ſlopes of the two halves of the block are then reverſed, and the face of *c d* becomes horizontal: hence it appears that a motion of the half block *c d* round its axis of motion, will carry any teleſcope *g*, or other body, placed on it parallel to its face, in the direction of the equator, provided it be placed in the meridian of the place when it has the greateſt elevation. Accordingly an axis of motion of a ſmall graduated equatorial circle *e* is attached perpendicularly to the face of the half block *c d*, round which the ſaid circle is moveable; and over this circle is mounted a graduated ſemicircle of declination *f*, or of altitudes, when the block is in its horizontal poſition, to which the teleſcope is made faſt. The circle *e* is divided into half degrees, or two minutes of time, and is ſubdivided by a vernier into $\frac{1}{30}$th of this quantity, that is, into minutes of ſpace, and four ſeconds of time; the declination-ſemicircle is alſo ſubdivided into minutes of ſpace by a vernier; and by enlarging the radii the ſubdiviſions might be rendered ſtill more minute; but the uſe of theſe graduations is merely to *find* a ſtar or planet, by its right aſcenſion and declination, to which purpoſe the inſtrument is quite competent. Mr. Troughton informs us, that he has made this ſtand an univerſal one ſometimes, by dividing the block diagonally by an angle of 45°, in which caſe it would take any degree of elevation from a horizontal to a vertical poſition, and one of the half blocks, being graduated into 360°, was read by a vernier fixed to the other, ſo as to aſcertain any given quantity of elevation; but as the conſtruction of the inſtrument does not admit of great accuracy in its adjuſtments and motions, he conſidered ſuch addition rather as curious than really uſeful in aſtronomy. Still, however, when the teleſcope is fitted up with the beſt micrometer for meaſuring the difference of right aſcenſions and declinations, and when the ſtand is made very ſteady, the inſtrument may be very ſerviceable in an obſervatory, and is often made a part of its furniture.

The ſliding tubes *h* are ſometimes ſuperadded to brace the eye-end of the teleſcope, and are found to anſwer a good purpoſe, when well made, and fitted to any pair of the legs that may happen to be turned towards this end of the teleſcope. Both the equatorial circle *e* and ſemicircle *f* have the uſual apparatus for quick or ſlow motion; and when the block is in the horizontal poſition, the teleſcope may be fixed, by the finger ſcrew under the block, to be conveniently uſed for viewing terreſtrial objects; in which poſition the inſtrument makes no contemptible theodolite, as well as equal-altitude inſtrument, when a level is added.

EQUEA, in *Geography*, a town of Africa, on the Gold coaſt.

EQUERY, or Ecury, a grand ſtable or lodge for horſes, furniſhed with all the conveniences thereof; as ſtalls, manger, rack, &c.

The word is formed from the French, *eſcurie*, which ſignifies the ſame thing. Some again derive *eſcurie* from the Latin, *ſcuria*, which not only denotes a place for beaſts to be put up in, but alſo a grange or barn. But a more probable derivation is from *equile*, a ſtable for horſes, of *equus*, horſe.

Some hold that the word ſtable, in propriety, relates only to bullocks, cows, ſheep, hogs, &c. and equery, to horſes, mules, &c.

A ſimple equery is that provided for one row of horſes; a double equery that provided for two, with a paſſage in the middle, or two paſſages; the horſes being placed head to head, as in the little equery at Verſailles.

Under equery are ſometimes alſo comprehended the lodgings and apartments of the equeries, grooms, pages, &c.

Equery, *eſcuyer*, is alſo an officer who has the care and management of the horſes of a king or prince.

EQUERIES, or Equerries, popularly called *querries*, are particularly uſed amongſt us for offices of the king's ſtables, under the maſter of the horſe, five in number, who, when his majeſty goes abroad, ride in the leading-coach, are in waiting, one at a time, monthly, and have a table with the gentlemen-uſhers during the time, and a ſalary of 300*l.* a year each: that of the firſt equerry and clerk-martial being 500*l.*

They uſed to ride on horſeback by the coach ſide when the king travelled: but that being more expenſive to them than neceſſary to the ſovereign, it has been diſcontinued.

Equeries *of the crown ſtable*, have that appellation, as being employed in managing and breaking the ſaddle-horſes, and preparing them for the king's riding.

The equerry of the crown ſtable has an annual ſalary of 200*l.* and is, or always ſhould be, in cloſe waiting at court; and when his majeſty rides holds the ſtirrup, while the maſter of the horſe, or one of the equerries in his abſence, aſſiſts in mounting him; and when his majeſty rides, they uſually attend him. To the eſtabliſhment of the queen's houſhold belong two equerries with a ſalary of 220*l.* each. There are alſo two belonging to the prince of Wales's houſhold. Officers under the ſame denomination form a part of the eſtabliſhed houſholds of the royal dukes, &c.

EQUES Auratus, is uſed to ſignify a knight bachelor, called *auratus*, q. d. *gilt*, becauſe anciently none but knights might gild or beautify their armour, or other habiliments of war, with gold.

In law this term is not uſed, but inſtead of it *miles*, and ſometimes *chevalier*.

EQUESTRIA, among the Romans, a place in the theatre where the equites or knights ſat.

EQUESTRIS, Equestrian, formed of the Latin, *eques*, knight, horſeman, of *equus*, horſe, a term chiefly uſed in the phraſe equeſtrian ſtatue, which ſignifies a ſtatue repreſenting a perſon mounted on horſeback.

The Fortuna equeſtris, in ancient Rome, was a ſtatue of the goddeſs on horſeback. We ſometimes alſo ſay, *equeſtrian* column, which ſee.

Equestrian *cohort*, in *Antiquity*. See Cohors *equitata*.

Equestrian *games*, *ludi equeſtres*, among the Romans, horſe-races, of which there were five kinds, the prodromus, or plain horſe-race, the chariot race, the decurſory race, about funeral piles, the ludi ſevirales, and the ludi neptunales.

Equestrian *order*, among the Romans, ſignified the order of the knights or equites.

EQUI, in *Ancient Geography*, a ſmall town of Africa Propria, near a lake in the vicinity of Utica. According to Diodorus Siculus it was taken by Agathocles.

EQUIANGULAR, in *Geometry*, is applied to figures whoſe angles are all equal; ſuch are the ſquare, and all regular figures.

All equilateral triangles are alſo equiangular.

An equilateral figure inſcribed in a circle is always equiangular; but an equiangular figure inſcribed in a circle is not always equilateral, except when it has an odd number of ſides. If the number of the ſides be even, then they may be either all equal, or elſe half of them will always be equal to each other, and the other half to each other; the equals being placed alternately. See Hutton's Math. Miſc. p. 272.

Equiangular is alſo applied to any two figures of the ſame kind, when each angle of the one is equal to a correſponding angle in the other, whether each figure, ſeparately conſidered, be an equiangular figure or not, that is, having all its angles equal to each other. Thus, two triangles are equiangular to each other, if, *e. g.* one angle in each be of 30°, a ſecond angle in each of 50°, and the third angle of each equal to 100°.

Equiangular triangles have not their like ſides neceſſarily equal, but proportional to each other; and ſuch triangles are always ſimilar to each other.

EQUICRURAL Triangle, is what we more uſually call an iſoſceles triangle.

EQUICULUS, Equuleus, or *Equus minor*, in *Aſtronomy*, a conſtellation of the northern hemiſphere. See Equuleus.

EQUIDIFFERENT, in *Arithmetic*. If in a ſeries of three quantities there be the ſame difference between the firſt and ſecond as between the ſecond and third, they are ſaid to be continually equidifferent; but, if in a ſeries of four quantities, there be the ſame difference between the firſt and ſecond as between the third and fourth, they are ſaid to be diſcretely equidifferent.

Thus, 3, 6, 7, and 10, are diſcretely equidifferent, and 3, 6, and 9, continually equidifferent.

EQUIDISTANT, in *Geometry*, a term of relation between two things which are every where at an equal or the ſame diſtance from each other. Thus, parallel lines are ſaid to be equidiſtant, as they neither approach nor recede.

EQUILATERAL, of *æquus*, equal, and *latus*, ſide, is applied to any figure whoſe ſides are all equal. Thus, an equilateral triangle is that whoſe ſides are of equal length. In an equilateral triangle all the angles are likewiſe equal. See Equiangular.

All regular polygons and regular bodies are equilateral. See Polygon, Regular, &c.

Equilateral *Hyperbola*, is that in which the conjugate axes, and every pair of conjugate diameters, are equal to each other. The aſymptotes are alſo at right angles to each other, and each of them forms a right angle with the axis. Such an hyperbola is alſo equal to its oppoſite hyperbola, and likewiſe to its conjugate hyperbola, ſo that all the four conjugate hyperbolas are mutually equal to each other.

Hence, as the parameter is a third proportional to the conjugate axes, they are all mutually equal; conſequently, if in the equation for the hyperbola $y^2 = \frac{p}{t} \times \overline{tx + x^2}$, or $= \frac{c^2}{t^2} \times \overline{tx + x^2}$, in which t is the tranſverſe axis, c the conjugate, p the parameter, x the abſciſs, and y the ordinate, t, c, and p being made equal, the equation for the equilateral hyperbola becomes $y^2 = tx + x^2$; differing from that of the circle merely in the ſign of the term x^2, which in the circle is —. See Hyperbola.

EQUILIBRIUM, or Equipoise, in *Mechanics*, means an equality of forces acting in oppoſite directions, ſo that they mutually balance each other. Thus, the ſcales of a balance are ſaid to be in equilibrio, when neither of them preponderates, in conſequence of which the beam of the balance remains perfectly horizontal. But, it muſt not be imagined, that the equality of weights alone determines the equilibrium of mechaniſms in general; for that is only the caſe when the velocities and directions are equal, as in the above-mentioned caſe of the balance, where the two arms of the beam being equal, the weights in the ſcales have equal velocities, ſuppoſing that the balance is made to vibrate, and move in vertical directions. Therefore, it has been ſaid above, that the equilibrium takes place, when the *forces*, which act in oppoſite directions, are equal; for the forces are eſtimated from the weight of the bodies, their velocities, and directions conjointly. Thus, in the common mechanical powers, the equilibrium takes place, when the power is to the weight as the velocity of the weight is to the velocity of the power. The equlibrium of ſolids forms a conſiderable part of the ſcience of ſtatics, and the equilibrium of fluids forms a conſiderable part of hydroſtatics.

Equilibrium is alſo uſed figuratively on other occaſions. A painter muſt take care to obſerve the equilibrium of his figures, *i. e.* diſpoſe them well on their centre of gravity, that they may not ſeem ill-ſupported, or ready to tumble. Thus, *e. gr.* if one arm be moved forward, the other muſt be proportionably backward to poiſe the figure.

In a picture there ſhould always be an equilibrium between one part and another; that is, the objects are to be diſtributed ſo as to balance and contraſt each other; and not too many, *e. gr.* be crowded on one ſide, and the other be left bare.

EQUIMULTIPLE, in *Arithmetic* and *Geometry*, is applied to ſimple magnitudes when multiplied equally, *i. e.* by equal quantities or multipliers.

Thus, taking A as many times as B, or multiplying them equally, there will ſtill remain the ſame ratio between the magnitudes thus multiplied, as between the primitive magnitudes before multiplication.

Now thoſe magnitudes, thus equally multiplied, are called equimultiples of the original ones A and B; whence we ſay, that equimultiples have the ſame ratio as the ſimple quantities. In arithmetic, we generally uſe the term equimultiples for numbers which contain equally or an equal number of times their ſubmultiples.

Thus 12 and 6 are equimultiples of their ſubmultiples 4 and 2, inaſmuch as each of them contains its ſubmultiple three times.

EQUINA Sella. See Sella.

EQUINOCTIAL, in *Aſtronomy*, a great circle of the ſphere, under which the equator moves in its diurnal motion.

The equinoctial is conceived by ſuppoſing a ſemidiameter of the ſphere produced through a point of the equator, and there, by the rotation of the ſphere about its axis, deſcribing a circle on the immoveable ſurface of the primum mobile.

The poles of this circle are the poles of the world. The ſphere is divided by it into two equal parts, the northern and ſouthern. It interſects the horizon of any place in the eaſt and weſt points; and at the meridian its elevation above the horizon is equal to the co-latitude of the place.

Whenever the ſun, in his progreſs through the ecliptic, comes to this circle, it makes equal days and nights all around the globe; as he then riſes due eaſt and ſets due weſt, which he never does at any other time of the year. And hence the denomination from *æquus* and *nox*, night, *quia æquat diem nocti.* All the ſtars that are under this circle, or that have no declination, do alſo riſe due eaſt and ſet due weſt.

The equinoctial, then, is the circle which the ſun deſcribes, or appears to deſcribe, at the time of the equinoxes: that is, when the length of the day is every where equal to that of night, which happens twice a year. (See Equinox.) From this circle is the declination in the heavens or latitude of places on the earth counted in degrees of the meridian. Upon this circle is reckoned the longitude, 180° weſt and 180° eaſt, in all 360°. Hence, 1° of longitude anſwers to 4′ of time; 15′ to 1′ of time; and 1′ to 4 ſeconds of time, &c.

The ſhadows of thoſe who live under this circle are eaſt to the ſouthward of them for one-half of the year, and to the northward of them during the other half; and twice in a year, *viz.* at the equinoxes, the ſun at noon caſts no ſhadow, being in their zenith.

Equinoctial *colure*, is that paſſing through the equinoctial points. See Colure.

Equinoctial *dial*, is that whoſe plane lies parallel to the equinoctial. See Dial.

Equinoctial *hours*, *line*, *orient*. See the ſubſtantives.

Equinoctial *points*, are the two points wherein the equator and ecliptic interſect each other: the one, being in the firſt point of Aries, is called the vernal point, or equinox; and the other, in the firſt point of Libra, the autumnal point, or equinox.

The equinoctial points, and, indeed, all the other points of the ecliptic, are found, by obſervation, to be continually moving backwards, or in antecedentia, *i. e.* towards the weſt. This retrograde motion is called the *Preceſſion of the equinoxes*; which ſee.

EQUINOX, in *Aſtronomy*, the time when the ſun enters one of the equinoctial points.

The equinoxes happen when the ſun is in the equinoctial circle, of conſequence the days are equal to the nights throughout the world, which is the caſe twice a year, *viz.* about the 21ſt of March, and the 22d of September, the firſt of which is the vernal, and the ſecond the autumnal equinox.

As the ſun's motion is unequal, that is, ſometimes ſwifter and ſometimes ſlower (from the cauſes already explained under the article Equation), it comes to paſs, that there are about eight days more from the vernal to the autumnal equinox than from the autumnal to the vernal, the ſun ſpending ſo much more time in travelling through the northern than the ſouthern ſigns.

According to the obſervations of M. Caſſini, the ſun is $186^{d}\ 14^{h}\ 53'$ in the northern ſigns, and only $178^{d}\ 14^{h}\ 56'$ in the ſouthern. The difference of which is $7^{d}\ 23^{h}\ 57'$.

The ſun, continually advancing forwards in the ecliptic and gaining a degree every day, makes no ſtay in the equinoctial points, but the moment he arrives in them he alſo leaves them.

Of courſe, therefore, though the day the ſun enters the equinoctial point is called the equinox, as being reputed equal to the night; yet it is not preciſely ſo, unleſs the ſun enter the equator at mid-day: for if the ſun riſing, ſhould enter the vernal equinox at ſetting, he will have departed from it, and have got northwards about 12′; conſequently, that day will be ſomewhat longer than 12 hours, and the night proportionably ſhorter.

The time of the equinoxes, *i. e.* the moment in which the ſun enters the equator, is found by obſervation, the latitude of the place of the obſervation being given.

Thus, in the equinoctial day, or near it, take the juſt meridian altitude of the ſun; if this be equal to the altitude of the equator, or the complement of the latitude, the ſun is that very moment in the equator: if it be not equal, the difference is the ſun's declination. The next day obſerve the meridian altitude as before, and find his declination; if the declination be of different kinds, *viz.* the one north and the other ſouth, the equinox has happened in the interval of time between them; otherwiſe, the ſun has not entered the equinoctial, or had paſſed it at firſt. From theſe obſervations a trigonometrical calculus gives the time of the equinox.

Thus, let D G (*Plate* XII. *Aſtronomy*, *fig.* 110.) repreſent the equator, A C the ecliptic, E the equinoctial point; the points A, B, C, the places of the ſun at the times of obſervation; the arcs A D, B F, C G, the correſponding declinations; in the right-angled ſpherical triangles C E G, B E F, the obliquity of the ecliptic, and the declinations are known; whence may eaſily be found E C, E B; then B C, the ſum or difference of E C, E B is the ecliptic arc deſcribed in 24 hours: then ſay as B C : B E :: 24 hours for B C : time for B E; and this time ſhews the diſtance of the equinox from the time of the middle obſervation.

EQUINUS Barbatus, a kind of comet. See Hippeus.

Equinus *ellipticus* and *quadrangularis*. See Hippeus.

Equinus *venter*. See Venter *equi*.

EQUIP, *To*, in *Naval Language*, a term borrowed from the French marine, and frequently applied to the buſineſs of fitting a ſhip for ſea, or arming her for war. See Fitting-out.

EQUIPAGE, in *Navigation*. See Crew and Fitting-out.

Equipage, *Camp.* Under this term we confine ourſelves entirely to what relates to the tents generally in uſe; remarking, that ſuch as ſuit admirably for a cold climate, would be found totally unſerviceable in higher latitudes, where the air, confined in a ſmall ſpace, under a vertical ſun, while probably not a leaf is in motion, could not fail to be unfit for reſpiration. Therefore, we ſhall give the regulation ſizes of tents, both according to the home ſervice, and to what is found neceſſary for troops employed in the Eaſt Indies.

Home Service, Laboratory Tent, with mallets, poles, pins, &c. ſhould weigh 3 cwt. 24lb.; and ought to be ſuſtained on poles of 14½ feet each in length; the ridge pole ſhould be 18 feet. Some of theſe are made with half-walls; that is, their flies, or canopies, do not come within three feet of the ground, but are there faſtened to a half-wall, or curtain, which being laced or hooked to the interior of the fly, hangs perpendicularly to the ground, to which it is ſecured by wooden pins, or pegs.

India Service, Laboratory Tent.—This claſs of tents is nearly ſimilar, but they have commonly extra flies, ſtanding at about a yard diſtant from the inner ſhell, which are ſometimes well ſoaked in oil, or ſlightly with tar, at leaſt ſufficiently to throw off rain. This occaſions them to be extremely ponderous; the poles being ſome feet longer, and the ſpread of canvas conſiderably greater; the average weight of a laboratory tent may here be taken at nearly half a ton. Such a weight could only be conveyed on an elephant, or on a cart, (the latter being far too dilatory for moſt ſituations,) were it not that the fly, the ſhell, and the walls, are all made to ſeparate. By this means two camels may conveniently bear one of theſe tents.

Home Service, Bell Tent, ſhould, according to the new conſtruction, have a pole of 9 feet long, and form a circular ſpread of 14 feet in diameter, ſo as to give ſhelter to twelve men. Since it has been found neceſſary to reduce the quantity of baggage attached to our armies, little or no uſe is made of any tents that are inadequate to the ſhelter of a certain number of perſons; conſequently thoſe bell tents, which were called "Bells of Arms," have in a manner ceaſed to be known in our arſenals, they being totally incompetent to any eſſential ſervice. The modern bell tent is, therefore, to be conſidered as a medium between the bells of arms, and the private tents formerly in uſe; they are extremely portable, and, in proportion to their weight, which ought not to exceed 45lb. are far more ſerviceable; as they cover twelve men better than the common infantry tents, that weighed 27lb., did five. The facility with which a tent, having only a pole, is raiſed, or ſtruck, the great ſafety it inſures from preſenting no flat ſide to the wind, and the paucity of pins, &c. requiſite for its uſe, give it a very conſiderable claim to preference.

Indian Service, Bell Tents, are made of very ſtout canvas, ſupported on poles of about 7 feet in length, and overlapping in their front, for the purpoſe of keeping the arms they contain perfectly dry. The muſquets, &c. are filed round the pole of a bell tent by means of two ſticks, about 18 inches in length, paſſing at right angles to each other, and to the pole alſo, through two holes made in the latter. Theſe, which may be drawn at pleaſure, form a croſs, in the four diviſions of which the arms of the company are filed. Average weight, when dry, 1 cwt.; when wet, 1 cwt. 1 qr. 14lb.

Home Service, Common Infantry (or Private) Tents, which are now leſs uſed than formerly, require two ſtandard poles, each 6 feet in length, and a ridge pole of 7 feet. They ſhould weigh *in toto* 27lb., and be capable of covering five men. It is obvious, that a tent of this deſcription muſt be leſs ſafe, and leſs comfortable to its inhabitants, than the bell tent now ſubſtituted

Indian Service, Private Tents, ſtand upon two poles, each 9 feet long, and have a ridge pole of 8 feet. Theſe tents are made of very ſtrong canvas, and are ſometimes lined ſeparately; whereby they are rendered tolerably cool. They ſhould be capable of ſheltering twelve men commodiouſly; but in hot weather not more than eight ought to be allotted to one tent. Conſiderable relief is afforded by the walls of theſe tents; which are generally about 30 inches high. The average weight of one, complete, may be about 2 cwt. 1 qr. when dry; but when wet, it will perhaps exceed 4 cwt.

Home Service, Officer's Marquee, ſhould have two ſtandard poles, each 8 feet high, and a ridge pole of 7 feet: the total weight about 130lb. This kind of tent has walls about 4 feet in height, and is generally furniſhed with a ſeparate lining throughout.

Indian Service, Marquees, are upon a very different conſtruction. The proportions are as follows; *viz.*

	Length.	Breadth.	Ridge Poles.	Standard Poles.
Captain's marquee on two poles lined throughout with gingham, and having walls of 5 ft. 6in.	23 feet.	15 feet.	10 feet.	12 feet.
Subaltern's tent on 1 pole	14 feet.	14 feet.	——	11 feet.

Theſe proportions may ſeem very great, but they are found to be actually neceſſary in that climate. The total weight of a captain's marquee may be eſtimated, when dry, at 4 cwt.; when wet, at 6½ cwt. A ſubaltern's marquee, when dry, 3½ cwt.; and when wet, 5 cwt.

With reſpect to the larger claſſes of tents, ſuch as are uſed by our colonels and general officers, they approach ſomewhat towards the conſtruction of what, in the Indian ſervice, are called field officers' ſleeping tents, which generally have from 12 to 14 feet between two poles of 14 feet in height. They are chiefly compoſed of ſtrong ſhells made of Ruſſia-duck, with flies of canvas, and are ordinarily lined with perpet. The weight of ſuch a tent may be computed at 5 cwt. when dry; and when wet at 7¼ cwt. State tents may meaſure about 18 feet in the ridge, and have ſtandards of full 16 feet in height. Their poles are generally made in two pieces, joining in their centres by means of a cylinder of iron; on the ſame principle as the ſliding ferrils in ladies' paraſols.

We have thus given ſome inſight into the proportions between the tents appropriated to the ſeveral claſſes, ſo far as they could tend to inſtruct the reader; who will, of courſe, underſtand, that in proportion as the ſtandards of a tent are lengthened, ſo will the ſeveral ſlopes of the fly be lengthened in a ſuitable ratio. The ordinary computation is, that the direct depth of the ſlope ought to be two-thirds the length of the poles where a full wall is to be attached; four-fifths where a half-wall is to be furniſhed; and that the pole ſhould be one-quarter, or even a third, leſs in length than the direct ſlope of the fly is deep, if no walls whatever are to be added. The climate will indicate the neceſſity for more or leſs ſteepneſs in the ſlope; for if little rain falls, leſs declivity will anſwer; whereas, if, as in India, the rains are abundant and heavy, ſuch a ſlope muſt be given as may inſure that the interior ſhould remain dry.

It is of the utmoſt importance, that all camp equipage ſhould be made not only conformably to a particular pattern, thereby to preſerve uniformity of appearance; but, as nearly as practicable, of the ſame kind of materials, and of a given weight; ſo that a very correct eſtimate may be formed both of the bulk and gravity of the whole, when about to be conveyed either by land or by water. Beſides, it is expedient, that the camp-colourmen, batmen, &c. ſhould have a perfect underſtanding of this branch of military economy, and have the whole of the tents handed to them, when about to be laden, or conveyed, packed in a regular manner; ſo as to occupy as little ſpace as poſſible; otherwiſe they never can ſtow to advantage, ſo as to be ſafe, and to afford as much ſpace as can be ſpared for other articles.

Equipage, in the *Military Art*, denotes all ſorts of utenſils, artillery, &c. neceſſary for commencing and proſecuting with eaſe and ſucceſs any military operations.

EQUIPOLLENCE, in *Logic*, is when there is an equivalence between any two or more terms or propoſitions; *i. e.* when they ſignify one and the ſame thing, though they expreſs it differently. Such propoſitions, &c. are ſaid to be equipollent.

EQUIPPE', in *Heraldry*, expreſſes a cavalier equipped, *i. e.* armed at all points.

EQUIRIA, in *Antiquity*, a feſtival inſtituted by Romulus, and celebrated on the 27th of February, in honour of Mars, at which there were horſe-races.

EQUISELIS, in *Natural Hiſtory*, the name of a large fly, of the ſize of a hornet, but having only two wings and no ſting: it otherwiſe much reſembles the common hornet in ſhape. This fly is found only in Macedonia. We have alſo in England flies which nearly reſemble the hornet, waſp, and bee, but in their wanting ſtings and having only two wings.

Equiselis, in *Ichthyology*, a name uſed by ſome authors for a ſea-fiſh, caught on the Spaniſh ſhores, and ſuppoſed by many to be the ſame with the *Dorado*, or *Coryphæna*, with the forked tail of Artedi. See Coryphæna.

EQUISETUM, in *Botany*, from *equus*, a horſe, and *ſeta*, a ſtrong hair or briſtle. Horſetail. Plin. Hiſt. Nat. lib. 26. cap 13. Linn. Gen. 559. Schreb. 753. Mart. Mill. Dict. v. 2. Sm. Fl. Brit. 1102. Hedwig. Theor. 33. t. 1, 2. Juſſ. 17. Claſs and order, *Cryptogamia Filices.* Linn. *Cryptogamia Miſcellaneæ.* Schreb. Nat. Ord. *Filices ſpicatæ.*

Gen. Ch. *Fructifications* in an ovate-oblong terminal catkin, compoſed of whorled, ſtalked ſcales. Each ſcale peltate, ſomewhat orbicular, but with many ſides, bearing on its under ſide from four to ſeven tubular, angular, obtuſe ſheaths, parallel to and ſurrounding the ſtalk of two valves, burſting internally, containing numerous florets. *Stam.* Filaments four, coiled up round the germen, in a ſpiral manner, while moiſt, divaricated when dry; anthers terminal, ſimple, ſpatulate. *Piſt.* Germen globoſe, wrapped up in the ſtamens; ſtyle none; ſtigma obſolete, acute. *Seeds* globoſe, deciduous, accompanied by the ſtamens.

Eſſ. Ch. Catkin with peltate ſcales, fructifying on their inſide. Partial involucrums tubular, of two valves. Seeds numerous, naked, ſurrounded by four ſpiral ſtamens.

Many different opinions have exiſted concerning the fructification of this genus, but Hedwig's, as above given, ſeems to us the moſt ſatisfactory. In the artificial claſſification we retain it among the ferns, to which it is cloſely allied in natural affinity, though of itſelf a moſt natural and diſtinct genus; nor do we think Schreber's order, entitled *Miſcellaneæ*, leſſens in any degree the difficulties reſpecting this tribe.

Seven ſpecies of *Equiſetum* are found in Britain, and two or three foreign ones are imperfectly known beſides.

E. *ſylvaticum*, Engl. Bot. t. 1874, known by its compound drooping branches, is one of the pretrieſt. It occurs chiefly in mountainous countries, in moiſt, ſhady ſpots.

E. *hyemale*, Engl. Bot. t. 915, called Shave-graſs or Dutch ruſh, is remarkable for the callous roughneſs of the ribs of its naked ſtem, which renders it uſeful in poliſhing wood, ivory, and even braſs. Being rare in England, it has for theſe purpoſes been imported from Holland. Profeſſor Davy has detected a large proportion of flinty earth in the cuticle, to which its hardneſs and aſperity are owing.

E. *variegatum*, Engl. Bot. t. 1987, found on the ſandy ſea-coaſt of Scotland, by Mr. G. Don, and a native alſo of Sweden, Denmark, Switzerland, &c. is a ſmaller ſpecies, nearly related to the laſt, and having a ſimilar roughneſs.

Equisetum, in *Natural Hiſtory*, is the name by which ſome writers have denominated certain foſſil plants, (phytolithii,) which are found bearing ſome faint reſemblance to the recent plant called horſe-tail. Mr. William Martin, after deſcribing an organic remain of this kind in his "Petrificata Derbienſia," ſays, "there are other plants with ſtellate leaves, to which it might with as much propriety be referred: hippuris, aſperiala, and galium, for inſtance," and he continues, "we may here obſerve, that little has yet been done with reſpect to diſcriminating the original genera of foſſil plants: thoſe parts indeed, on which ſuch diſcrimination *muſt* be founded, are rarely, if ever, viſible in the petrified ſtate. The characteriſtic diſtinctions of the ſpecies are frequently attainable, if ſtudiouſly ſought after, by a diligent and careful compariſon of various ſpecimens; and the habit or general appearance of the foſſil often leads to the knowledge of the natural claſs and order of the recent plant: but its genus, for the moſt part, remains undetermined or doubtful." The great importance of the organic remains or *reliquia* in tracing and identifying the ſtrata, according to the new diſcoveries of Mr. Smith and his pupils, will, it is hoped, ere long, induce naturaliſts ſeriouſly to turn their attention to this neglected branch of ſcience.

EQUISONANCE, in *Muſic*, a name by which the ancients diſtinguiſhed octaves from other concords. Octaves being the only *paraphoni*, or concords, when doubled above or below. This is a diſtinction which would be as uſeful in modern muſic as in the ancient. All other concords, doubled, become diſcords.

EQUITANTIA, Folia, in *Botany*, is applied to leaves ſo folded at the baſe, as to embrace each other in two ranks. See Leaf.

EQUITATA Cohors, in *Antiquity*. See Cohors *Equitata.*

EQUITY, Æquitas, denotes juſtice or right, mitigated and tempered by the conſideration of particular circumſtances; or a correction and abatement of the ſeverity of ſome law; or a temperament, which, without being unjuſt, abates the rigour of ſome juſt law.

Equity, as Grotius defines it, is the correction of that, wherein the law (by reaſon of its univerſality) is deficient. For ſince in law all caſes cannot be foreſeen or expreſſed, it is neceſſary, that when the general decrees of the law come to be applied to particular caſes, there ſhould be ſomewhere a power veſted of defining thoſe circumſtances, which (had they been foreſeen) the legiſlator himſelf would have expreſſed. And theſe are the caſes which, according to Grotius, "lex non exacté definit, ſed arbitrio boni viri permittit."

This is what the Greeks call επιεικεια. The utmoſt ſeverity of a good law is frequently contrary to juſtice; it ſhould always have equity for its rule and guide. "Summum jus, ſæpe ſumma injuria."

The foundation of equity is not that there is any miſtake in the law, but that the law was laid down univerſally, becauſe all circumſtances could not be conſidered or taken in under one law.

For an inſtance, ſuppoſe it an expreſs law, that the city being now beſet with an enemy, the gates be all ſhut; and ſuppoſe it fall out that the enemy is then in purſuit after ſome of the citizens by whom it is defended, ſo that it would be highly prejudicial thereto not to open for them the gates; equity here decrees the gates to be opened, contrary to the expreſs words of the law.

As equity depends, eſſentially, upon the particular circumſtances of each individual caſe, there can be no eſtabliſhed rules and fixed precepts of equity laid down, without deſtroying its very eſſence, and reducing it to a poſitive law. And, on the other hand, the liberty of conſidering all caſes in an equitable light, muſt not be indulged too far; leſt we thereby deſtroy all law, and leave the deciſion of every queſtion entirely in the breaſt of the judge. And law, without equity, though hard and diſagreeable, is much more deſirable for the public good, than equity without law; which would make every judge a legiſlator, and introduce infinite confuſion, as there would then be almoſt as many different rules of action laid down in our courts, as there are differences of capacity and ſentiment in the human mind.

Equity is of two kinds, and thoſe of contrary effects; the one abridges, and takes from the letter of the law; and the other enlarges, and adds to it.

The firſt is defined the correction of a law, made generally in that part wherein it fails; as ſuppoſe a ſtatute made, "that whoſoever does ſuch a thing ſhall be a felon, or ſuffer death:" yet if a mad-man, or an infant, who hath no diſcretion, do the ſame, he ſhall neither be a felon nor ſuffer death.

The other is defined an extenſion of the words of the law to caſes which are not expreſſed, which yet come under the ſame reaſon: ſo that when one thing is enacted, all other things which are of the like degree are ſo too.

Thus, the ſtatute which ordains, that in action of debt againſt executors, he who appears by diſtreſs ſhall anſwer, extends by equity to adminiſtrators; and ſuch of them as ſhall appear firſt by diſtreſs, ſhall anſwer by the equity of the ſaid act, "quia ſunt in æquali genere."

Equity is alſo uſed for the virtue of juſtice. See Justice.

Equity, in our *Laws*, &c. is alſo frequently uſed for the Court *of Chancery*, (which ſee,) where controverſies are ſuppoſed to be determined according to the exact rules of equity and conſcience, by mitigating the rigour of the common law.

"Æquitas ſequitur legem," is an old maxim in law; but, from the great increaſe of ſuits in chancery, ſome have thought fit to give it this conſtruction, that in all caſes after a man has been at law, he muſt go to equity.

Judge Blackſtone has given a brief, but comprehenſive view of the nature of equity, as it is now underſtood and practiſed in our ſeveral courts of judicature. Equity, he ſays, in its true and genuine meaning, is the ſoul and ſpirit of all law; *poſitive* law is conſtrued, and *rational* law is made by it. In this, equity is ſynonymous to juſtice: in that, to the true ſenſe and ſound interpretation of the rule. But the very terms of a court of *equity*, and a court of *law*, as contraſted to each other, are apt to confound and miſlead us; as if the one judged without equity, and the other was not bound by any law. Whereas every definition or illuſtration to be met with, which now draws a line between the two juriſdictions, by ſetting law and equity in oppoſition to each other, will be found either totally erroneous, or erroneous to a certain degree. Thus, in the *firſt* place, it is ſaid, that it is the buſineſs of a court of equity in England to abate the rigour of the common law; but no ſuch power is contended for. The learned judge ſpecifies various caſes of poſitive law, in which the court of equity can give no relief, and in which theſe, as well as the courts of law, muſt ſay with Ulpian, "hoc quidem perquam durum eſt, ſed ita lex ſcripta eſt." Again it is ſaid, that a court of equity determines according to the ſpirit of the rule, and not according to the ſtrictneſs of the letter: but ſo alſo does a court of law. Both, for inſtance, are equally bound, and equally profeſs, to interpret ſtatutes according to the true intent of the legiſlature. In general laws, all caſes cannot be foreſeen; or, if foreſeen, cannot be expreſſed: ſome occur that will fall within the meaning, though not within the words of the legiſlator; and others, which may fall within the letter, may be contrary to his meaning, though not expreſsly excepted. Theſe caſes, thus out of the letter, are often ſaid to be within the equity of an act of parliament; and ſo caſes within the letter are frequently out of the equity. Here by equity we mean nothing but the ſound interpretation of the law; though the words of the law itſelf may be too general, too ſpecial, or otherwiſe inaccurate or defective. Theſe are the caſes to which Grotius refers in the paſſage cited above. But there is not a ſingle rule of interpreting laws, whether equitably or ſtrictly, that is not equally uſed by the judges in the courts both of law and equity; the conſtruction muſt in both be the ſame, or, if they differ, it is only as one court of law may alſo happen to differ from another, each endeavours to fix and adopt the true ſenſe of the law in queſtion: neither can enlarge, diminiſh, or alter that ſenſe in a ſingle tittle.

It has been further ſaid, that *fraud*, *accident*, and *truſt*, are the proper and peculiar objects of a court of equity. But every kind of *fraud* is equally cognizable, and equally adverted to, in a court of law. Many *accidents* are alſo ſupplied in a court of law. And, although a technical *truſt*, created by the limitation of a ſecond uſe, was forced into the courts of equity; and this ſpecies of truſts, extended by inference and conſtruction, has ever ſince remained as a kind of *peculium* in theſe courts; yet there are other truſts which are cognizable in a court of law. Moreover, it has been ſaid that a court of equity is not bound by rules or precedents, but acts from the opinion of the judge, founded on the circumſtances of every particular caſe. Whereas the ſyſtem of our courts of equity is a laboured, connected ſyſtem, governed by eſtabliſhed rules, and bound down by precedents, from which they do not depart, although the reaſon of ſome of them may perhaps be liable to objection.

In ſhort, if a court of equity in England did really act, as many ingenious writers have ſuppoſed it (from theory) to do, it would riſe above all law, either common or ſtatute, and be a moſt arbitrary legiſlator in every particular caſe. Formerly, indeed, our courts of equity arrogated to themſelves ſuch an unlimited authority as hath totally been diſclaimed by their ſucceſſors for more than a century paſt. But the ſyſtems of juriſprudence, in our courts, both of law and equity, are now equally artificial ſyſtems, founded in the ſame principles of juſtice and poſitive law; but varied by different uſages in the forms and mode of their proceedings; the one being originally derived (though much reformed and improved) from the feudal cuſtoms, as they prevailed in different ages in the Saxon and Norman judicatures; the other (but with equal improvements) from the imperial and pontifical formularies, introduced by their clerical chancellors.

The ſuggeſtion indeed of every bill, to give juriſdiction to the courts of equity (copied from thoſe early times) is, that the complainant hath no remedy at the common law. But he, who ſhould from thence conclude, that no caſe is judged of in equity, when the law might have given relief, and, at the ſame time, caſts his eye on the extent and variety of the caſes in our equity reports, muſt think the law a dead letter indeed. The rules of property, rules of evidence, and rules of interpretation, in both courts, are, or ſhould be, exactly the ſame; both ought to adopt the beſt, or muſt ceaſe to be courts of juſtice. Neither a court of equity nor of law can vary men's wills or agreements, or (in other words) make wills or agreements for them. Both are to underſtand them truly, and therefore both of them uniformly. The rules of deciſion are in both courts equally appoſite to the ſubjects of which they take cognizance. Such then being the parity of law and reaſon which governs both ſpecies of courts, it may be aſked what conſtitutes their eſſential difference? It principally conſiſts in the different modes of adminiſtering juſtice in each; in the mode of proof, the mode of trial, and the mode of relief. Upon theſe, and upon two other accidental grounds of juriſdiction, which were formerly driven into theſe courts by narrow deciſions of the courts of law, *viz.* the true conſtruction of ſecurities for money lent, and the form and effect of a truſt or ſecond uſe; upon theſe main pillars hath been gradually erected that ſtructure of juriſprudence which prevails in our courts of equity, and is inwardly bottomed upon the ſame ſubſtantial foundations as the whole ſyſtem of law. As to the mode of proof, when facts, or their leading circumſtances, reſt only in the knowledge of the party, a court of equity applies itſelf to his conſcience, and purges him upon oath with regard to the truth of the tranſaction; and, that being once diſcovered, the judgment is the ſame in equity as it would have been at law. But, for want of this diſcovery at law, the courts of equity have acquired a concurrent juriſdiction with every other court in all matters of account. From this compulſive diſcovery upon oath, the courts of equity have acquired a juriſdiction over all matters of fraud. As to the mode of trial, this is by interrogations adminiſtered to the witneſſes, upon which their depoſitions are taken in writing, wherever they happen to reſide. With reſpect to the mode of relief, the want of a more ſpecific remedy, than can be obtained in the courts of law, gives a concurrent juriſdiction to a court of equity in a great variety of caſes. Thus it is in executory agreements, and in various kinds of frauds, &c. The true conſtruction of ſecurities for money lent is another fountain of juriſdiction in courts of equity. The form of a truſt, or ſecond uſe, gives the courts of equity an excluſive juriſdiction as to the ſubject-matter of all ſettlements and deviſes in that form, and of all the law terms created in the preſent complicated mode of conveyancing. This is a very ample ſource of juriſdiction. Blackſt. Com. vol. iii.

Equity *of redemption*, on mortgages, is that right which a mortgagor has of redeeming his eſtate upon payment of the money borrowed. This enables a mortgagor to call on the mortgagee who has poſſeſſion of his eſtate to deliver it back, and account for the rents and profits received, on payment of his whole debt and intereſt; thereby turning the *mortuum* into a kind of *vivum vadium*. But on the other hand, the mortgagee may either compel the ſale of the eſtate in order to get the whole of his money immediately, or elſe call upon the mortgagor to redeem his eſtate preſently, or, in default thereof, to be for ever foreclosed from redeeming the ſame, that is, to loſe his equity of redemption without poſſibility of recall. And alſo in ſome caſes of fraudulent mortgages, (ſtat. 4 & 5 W. & M. c. 16.) the fraudulent mortgagor forfeits all equity of redemption whatſoever. This is done by proceedings in the court of chancery. But the chancery cannot ſhorten the time of payment of the mortgage money, where it is limited by expreſs covenant, though it may lengthen it; and then upon non-payment, the practice is to foreclose the equity of redemption of the mortgagor. 2 Vent. 364.

To foreclose the equity, a bill in chancery is exhibited, to which an anſwer is put in, and a decree being obtained, a maſter in chancery is to certify what is due for principal, intereſt, and coſts, which are to be prefixed by the decree, whereupon the premiſes are to be re-conveyed to the mortgagor; or, in default of payment, the mortgagor is ordered to be foreclosed from all equity of redemption, and to convey the premiſes abſolutely to the mortgagee. Law of Securities, p. 129. 133.

By ſtat. 7 Geo. II. cap. 20, after payment or tender by the mortgagor of principal, intereſt, and coſts, the mortgagee can maintain no ejectment, but may be compelled to re-aſſign his ſecurities.

Equity, in *Mythology*, ſometimes confounded with Juſtice, a goddeſs among the Greeks and Romans, repreſented with a ſword in one hand and a balance in the other.

EQUIVALENT, is underſtood of ſomething that is equal in value, force, or effect, to another.

Equivalence is of various kinds, in propoſitions, in terms, and in things.

Equivalent *propoſitions*. See Equipollence.

Equivalent *terms*, are where ſeveral words that differ in ſound have yet one and the ſame ſignification; as "every body was there," and "nobody was abſent," *nihil non*, and *omne*.

Equivalent *things*, are either moral, phyſical, or ſtatical. Moral, as when we ſay that the commanding or adviſing a murder is a guilt equivalent to that of the murderer. Phyſical, as when a man who has the ſtrength of two men is ſaid to be equivalent to two men. Statical, whereby a leſs weight becomes of equal force with a greater, by having its diſtance from the centre increaſed.

EQUIVOCAL, Equivocum, denotes a word or expreſſion that is dubious and ambiguous, or that may have ſeveral ſenſes, one true and another falſe.

Equivocal terms anſwer to what are otherwiſe called *homonyma*, or homonymous terms.

Such is the word *emperor*, which is both the name of a dignity, the proper name of a perſon, and the name of a plant. So alſo the Latin *gallus*, which ſtands indifferently for a cock and a Frenchman.

In theſe caſes, one word denotes two or more different ideas, or different ſorts of objects: whence that common definition of equivocals in the ſchools, "quorum nomen eſt commune ratio vero eſſentiæ ſecundum illud nomen diverſa." Philoſophers diſtinguiſh equivocals into active and paſſive; or æquivoca æquivocantia, and æquivocata.

Æquivoca æquivocantia, or thoſe that denominate and ſignify things, are words common to ſeveral things in a very different ſignification, *i.e.* to ſeveral things which have a ſimilar eſſence correſpondent to the ſimilar denominations. *E.gr.* The word *taurus*, which ſtands for a ſign, a mountain, and an animal; and in one ſignifies a lowing animal; in another, a heap of ſtones and earth; and in the third, a conſtellation or ſyſtem of ſtars.

Æquivoca æquivocata, or thoſe that are called or denominated, are the things ſignified by ambiguous names, *e. gr.* a ſign, a mountain, and an animal; which laſt ſpecies of equivocals alone Ariſtotle ſeems to have had in view in his definition, which agrees to theſe, and theſe only.

Equivocal *action and cauſe.* See Action and Cause.

Equivocal *generation*, is a method whereby animals and plants are ſuppoſed to be produced, not by the uſual way of coition between male and female, but by ſome ſuppoſed plaſtic power or virtue in the ſun, &c.

Thus, inſects, maggots, flies, ſpiders, frogs, &c. have uſually been ſuppoſed to be produced by the heat of the ſun warming, agitating, and impregnating the duſt, earth, mud, and putrified parts of animals.

This method of generation, which we alſo call *ſpontaneous*, was commonly aſſerted and believed among the ancient philoſophers; but the moderns, from more and better obſervations, unanimouſly reject it, and hold that all animals, nay, and vegetables too, are univocally produced; that is, from parent animals, and vegetables of the ſame ſpecies and denomination.

It were a thing, one would imagine, ſufficient to diſcredit the Ariſtotelian, or rather the Egyptian doctrine of equivocal generation, to find flies, frogs, lice, &c. to be male and female, and accordingly to ingender, lay eggs, &c.

The doctrine of equivocal generation we call an *Egyptian doctrine*, as having, in all probability, had its riſe in Egypt, to ſolve the hypotheſis of the original production of men, and other animals, out of the earth, by the help of the ſun's heat.

To prove which, the Egyptians, as Diodorus Siculus obſerves, produce this obſervation, that about Thebes, when the earth is moiſtened by the Nile, and afterwards impregnated by the intenſe heat of the ſolar rays, an innumerable ſwarm of mice come forth: whence he infers, that all kinds of animals might equally have ariſen out of the earth at the beginning of things; and from theſe biſhop Stillingfleet takes the other writers and adherents to the doctrine of equivocal generation, Mela, Pliny, Ovid, &c. to have borrowed the hypotheſis without inquiring into its truth. Derham's Phyſ. Theol. lib. iv. cap. 15. See Generation.

EQUIVOCATION, Æquivocatio, the uſing a term or expreſſion that has a double ſignification.

Equivocations are expedients to ſave telling the truth; and yet without telling a falſity. The fathers are great patrons of equivocations and mental reſervations, holding, that the uſe of ſuch ſhifts and ambiguities is in many caſes allowable.

St. Auguſtine, particularly, is reproached with endeavouring to vindicate Iſaac for ſaving his wife from a crime by an equivocation; "tacuit aliquid veri, & non dixit aliquid falſi." To advance a dubious propoſition, knowing it will be underſtood in a ſenſe different from that you give it in your mind, is an equivocation, and a breach of good faith and ſincerity.

In moral theology, it is ſtrictly underſtood of a term or phraſe with two different ſignifications, the common and obvious, the other more unuſual and remote; the latter of which being underſtood by the ſpeaker, but the former by the hearers, they conceive ſomething different from one another.

Of this we have an inſtance in St. John, chap. xi. where our Saviour is repreſented as ſaying, "Lazarus ſleepeth," for the diſciples who took the word ſleeping in the uſual ſignification, concluded that Lazarus, whom they had been told, was ſick, began to take reſt, and would ſoon recover; but Jeſus, uſing the word in a leſs direct and uſual ſignification, meant that Lazarus was dead.

When the equivoque conſiſts of ſeveral words, it is properly called an *amphibology*, (which ſee,) of which we have an inſtance in St. John, chap. ii. "Deſtroy this temple," ſays Jeſus, ſpeaking to the Jews, "and I will raiſe it again in three days."

The lawfulneſs of the uſe of equivocations has been greatly diſputed among the modern caſuiſts; many grave authors deny that it is allowable to uſe them on any occaſion whatever. Their reaſon is, that an equivoque is to all intents and purpoſes the ſame thing with a lie.

EQUIVOQUE, L', in *Muſic*, is when a ſharp, by extraneous modulation, becomes a flat, and *è contra*. As the chord of D♭ becoming the chord of C♯ with a ſharp 3d, &c. See Modulation, and Extraneous.

EQUULEUS, or Eculeus, in *Antiquity*, a kind of rack, or engine of torture, uſed for extorting the truth; at firſt chiefly on ſlaves, but afterwards turned againſt the Chriſtians.

The patient's arms and legs being faſtened on the equuleus with cords, he was hoiſted aloft, and extended in ſuch manner that all his bones were diſlocated. In this ſtate, red-hot plates were applied to his body, and he was alſo goaded in the ſides with an iron-forked inſtrument, called *ungula*.

The equuleus was of wood, and had holes at certain diſtances, with a ſcrew, by which the criminal was ſtretched to the third, ſometimes to the fourth or the fifth hole: at intervals, the ſcrew was ſlackened again, by which he had ſome reſpite; but then he was tormented with queſtions.

The equuleus in more ancient times was conſtructed in the form of a horſe; the criminal was laid on his back, and his arms were turned under the breaſt of the equuleus, his hands were bound, and his feet ſtretched out towards his tail. A rope faſtened to the feet was made to paſs over a ſmaller pulley between the hind-legs of the equuleus, and made to coil over another larger pulley fixed under the belly by means of a handle, which the executioner turned round till all the bones, &c. were diſlocated. See a learned diſſertation on the form and uſe of this inſtrument, by Dr. Ward, in the Phil. Tranſ. vol. viii. part iv. p. 32, &c.

Hieronymus Magius, when a priſoner among the Turks, wrote an expreſs treatiſe "De Equuleo;" and another of Bells, merely as it is ſaid from his memory, without any aſſiſtance of books. Sigonius had another treatiſe on the ſame ſubject.

Equuleus, *Equiculus*, and *Equus minor*, *equi ſectio*, the *Horſe's Head*, in *Aſtronomy*, a conſtellation of the northern hemiſphere, whoſe ſtars in Ptolemy's Catalogue are 4, in Tycho's 4, in Hevelius's 6, and in Mr. Flamſteed's 10. See Constellation.

Equuleus, in *Arts* and *Manufactures*. See Horse.

EQUUS, in *Zoology*, a genus of the Belluæ order. The fore-teeth in the upper jaw are ſix, erect, and parallel; the lower ſix, and more prominent; tuſks ſolitary, included, remote; teats two, inguinal.

Species.

Caballus. Tail with long flowing hair. *Equus cauda undique ſetoſa*, Linn. *Equus auriculus brevibus erectis, juba longa*, Briſſ. Ἵππος. Ariſtot. Ælian, &c. *Equus, equa, equiferus*, Pliny. Geſn. Aldr. &c. *Cheval*, Buff. *Roſs*, Geſn. *Horſe.*

Ferus. α. *equus ferus*, Haſſelq. *Wilde Pferde*, Gmel. Pallas. *Tarpany*, Rytſchk. Orenb. *Wild horſes*, Bell.

Domesticus. β. *equus domeſticus*. *Domeſtic horſe.*

This generous animal is cultivated in moſt parts of the earth, and is found in a wild ſtate in the deſerts of Great Tartary, in the ſouthern parts of Siberia, the banks of the river Don, and other parts of Aſia and Africa. See Horse.

Hemionus. Longitudinal dorſal ſtripe without humeral tranſverſe band; tail hairy at the tip only. *Equus hemionus*, Pallas Nov. Comm. Petrop. v. 19. Gmel. *Czigitai*, Buff.

This curious animal, deſcribed by Pallas in the Tranſactions of the Royal Academy of Peterſburgh, is ſuppoſed by that naturaliſt to be the hemionos of Ariſtotle, and which appears, if this conjecture be correct, to have remained almoſt unnoticed from the time of Pliny, who mentions it as a native of Cappadocia.

The *Czigitai*, or, as more commonly called, *Dſhiggetéi* in the Mongolian language, is a native of the deſert regions between the rivers Onon and Argun, in the ſouthern parts of Siberia, and eſpecially thoſe of Gobi, which extend even to the confines of China and Thibet. The name *Dſhiggetéi* ſignifies *Great Ears*, and is given to this ſpecies of wild horſe, becauſe its ears exceed in proportion the ſize of thoſe of the common kind. They are, nevertheleſs, ſtraighter and better formed than thoſe of the mule, to which the whole conformation of the animal bears much ſimilitude. His ſtature is that of a mule of the common dimenſions: the length being more than five feet, and his weight from four to five hundred pounds. The head is large, with an appearance of heavineſs, and the front flattened: the eyes moderate, with aſh-coloured irides. The mouth is furniſhed with thirty-four teeth. The neck is ſlender, and compreſſed with a ſoft, ſhort, erect mane, and on the fore-top a tuft of downy hair about two inches in length. The body is rather long; the breaſt large and protuberant; the back ſomewhat concave or depreſſed, with the flanks and poſterior part thin, as in the mule. The limbs are long and ſlender, with an oval callus within the fore legs; the hoofs like thoſe of the aſs; and the tail, which is two feet in length, correſponding with that of the cow, in being naked for half its length, and having the tip hairy.

During ſummer the prevailing colour of this animal is yellowiſh brown, with the upper part of the head and inner part of the limbs tawny, and ſometimes the inſide of the hind thighs and belly are ſaid to be whitiſh. The noſe is white; the mane and tail blackiſh; and the back marked with a line of cheſnut or deep black, extending from the mane to the tail. The dorſal line is rather dilated on the loins, and becomes narrower towards the tail. The ſummer coat is much ſmoother than that which it aſſumes in winter, for the hair during the latter ſeaſon is longer, and changes to a deeper or more ruddy hue, inclining at the tips to grey.

Theſe animals are of a ſocial diſpoſition among themſelves, living together in troops of twenty or thirty, or ſometimes an hundred. They prefer the open plains, abounding in ſalt marſhes; and never approach the foreſts nor mountainous ſituations. Each of thoſe troops is placed under the guidance of a leader, who is conſtantly on the watch while the reſt of the herd is at reſt, or feeding; and who, in caſe of danger, gives the ſignal of alarm, by leaping and looking ſteadfaſtly at the object which excites his fears. This vigilant leader is often killed, becauſe he is ſtationed at ſome diſtance from the herd, and oftentimes approaches ſtill nearer to the hunters, in order to watch them attentively; and when he falls the herd does not diſperſe till many of them are killed. When alarmed and put to flight the beſt horſes could not overtake them; their ſwiftneſs ſurpaſſes that even of the antelopes. They have the ſenſes of ſight and ſmell in exquiſite perfection In their manners they are naturally timid, but when cloſely preſſed by an enemy are very fierce, and defend themſelves both with their teeth and feet. Their neigh is more ſhrill than that of a horſe. The pregnant females are with young from Auguſt till the following ſpring, when each produces a foal, or rarely two.

The Czigitais would form an excellent race of ſmall horſes, could they be reduced to a ſtate of domeſtication, but ſuch is the untractableneſs of their diſpoſition, that the difficulties of training them for this purpoſe appear unſurmountable. The people of the vaſt deſerts which they inhabit purſue them only for the ſake of their fleſh and ſkin, the former of which they eſteem a delicacy.

Asinus. Tail briſtly at the extremity; a black croſs on the ſhoulders. Linn. The Aſs.

This animal is deſcribed at length under the article Asinus.

Zebra. Body pale buff, with perpendicular fuſcous bands; limbs tranſverſely ſtriped with fuſcous. *Equus zebra, faſciis fuſcis verſicolor*, Linn. *Equus indicus*, Jonſt. *Equus braſilienſis*, Jacob. *Zecora*, Ludolf. *Aſne de beauté extraordinaire*, Thevenot. *Indianiſch Maulthier*, Geſn.

The zebra is one of the moſt beautiful quadrupeds known; uniting to the grace of the horſe, and ſwiftneſs of the ſtag, a peculiar combination of colours, that renders its appearance admirable. This animal is rather larger than the common aſs, and bears ſome reſemblance to the mule. The head is of moderate ſize, and well formed, the ears long, the legs delicate, the body graceful, and the beauty of its ſhape heightened by the ſmoothneſs of the ſkin. The colour is either milk white, or faintly tinged with brown, or pale ferruginous, and the whole animal adorned with alternate pale and fuſcous bands diſpoſed with ſuch amazing regularity as to have rather the appearance of art than nature. The ſtripes run in a tranſverſe direction both on the body and limbs. The head is ſtriped with fine bands of black and whitiſh, forming a centre in the forehead. The neck is adorned with ſtripes of the ſame, running in the ſame direction as thoſe on the back, all which point perpendicularly towards the belly. The thighs and legs are faſciated tranſverſely with fuſcous. The tail is of moderate length, round, rather ſlender, marked with blackiſh bands, and terminated by a thick tuft of browniſh hair. The colours in the male are remarkably vivid, being ſometimes of a fine yellow or yellowiſh, with the ſtripes nearly black, the female is almoſt white, with the ſtripes brown.

Theſe animals are found in the hotter regions of Africa, from Ethiopia to the Cape of Good Hope; and are in particular met with in great plenty in the extenſive ſolitary mountainous waſtes of the latter tract of country. They live in large herds, and poſſeſs much of the manners both of the horſe and the aſs, are exceſſively ſwift and vigilant, and prefer ſubſiſting on the hard and dry herbage their ſterile haunts afford, to deſcending into the more fertile and more frequented plains. The diſpoſition of the zebra is more unmanageable than that either of the horſe or aſs; and even ſuch as have been taken when very young have evinced the ſame invincible degree of paſſion for liberty, when grown up, as thoſe caught at an age of maturity. The Dutch have taken great pains to train them for domeſtic purpoſes, but with little ſucceſs, and which is the more to be regretted as the domeſtication of theſe animals would be of eſſential utility to the colony. This is teſtified from the actual obſervations of many travellers.

The zebra, tranſported into the temperate climates of Europe, have been known to produce young; but their offſpring degenerates. It has been known to couple with the Arabian horſe, and to give birth to a ſmall mule not very unlike the hybrid creature formed between the horſe and aſs. According to Sparrmann, the zebra is hunted by the Hottentots for the ſake of its fleſh, which they deem excellent; but, in reality, it is in no reſpect ſuperior to that of the horſe. Le Vaillant deſcribes the manners of theſe animals: the cry of the zebra, according to this writer, is very ſingular.

Quagga. Above cheſnut faſciated with fuſcous, ſides ſpotted; belly, legs, and thighs white. *Equus quagga*, Gmel. *Opeagha*, or *quagga*, of the Hottentots. Maſſon's Travels, Phil. Tranſ.

The quagga approaches ſo nearly in reſemblance to the zebra, as to have remained till very lately confounded with it, and from various circumſtances to be conſidered as the female. This animal is inferior in ſize to the zebra. The prevailing colour reddiſh brown, and the upper part is marked with bands of black, but one of the principal differences conſiſts in the belly, legs, and thighs being white, and deſtitute of bands, as are alſo the flanks and buttocks. There is an obvious diſtinction between the two ſexes of this animal, the colours of the male being far more vivid than thoſe of the female.

The more ſolitary regions in the ſouthern parts of Africa are the haunts of this beautiful animal. They are of a ſocial diſpoſition, and in a ſtate of wildneſs, herd in troops of a hundred or more together; and it is obſerved that though they inhabit the ſame deſerts as the zebra they never aſſociate with that ſpecies. The quagga, unlike the zebra, is of a tractable nature: in ſize it is ſmaller, but ſtronger, and in proportion more robuſt. The attempts of the coloniſts of the Cape to reduce this animal to a ſtate of ſervitude, like the horſe, has been attended with ſome ſucceſs; an inſtance of this is mentioned by Sparrmann. Quagga, opeagha, and alſo *ewah*, or *kwah*, are the names by which the Hottentots diſtinguiſh this animal; its cry reſembles the barking of a dog, in which ſounds, ſimilar to the latter words, are frequently repeated. Its fleſh, which reſembles that of the zebra, is eaten by the natives.

Appendix.

Biſulcus. Hoofs cloven. Gmel. *Guémul*, or *Huémul*, Molina. Hiſt. Chili.

The cloven-footed, or Chileſe horſe, is an animal of very ambiguous character, and which, if our ſuſpicions be well founded, will be removed from the equus tribe whenever naturaliſts become better acquainted with this ſuppoſed ſpecies than they appear to be at preſent. The animal ſeems to have been unknown till obſerved by Wallis in the ſtraits of Magellan. Molina, in his "Storia Naturale del Chili," deſcribes it as a horſe, under the title of *Guémul* or *Huémul*, and, as later writers depend on the authority of Molina for their deſcription of this anomalous animal, it may not be amiſs to repeat the particular information his account affords us. The guemul is deſcribed by him as reſembling in different reſpects both the horſe and the aſs; it bears an affinity to both, but cannot appertain to either; the diviſion of the hoofs alone being ſufficient to remove it from theſe apparently congenerous animals. In point of ſtature and appearance, the texture of the hair, and colour, the guemul, according to Molina, reſembles the aſs. The form and diſpoſition of the teeth correſpond with thoſe of the horſe. The ears are not long, as in the aſs; they are ſhort, ſtraight, and pointed, as in the horſe; neither is the back or ſhoulders of the guemul marked with the black ſtripe by which the aſs is uſually diſtinguiſhed. The head is better formed than that of the aſs, the cheſt more elegant, and the tail and buttocks more graceful. The internal conformation affords the moſt obvious diverſity; and the voice, dependant, in a material degree, on this interior organization, rather reſembles the neighing of the horſe than the bray of the aſs. Gmelin is not correct in his tranſlation from Molina, when he deſcribes the "ſtructura interna," &c. as correſponding with that of the aſs; this point may be thought material to the developement of the true character of the animal, and ſhould be therefore mentioned; and the more eſpecially ſince the ſame miſtake prevails in all the Engliſh deſcriptions of this cloven-footed, or Chileſe horſe, that we have ſeen.

Molina ſpeaks of the guemul as an animal of a vicious nature, wild, and of ſurprizing velocity. It inhabits the heights of the moſt inacceſſible mountainous regions of the Andes of Chili; and it is ſaid, beſides, to be found in other Alpine tracts of South America.

The information upon which this animal is deſcribed appears to be not ſufficiently explicit. We think the guemul ought not to be retained with the horſe or equus tribe. Perhaps it is of the camelus tribe, or that, with ſtill more propriety, it ought to be allowed to conſtitute a new genus. An ingenious writer obſerves, that "if only a ſingle ſpecimen of this animal had been deſcribed, we might have heſitated as to admitting it otherwiſe than as an accidental variety." We could have wiſhed the other authorities alluded to had been adduced. The continental naturaliſts offer argument and ſpeculation dependant on the deſcription given by Molina only; any farther information would therefore prove acceptable. In the Gmelinian "Syſtema Naturæ" this animal is claſſed as a horſe. Sonnini conſiders it as allied to the lama, or camelus glama, and camelus vicugna. According to the character "pedes ungula indiviſa," eſtabliſhed by Linnæus for the equus genus, nothing can be more abſurd than a cloven-footed horſe. Its affinity to the camel appears rather more evident, or, as before intimated, if it be not of that tribe, it is not improbable that it may conſtitute a new genus.

Equus *Marinus*, in *Ornithology*, the *Fulmar* of Pennant and Latham, and the Procellaria *Glacialis* of other writers, which ſee.

Equus *Marinus*, in *Zoology*, a name given by ſome to an animal very different from the hippopotamus, or river-horſe, and more uſually known by the name of the *Morſe*. See Trichechus *Roſmarus*.

ERA, in *Chronology*. See Æra.

Era, in *Geography*, a river of Tuſcany, which runs into the Arno; 14 miles above Piſa.

ERABA, a town of Perſia, ſituated on the eaſtern bank of the river that anſwers to the Arabius of Alexander and Nearchus.

ERACLISSA, in *Botany*, ſo named by Forſkall, from the Greek village near which he gathered it, is according to Juſſieu, no other than *Andrachne telephioides* of Linnæus. See Forſk. Fl. Ægyptiaco-Arab. 208.

ERACTUM, in *Ancient Geography*, a town of European Sarmatia, in the country of the Baſtarnæ, according to Ptolemy. It has been thought to be the modern *Row*, a ſmall town of Podolia.

ERADICATIVE, in *Medicine*. See Radical.

ERÆ, in *Ancient Geography*, a ſmall maritime, fortified town of Aſia Minor, in Ionia, according to Strabo, who ſays that it was either founded or poſſeſſed by the Teians.

ERAGE, a town of Africa, in the Pentapolis, according to Ptolemy.

ERAGISA, Rajik, a town of Syria, in the Cyrrhaſtii territory, upon the banks of the Euphrates, according to Ptolemy, ſituated S. S. E. of Hierapolis.

ERAGROSTIS, in *Botany*, from ερος, *love*, and αγρωστις, *graſs*, the name of an elegant graſs, *Poa Eragroſtis* of Linnæus, called in Latin *Gramen Amoris*, and in French *Amourettes*. See Sm. Fl. Græc. Sib. t. 73, where the Linnæan *Briza Eragroſtis* is given as a ſynonym.

ERANA, in *Ancient Geography*, a borough of Aſia, in Cilicia; being the chief place of mount Amanus, upon which it was ſituated, on the ſame ſide with the altars of Alexander. Cicero ſays it reſembled a town rather than a village.

ERANARCHA, formed of ερανος, *alms*, *contribution*, and αρχη, *command*, a public officer among the ancient Greeks, whoſe buſineſs was to preſide over and direct the alms given, and proviſions made for the poor.

The eranarcha was properly the adminiſtrator or ſteward of the poor: when any perſon was reduced to poverty, taken captive, or had a daughter to marry, which he could not effect for want of money, &c. this officer called an aſſembly of friends and neighbours, and taxed each, according to his means and eſtate, to contribute towards his relief. This is what we learn from Cornelius Nepos, in his life of Epaminondas.

ERANG, in *Geography*, a town of the iſland of Ceram.

ERANGELIA, in *Botany*, (Ηραγγελια, the herald of ſpring), a name given by Renealm in his Specimen Hiſtoriæ Plantarum, 97, to the Snow-drop. See GALANTHUS.

ERANNA, in *Ancient Geography*, a town of the Peloponneſus, in Triphylia, a province of the Elide. Strabo calls it *Erana*, and places it between Cypariſſia and Pylus.

ERANNOBOAS, or ERRANOBOAS, a river of India, according to Arrian; ſituated within the Ganges, into which it diſcharged itſelf near the town of Palibothra. This river was of the third degree of magnitude among the Indian rivers, and inferior to none but the Ganges and Indus. Major Rennell cannot apply the name Erranoboas to any particular river. Pliny certainly ſays, that the Jomanes (Jumnah) entered the Ganges by Palibothra, between Methora and Cliſobara (otherwiſe Caryſobora and Cyriſoborca): but it is equally true, that in another place he mentions the conflux of the Ganges and Jomanes, and in the very next article ſays that Palibothra is ſituated 425 miles below that very point of conflux. Strabo does not give the name of the adjoining river. See PALIBOTHRA.

ERANTHEMUM, in *Botany*, from ερα, *the earth*, and ανθος, *a flower*, according to Linnæus (Phil. Bot. 177.) who is the author of the name; but ſuch a derivation is, in the preſent inſtance, wholly deſtitute of any appropriate meaning. We ſhould have ſuppoſed it rather from ερος, love, on account of the beauty of the flower, which might well juſtify ſuch a denomination; and it is not impoſſible that Linnæus might have had this idea in his mind when he wrote the Flora Zeylanica, but forgot it when compoſing his Philoſophia Botanica. Linn. Fl. Zeyl. 6. Diſſ. Nov. Gen. Pl. 1. Am. Acad. v. 1. 384. Gen. Pl. ed. 4. 418. ed. 6. 11. Schreb. 15. Willd. Sp. Pl. v. 1. 51. Mart. Mill. Dict. v. 2. Juſſ. 110.

Gen. Ch. *Cal.* Perianth five-cleft, tubular, very narrow, erect, ſhort, pointed, permanent. *Cor.* of one petal, funnel-ſhaped; tube very long and thread-ſhaped; limb deeply five-cleft, (occaſionally four-cleft), flat, its ſegments obovate. *Stam.* Filaments two, very ſhort, in the mouth of the corolla; anthers nearly ovate, compreſſed, projecting beyond the tube. *Piſt.* Germen ovate, minute; ſtyle thread-ſhaped, reaching to the top of the ſtamens; ſtigma ſimple. *Peric.* and *ſeeds* not known. Linnæus adds, that he had ſeen only a ſingle ſpecimen, (which by the mark †, was a dried one), and therefore he left the genus to the attentive examination of other botaniſts.

Eſſ. Ch. Corolla five-cleft; tube thread-ſhaped. Anthers projecting beyond the tube. Stigma ſimple. Fruit ....

Such are the characters given by Linnæus, and copied by Schreber, but the plant whence they were taken being no other than a *Juſticia*, very near, if not the ſame with *J. pulchella*, Roxb. Corom. t. 177, *Eranthemum* falls to the ground. Linnæus indeed, in his own Gen. Pl. has made the following manuſcript corrections: that the two upper ſegments of the calyx are the ſhorteſt; ſegments of the corolla not obovate but oblong, two of them joined together; anthers within the mouth of the tube.—Whence theſe corrections were taken we have no knowledge; probably from ſome of the plants he ſubſequently referred to *Eranthemum*, for he certainly never again ſaw the ſpecimen he originally deſcribed from Herman's herbarium, nor had he in his own any thing to illuſtrate the ſubject. In the Species Plantarum one ſpecies only is mentioned, by the name of *E. capenſe*, ſaid to grow in Ethiopia, and to have the habit of a *Chironia*; yet he comprehends under it the plant of his Flora Zeylanica, which, as we have ſaid, is a *Juſticia*, and with this laſt the ſynonyms of Herman's Paradiſus, Amman and Ray have certainly no connection. In the thirteenth and fourteenth editions of the Syſtema Vegetabilium *Selago dubia* of Sp. Pl. having but two ſtamens and its fruit not aſcertained, is called *Eranthemum anguſtifolium*; while another ſpecies, called *parvifolium*, is adopted from Bergius, along with a ſynonym of Commelin, who figures it with four ſtamens and all the aſpect of a *Selago*; indeed Linnæus, in his own copy of Bergius, has expreſſed a ſuſpicion of its being ſuch. *E. ſalſoloides*, from Teneriffe, the only ſuppoſed ſpecies beſides is deſcribed in the Suppl. Pl. but wholly unknown to us. How far the above, and other ſpiked ſpecies of *Selago*, may conſtitute a genus by themſelves, as Juſſieu ſuſpects, we muſt leave in doubt; but if ſo, they cannot have any thing to do with the name or the above generic characters of *Eranthemum*. S.

ERANUSA, in *Ancient Geography*, a ſmall town of Italy, placed by Pliny near the promontory of Lavinium.

ERARIUM. See ÆRARIUM.

ERAS, in *Ancient Geography*, a town of Aſia Minor, in Ionia, in the vicinity of Epheſus, according to Thucydides.

ERASED, in *Heraldry*, expreſſes any thing that ſeems violently torn off from its proper place. It is uſed in contradiſtinction to couped, which ſignifies a thing clean cut off. The family of Card bears ermine, a demy lion rampant eraſed, azure, &c.

ERASINUS, in *Ancient Geography*, a river of the Peloponneſus, in Arcadia, according to Strabo, who ſays that this river had its mouth near Bura, in the gulf of Corinth.—Alſo, a river of Greece, in Eretria. Strabo.—Alſo, a river of Greece, in Attica, near Brauron. Strabo.—Alſo, a river of Aſia Minor, in Lycia.—Alſo, a river of the Argolide, towards the S. E. of Cenchrea, which formed a confluence with the Phryxus.

ERASISTRATUS, in *Biography*, a phyſician of great reputation among the ancients, but of whoſe parentage and birthplace, as well as of the æra in which he flouriſhed, different accounts have been tranſmitted to us by different writers. It appears moſt probable, however, that he was born at Julis, in the iſle of Cea or Ceos, (and not in Cos, the birthplace of Hippocrates, as has been aſſerted,) that he was the moſt diſtinguiſhed pupil of Chryſippus, the Cnidian phyſician, and had attained a high character in his profeſſion in the 123d olympiad. His fame acquired him the notice and eſteem of Seleucus Nicanor, king of Syria, at whoſe court he is ſaid to have evinced his ſagacity in the following manner. Antiochus, the king's ſon, was ſeized with a ſevere malady, and the moſt ingenious phyſicians of the time were unable to diſcover the cauſe of it; until Eraſiſtratus, obſerving the prince moſt attentively, remarked, that whenever Stratonice, his father's ſecond wife, entered his apartment, he became conſiderably agitated, a bluſh ſuffuſed his countenance, his voice grew more feeble, and his pulſe quickened:—whence the phyſician decided that his diſorder was the effect of a concealed paſſion for Stratonice. In order to inform the king of this delicate affair, he ſtated that

Antiochus's diſeaſe was the reſult of a paſſion, the more unfortunate as it could not be gratified. The king, ſurpriſed at the impracticability of gratifying the inclinations of his ſon, demanded eagerly who was the object of his love. "My wife," replied Eraſiſtratus, promptly. Seleucus having urged him ſtrongly not to occaſion the death of his ſon, by refuſing to give up his wife, Eraſiſtratus inquired, if he would give up Stratonice to ſave his ſon's life, were ſhe the object of his affection; with which the king expreſſed his ready compliance, and Eraſiſtratus avowed that this would be the only means of preſerving the life of Antiochus. Seleucus immediately declared him king of the provinces in Upper Aſia, and gave him Stratonice in marriage, although ſhe had already had one child.

The great character of Eraſiſtratus, however, is founded upon more ſolid ground than this anecdote diſplays. He may be conſidered as the father of anatomical ſcience, at leaſt conjointly with Herophilus. It ſeems to be clearly eſtabliſhed, that, before the time of theſe phyſicians, no one had dared to diſſect human bodies; anatomical examinations had been confined excluſively to the bodies of brutes. Human bodies had, indeed, been opened for the purpoſe of embalming, among the Egyptians, but no anatomical inquiry had reſulted from that practice. The Ptolemies, eſpecially Soter and Philadelphus, being deſirous that the arts ſhould be cultivated, and having ſurmounted the prejudices of the age, granted the bodies of malefactors to the phyſicians for diſſection, of which opportunity Eraſiſtratus and Herophilus availed themſelves largely, and made ſeveral important diſcoveries. To what extent theſe diſcoveries were carried, it is not eaſy to aſcertain, ſince the works of theſe phyſicians are loſt; and what we learn reſpecting them is chiefly through the medium of Galen, who deeming Eraſiſtratus in ſome ſort a rival of his idol, Hippocrates, ſeldom quotes him but to confute him. It is aſſerted by Celſus (De Medicinâ, Præfat.), that the monarchs above-mentioned took the condemned criminals from priſon, and gave them up to Eraſiſtratus and Herophilus, who diſſected them alive, in order to obtain a more accurate knowledge of the vital motions. (See EMPIRIC.) It has been doubted, however, whether they were guilty of this barbarous practice, in conſequence of their adoption of the opinion of Praxagoras, that the veins only received blood, and the arteries, and left ventricle, air; ſince, if they had opened the living body, they muſt have had ocular demonſtration of the exiſtence of blood in the latter: and this imputation is ſuppoſed to have been thrown upon them in a fabulous age; juſt as Medea is ſaid to have boiled living men, becauſe ſhe was the firſt who practiſed warm bathing. (See Eloy Dict. Hiſt.) It would appear, however, from the ſtatement of Galen, that the evidence of their ſenſes, upon this ſubject, was contravened by this ſort of ſubterfuge: "as ſoon as the left ventricle of the heart is opened," they obſerved, "the air is diſſipated, and the ventricle is inſtantaneouſly filled with blood." (Galen, an ſanguis ſit naturâ in arteriis.)

Eraſiſtratus and Herophilus were the firſt who diſſected the human brain accurately; according to the fragments preſerved by Galen, Eraſiſtratus deſcribed the brain minutely, its convolutions, the diviſion of cerebrum and cerebellum, its cavities or ventricles, with their paſſages of communication, and the origin of the nerves; and he inferred that the brain was the common ſenſorium, or ſource of all the vital actions and ſenſations, which were effected through the medium of the nerves. (Galen, De Hippoc. et Platon. decret. lib. vii. cap. 3.) He alſo examined minutely the ſtructure of the heart and of the great veſſels, and was the firſt to point out the valvular apparatus, and its peculiar form in each of the cavities of that viſcus. (Loc. cit lib. i. cap. 10. and lib. vi. cap. 6.) He affirmed that the veins divided in the liver, for the purpoſe of ſecreting the bile; and knew that the urine was ſecreted by the kidnies.

His phyſiology, in general, was not, however, very profound, and his pathology neceſſarily imperfect; although he attempted to explain the cauſes of diſeaſes from his knowledge of the ſtructure of the body. The function of reſpiration ſerved, in his opinion, merely to fill the arteries with air. "The thorax being dilated," he ſaid, "the lungs expand at the ſame time, and receive air: this air paſſed to the extremities of the diviſions of the trachea, and from them into the extremities of the pulmonary artery, whence it is pumped into the heart, by the dilatation of that organ, in order to be diſtributed to all parts of the body, by the great artery." He attributed digeſtion to attrition produced by the coats of the ſtomach; but he did not attempt to explain the particular manner in which the ſtomach accompliſhed ſuch attrition.

The hypotheſis, by which Eraſiſtratus attempted to explain the origin of inflammation, reſembled, in its leading feature, that modern ſuppoſition, which, ſanctioned by the name of Boerhaave, was generally received in the medical world for a long ſeries of years. (See ERROR *loci*.) He maintained, as we have already ſtated, that the great vein (*vena cava*) was the reſervoir of blood, and the great artery (*aorta*) the reſervoir of air. "Theſe reſervoirs are divided and ſubdivided," he affirmed, "until they arrive at the ſurface, where the ramifications become ſo minute, that the blood cannot paſs farther. Here the mouths or extremities of the arteries and veins cloſe to each other, but the blood continues within its proper bounds, and does not enter the arterial or air-veſſels, ſo that the body continues in the natural ſtate. But when any cauſe of violence occurs to diſturb this regularity, the blood is inſinuated into the arteries, and hence the origin of diſeaſes. Among the cauſes of diſturbance juſt alluded to, too great abundance of blood is the principal; for by it the coats of the veins are preternaturally dilated, and their extremities, which are ordinarily impervious, open, and admit of the paſſage of the blood into the arteries. This transfuſed blood becomes an impediment to the courſe and motion of the arterial ſpirit or air, which is ſent from the heart; and if the oppoſition of the two matters is direct, or if the blood be arreſted near a vital part, a *fever* is produced; but if the air repel the blood, ſo that it paſs not farther than the extremity of the artery, *inflammation* of that part is the conſequence." (Galen, de venâ ſect. adverſ. Eraſiſtratum.)

The practice of Eraſiſtratus, like that of his maſter Chryſippus, was extremely ſimple. He did not employ bloodletting, nor purgatives; conſidering the former as hazardous in the operation, and debilitating in its effects, and the latter as not bringing away the proper humours of the body, but humours in a ſort of corrupted ſtate. He ſometimes employed glyſters, but theſe of the mildeſt qualities. All theſe remedies operated, in his opinion, by reducing plethora, which might be effected more ſafely and naturally by faſting, or abſtinence in diet, eſpecially when aided by exerciſe. He adviſed his patients, therefore, to uſe ſuch articles of diet as contained little nutriment, as melons, cucumbers, and vegetables in general. He was exceedingly averſe from the employment of compound medicines, and eſpecially of the mixture of mineral, vegetable, and animal ſubſtances; and he exclaimed againſt the uſe of the antidotes of the phyſicians of his day, in which ſimplicity was altogether ſhunned.

From the fragments of his writings to be found in Galen and Cælius Aurelianus, it would appear, that Eraſiſtratus wrote an accurate treatiſe on the dropſy, in which he diſapproves of the operation of tapping; and that he had left other books on the following ſubjects:—*viz.* on the Diſeaſes of the Abdomen, on the Preſervation of Health, on wholeſome Things, on Fevers, and Wounds, on Habit, on Palſy, and on Gout.

Having lived to extreme old age, and ſuffering ſeverely from the pains of an ulcer in the foot, Eraſiſtratus is ſaid to have terminated his exiſtence by ſwallowing the juice of cicuta, or hemlock. See Le Clerc, Hiſt. de la Medicine, Eloy, Dict. Hiſt. Cælius Aurel.

ERASMUS, Desiderius, a man of great celebrity in the republic of letters, was born at Rotterdam on the 28th of October, 1467. He was the natural ſon of Gerard, a native of Tergou, by Margaret the daughter of a phyſician, whom he intended to marry, but being deceived by a report of her death, he entered into the church, and on this account Eraſmus has been called, by way of reproach, the ſon of a prieſt, though his father was not in orders at the time of his birth. When Eraſmus was about nine years old he was ſent to ſchool at Deventer, where he made very conſiderable progreſs in learning, and was particularly diſtinguiſhed by the excellence of his memory. His mother, who followed him to Deventer, to watch over his health, died of the plague when he was about 13 years of age. He was now left an orphan, and his guardians, forgetful of the ſacred truſt repoſed in them, forced him into the church with a view of embezzling his property. Eraſmus reſiſted their importunity for a conſiderable time, but at length, when he was nineteen years old, he entered among the regular canons in the monaſtery of Stein, near Tergou. He was of a delicate conſtitution, and his health was not ſufficiently robuſt for the life of a monk. His temper and ſentiments were likewiſe averſe from the habits of the profeſſion; he accordingly, with the leave of his ſuperiors, accepted, in his 23d year, an invitation to reſide with the archbiſhop of Cambray; but finding the patronage of that prelate not equal to his expectations, he went to Paris and ſtudied in the college of Montaigne. Here he ſupported himſelf by giving private lectures to thoſe who were leſs advanced in their learning than himſelf. His neceſſities required great exertion, and thus he acquired habits of induſtry which raiſed him to the higheſt pitch of literary excellence. Some of his pupils at Paris were the ſons of Engliſhmen of conſiderable conſequence, by whoſe liberality and earneſt requeſt he viſited their country, and contracted many valuable friendſhips. This was in the year 1497; from England he went to Italy, continued a year or more at Bologna, from thence to Venice, where he publiſhed his Adagia; afterwards to Padua, and at laſt he viſited the capital, Rome, where his reputation was very high, and where he might have ſettled to great advantage, had he not determined, at the entreaties of his friends, and by the expreſs invitation of Henry VIII. to return to England. Henry, while prince, had contracted a friendſhip and high reſpect for Eraſmus, and in a few months after he ſucceeded to the crown, we find Eraſmus at the court of London high in favour with the monarch, with Wolſey, with the archbiſhop of Canterbury, and with other perſons of diſtinction.

At firſt he lived with ſir Thomas More, under whoſe roof he wrote his "Moriæ Encomium," or "Praiſe of Folly," a witty and ſatirical compoſition. He afterwards went to Cambridge, and read lectures to the ſtudents in Greek and theology. For this he was remunerated with a living and many valuable preſents, though not of ſo ſubſtantial a nature as to ſatisfy his expectations. He wiſhed for an independency, and not being able to ſecure that in England, he went over to Flanders in 1514, and was ſhortly after created nominal counſellor to prince Charles of Auſtria, with a ſtipend. Soon after this he paid a viſit to Baſil, where he formed an intimacy with ſome valuable friends, which induced him to ſpend his latter days in that place. At Baſil he publiſhed, in the year 1516, his New Teſtament, in Greek and Latin, which was received with the utmoſt eagerneſs by all thoſe whoſe minds were turned to theological purſuits. It was dedicated to Leo X. In the courſe of the ſame year, his edition of St. Jerome, a favourite author, made its appearance, which he inſcribed to his generous patron, archbiſhop Warham. Eraſmus was ever inimical to that ſyſtem of war which in his time, as in ours, was but too much in faſhion among the ambitious rulers of mankind; he publiſhed, in 1517, a work entitled "Querela Pacis, undique gentium ejectæ profligatæque," which is written with much ſtrength of reaſoning and true eloquence. By his contemporaries he was charged with maintaining the unlawfulneſs of war on all and every occaſion: this, however, was a calumny invented by his enemies, of whom he had many, for, in the work alluded to, he expreſsly ſays he is ſpeaking only of wars undertaken on trifling and unjuſtifiable occaſions. "I think," ſays he, "very differently of wars, which are ſtrictly and purely defenſive, ſuch as with an honeſt and affectionate zeal for the country, repel the violence of invaders, and at the hazard of life, preſerve the public tranquillity." He was aware of the horrors and atrocities of a ſtate of warfare, and thought almoſt any ſacrifice might be made by wiſe princes to prevent it. He undertook to vindicate the cauſe of peace, whom he makes the ſpeaker on this occaſion. But the arguments which he puts into her mouth, and the perſuaſive eloquence with which ſhe addreſſes the ſovereign princes of thoſe dark times, as they are ſometimes called, would ſcarcely be borne by the monarchs of Europe in this enlightened age. His deſcriptions are vivid, and his reflections but too juſt: "Exuruntur vici, vaſtantur agri, diripiuntur templa, trucidantur immeriti cives, dum princeps interim otioſus ludit aleam, dum ſaltitat, dum delectat ſe morionibus, dum venatur, dum amat, dum potat. O Brutorum genus jam olim extinctum! O fulmen Jovis aut cæcum aut obtuſum." To whom this is particularly applied it does not appear, but the "Querela Pacis" was occaſioned by the following remarkable circumſtance:

It was a favourite project at this period to aſſemble a congreſs of kings at Cambray, conſiſting of the emperor of Germany, the kings of France, England, and the Low Countries; "of which," ſays the author, "I am a native. They were to enter into mutual and indiſſoluble engagements to preſerve peace with each other, and throughout Europe. This momentous buſineſs was very much promoted by William a Ciervia, and by one, who ſeemed to have been born to advance the happineſs of his country, and of human nature, John Sylvagius, chancellor of Burgundy. But certain perſons, who get nothing by peace, and a great deal by war, threw obſtacles in the way which prevented this truly kingly purpoſe from being carried into execution. After this great diſappointment, I ſat down and wrote, by deſire of Sylvagius, my Querela Pacis." This work was dedicated to Philip of Burgundy, biſhop of Utrecht, who was likewiſe a zealous promoter of peace, and who, ſo far from being offended with the free ſentiments of the book, thanked the author, and even preſſed him to accept a living, as a remuneration, which he civilly refuſed. Eraſmus ſought no preferment, though, ſays his biographer, he merited the higheſt: he ſought the happineſs of his fellow creatures, and felt himſelf abundantly rewarded by his own conſcience, and their approbation. The biſhop, however, in token of his high eſteem, ſent him a moſt beautiful ring, ſet with a ſapphire, which his own brother, his predeceſſor, in the biſhopric, had conſtantly worn, and which he deſired Eraſmus to wear for his ſake.

The commencement of the reformation, under Luther, was a circumſtance of conſiderable importance in the life of Eraſmus. He had ſhewn himſelf inimical to the ſuperſtitions of the times, he had arraigned the principles and practices of the monks, and had done much to undermine the whole ſyſtem of popery, and to expoſe the various frauds which had been attached to its obſervance by avaricious and licentious prieſts; yet he was not prepared to join the reformers as ſuch, his zeal was not ſufficient to enable him to endure perſecution: he did not wiſh to break openly from the church, nor was he quite ſatisfied with the doctrines of the reformers, and ſtill leſs was he diſpoſed to coaleſce with the rudeneſs, vulgarity, and contempt of polite literature which characterized ſome of that claſs of people. It has alſo been ſaid that he was very deſirous of being noticed by the great, that he had habituated himſelf to that degree of indulgence, which would render the proſpect of poverty and impriſonment abſolutely inſupportable to his mind. His income likewiſe aroſe almoſt entirely from penſions which he received from crowned heads, prelates, and men of conſequence belonging to the Catholic perſuaſion, which he would unqueſtionably have loſt had he gone over to the oppoſite ſide. Theſe are the reaſons which have been aſſigned why Eraſmus did not come boldly forward in defence of the reformation; but with theſe deductions there is enough in his character to challenge the admiration and gratitude of the friends to liberty and the human race. He was ever the undaunted advocate of free enquiry, and perpetually waged war againſt the ignorance and bigotry that characterized the age in which he lived. On theſe accounts he was, in the firſt years of the reformation, highly regarded by Luther, and it was owing to ſome unadviſed, and, probably, unwarranted attacks made upon Eraſmus, about the year 1520, by the zealous reformers, that he was driven to enliſt among the defenders of the church of Rome.

In the year 1522, he publiſhed his "Colloquies," which, though apparently intended for young perſons, were generally read, and are ſuppoſed to have been very efficacious in promoting the principles of the reformation. As ſoon as their tendency was diſcovered, the clergy attempted to ſtop their ſale, but it was then too late; more than twenty thouſand copies of them were diſpoſed of in Paris, beſides a number of editions which were printed and ſold in other places.

In 1524, Eraſmus publiſhed his treatiſe, "De Libero Arbitrio," which was an avowed attack upon Luther's opinion concerning predeſtination, but the author, in his zeal, ſpoke againſt reformers in general; Luther replied, and had unqueſtionably the beſt of the argument: in ſome paſſages he ſeemed to commiſerate the caſe of his antagoniſt, and to regret the neceſſity that he was under of expoſing him. "We ſaw," ſays he, "that the Lord had not conferred upon you the diſcernment, the courage, and the reſolution to join us in oppoſing thoſe monſters, and therefore we dared not to exact from you that which greatly ſurpaſſes your ſtrength and capacity." He then refers to the motives of worldly intereſt by which Eraſmus had ſuffered himſelf to be ſwayed from the path of rectitude. The controverſy increaſed in violence, and much unjuſtifiable acrimony proceeded from the pens of the diſputants. Under the article Reformation we ſhall have occaſion to enter more at large into this ſubject, and alſo into the controverſy between Eraſmus and Melancthon.

Another antagoniſt with whom our author had to contend was Julius Cæſar Scaliger, who had put himſelf at the head of thoſe who were ſo faſtidious in the uſe of pure Latin as to reject every word not to be found in the works of Cicero, and who on that account had aſſumed the title of "Ciceronians." Eraſmus, ſuperior to this pedantry, employed new words for new ideas, and in juſtification of his conduct publiſhed, in 1528, a dialogue entitled "Ciceronianus," in which he attacked the ſect both with argument and ridicule. Scaliger wrote againſt him with all the malignity that human wit and learning could deviſe, and he was backed in his ſcurrility by others of the Ciceronians leſs able in the warfare, but not leſs inveterate than their maſter. The nature of this controverſy is fairly exhibited in the notes on the life of Eraſmus by Bayle.

Eraſmus, wearied, perhaps, by diſputation, publiſhed, in a ſhort time after his "Ciceronianus" had made its appearance, a treatiſe of much ability and learning, entitled "De Recta Latini Græcique ſermonis Pronunciatione." In the year 1529, Eraſmus left Baſil for Friburg, in order to ſhew his attachment to the church which had for ſome years been loſing ground in Baſil, and ſo completely had the reformed religion gained an aſcendancy there at this period, that all the images were taken from the town-houſe and other public places and burnt, which was ſuppoſed to have been the means of putting an end to the differences among the common people. Eraſmus was now advancing in life, and ſeemed, more than ever, fearful of being thought friendly to the reformation, and to ſhew his zeal for the oppoſite ſyſtem he wrote and publiſhed an epiſtle againſt ſome "who falſely call themſelves Evangeliſts," and as they, from his former works, had produced his authority againſt perſecution, he began to maintain that there were certain caſes in which they might lawfully be puniſhed capitally as blaſphemers and ſeditious perſons. Such were the unworthy ſteps to which he was led by an anxiety to keep on good terms with his patrons and protectors.

In 1535 he returned to Baſil, and ſo highly was he eſteemed by the church of Rome, that there was an intention to give him a place in the college of cardinals; but it was too late for him to accept of the high honour. His health rapidly declined, and on July 12, 1536, he died of a dyſentery at the age of ſixty-nine. He was buried with great funeral pomp in the cathedral church of Baſil, where his tomb ſtill remains. By his will he left legacies to ſeveral friends, and the reſidue of his property he devoted to charitable purpoſes. In perſon he was below the middle ſize, well-ſhaped, of a fair complexion, with a chearful countenance, a low voice, and agreeable elocution. He had aſſumed the name of Eraſmus in conformity with the pedantic taſte then prevailing among men of letters of taking names of Greek or Latin etymology; he tranſlated his name of "Gerard," ſignifying "Amiable," into the equivalent ones of "Deſiderius" in Latin, and "Eraſmus" in Greek, making uſe of both, but the latter was his common and perpetual appellation.

Eraſmus was a voluminous writer; and his works were publiſhed in nine volumes folio. They conſiſt of numerous tranſlations from the Greek; of grammatical and philological pieces; of poems, declamations, and orations; of a collection of adages and apophthegms; of works in divinity on various topics, moral, didactic, and controverſial; of a verſion of the New Teſtament, paraphraſes of the goſpels and the epiſtles, and commentaries on ſome other parts of ſcripture; and of apologies, epiſtles to correſpondents, &c. A new and handſome edition of his works was publiſhed in Holland by Le Clerc in eleven volumes folio,

1703. Dr. Jortin, the biographer of Eraſmus, ſpeaking of his Latin ſtyle, ſays, it "is that of a man who had a ſtrong memory, a natural eloquence, a lively fancy, and a ready invention, who compoſed with great facility and rapidity, and who did not care for the trouble of reviſing and correcting; who had ſpent all his days in reading, writing, and talking Latin; for he ſeems to have had no turn for modern languages, and perhaps he had almoſt forgotten his mother-tongue. His ſtyle, therefore, is always unaffected, eaſy, copious, fluent, and clear; but not always perfectly pure and ſtrictly claſſical."

No one contributed ſo much as Eraſmus to throw diſcredit upon the barbariſm and ignorance of the ſchools, or to make literature agreeable, and connect it with good ſenſe and ſolid criticiſm. He was a great public benefactor; and therefore he is juſtly regarded as one of the principal glories of his age and country. His memory is equally honoured at the place of his birth and of his death. Several of his relics are preſerved at the latter place, and at the former, the houſe in which he was born, is marked with an inſcription, and his ſtatue decorates the great ſquare. Jortin's life of Eraſmus. Bayle. Complaint of Peace. 1802.

Eʀᴀsᴍᴜs, in *Geography*, a mountain of the iſland of Ceylon; 30 miles N.W. of Trincomaly.

ERASTIANS, in *Eccleſiaſtical Hiſtory*, a religious ſect or faction, which aroſe in England during the time of the civil wars, thus called from their leader, Thomas Eraſtus, a German divine of the ſixteenth century, whoſe diſtinguiſhing doctrine was, that the church had no right to diſcipline, that is, no regular power to excommunicate, exclude, cenſure, abſolve, decree, or the like.

According to the founder of this ſect, the paſtoral office was only perſuaſive, like a profeſſor of the ſciences over his ſtudents, without any power of the keys annexed. The Lord's ſupper and other ordinances of the goſpel were to be free and open to all. The miniſter might diſſuade the vicious and unqualified from the communion, but might not refuſe it, or inflict any kind of cenſure; the puniſhment of all offences, either of a civil or religious nature, being reſerved to the magiſtrate. The pretended advantage of this ſcheme was, that it avoided erecting *imperium in imperio*, or two different powers in the ſame civil government; it effectually deſtroyed all that ſpiritual juriſdiction and coercive power over the conſciences of men, which had been challenged by popes, prelates, preſbyteries, &c. and made the government of the church "a creature of the ſtate." Moſt of our firſt reformers adopted theſe ſentiments ſo far as to maintain, that no one form of church government is preſcribed in ſcripture as a rule for future ages, as Cranmer, Redmayn, Cox, &c. and archbiſhop Whitgift, in his controverſy with Cartwright, delivers the ſame opinion. The Eraſtians formed a party in the Aſſembly of Divines in 1643, and the chief leaders of it were Dr. Lightfoot, Mr. Colman, Mr. Selden, and Mr. Whitlock; and in the houſe of commons there were, beſides Selden and Whitlock, Oliver St. John, eſq., ſir Thomas Widdrington, John Crew, eſq., ſir John Hipſley, and others of diſtinguiſhed reputation. In the aſſembly, the Eraſtians did not except againſt the preſbyterian government as a "political inſtitution," proper to be eſtabliſhed by the civil magiſtrate, but they were againſt the claim of a "divine right." Accordingly the clauſe of divine right was loſt in the houſe of commons. Neale's Hiſt. Purit. vol. ii. 4to.

ERASTUS, Tʜᴏᴍᴀs, in *Biography*, a phyſician, was born, in 1523, at Auggenen, a village in the diſtrict of Badenweiller, in Switzerland. He ſtudied at Baſil, where he was ſeized with the plague in 1542, and narrowly eſcaped death. He ſuffered a long and tedious convaleſcence, which, together with his poverty, threw an almoſt inſurmountable impediment in the way of his ſtudies; but he fortunately found a generous protector, who opened the door of the ſciences to him, and furniſhed him with the means of travelling to Italy. He took up his reſidence at Bologna, where his proficiency in the ſtudy of philoſophy and medicine was ſuch, that he obtained the honour of the degree of doctor of theſe two ſciences. Finding himſelf in a ſhort time holding a diſtinguiſhed ſituation among the men of learning, he followed the cuſtom of the times by changing his name; giving a Greek turn to his original name, which was Lieber, (beloved,) he called himſelf Eraſtus. Under this appellation he became a teacher of medicine at Heidelberg, where he obtained conſiderable reputation; and in 1581 he was called to fill the medical chair in the univerſity of Baſil. But this honourable ſituation he did not long enjoy; he died on the 1ſt of January, 1583.

He left many works behind him, of which ſome were printed during his life, and others have been publiſhed ſince his death; their contents, however, are not particularly intereſting; the following is a liſt of their titles and editions. "Diſputationum de Medicina nova Phillippi Paracelſi," p. i. Baſil, 1572, p. ii. ibid. 1572, p. iii. ibid. 1572, p. iv. et ultima, ibid. 1573, all in 4to. In theſe volumes he refutes the doctrines which Paracelſus had previouſly taught at Baſil, and had committed to writing. 2. "De Cauſa Morbor. Continente," 4to. 1572. 3. "De Occult. Pharmacor. Poteſtatibus," 4to; ibid. 1574; Francofurti, 1611. 4. "Diſputat. de Auro Potabili." 4to. Baſil, 1578, 1594. 5. "De Putredine Liber," 4to. ibid. 1580; Lipſiæ, 1590. 6. "Epiſtola de Aſtrologia Divinatrice," 4to. Baſil, 1580. 7. "De Pinguedinis in Animalibus Generatione et Concretione," 4to. Heidelbergæ, 1580. 8. "Comitis Montani, Vicentini, novi Medicorum cenſoris, quinque Librorum de Morbis nuper Editorum Viva Anatome," 4to. Baſil, 1581. 9. "Ad Archangeli Mercenarii Diſputationem de Putredine reſponſio," 4to. ibid. 1582. 10. "Varia Opuſcula Medica," folio, Franc. 1590. See Eloy Dict. Med. Biog. Dict.

ERATO, from εραω, *I love*, in *Mythology*, the name of one of the nine Muſes who preſided over love-poetry. "By Erato," ſays Callimachus in his epigram on the nine Muſes, "the pious hymn was made." To this Muſe ſome have aſcribed the invention of the lyre and lute; but particularly the pſaltery or long lyre of nine ſtrings; and ſhe is repreſented with a garland of myrtles and roſes, holding a lyre in one hand, and a bow in the other, and at her ſide a Cupid with his torch. In the portraits of Apollo and the Muſes, dug out of Herculaneum, Erato is exhibited holding a plectrum or bow in her right hand, and ſeeming to play with the fingers of her left. The pſaltery, or lyre, is more than twice the length of that in the hand of Terpſichore. (See Mᴜsᴇs.) There is alſo a Nereid of the ſame name.

ERATONOS, in *Ancient Geography*, iſlands of the Arabic gulf. Pliny deſignates their aridity by the epithet *Sitientes*.

ERATOSTHENES, in *Biography*, an eminent Greek mathematician, philoſopher, and chronologiſt, was born at Cyrene in the ſecond year of the 126th olympiad, or 275 B. C. He was educated under Ariſto, the philoſopher of Chios, and Callimachus, the poet; and he himſelf had ſeveral diſciples who were eminent, and among the number was Ariſtophanes of Byzantium, one of the moſt celebrated grammarians of his time. Such was the fame of Eratoſthenes as a man of extenſive erudition, that he was denominated πενταθλος, *i. e.* victorious in five conteſts, alluding to the five prizes of the Olympic games, and expreſſing his pre-eminence in all kinds of literary purſuits. He was alſo ſtyled the coſmographer and father of chronology, the meaſurer of the univerſe, and the ſecond Plato. On the invitation of Ptolemy Euergetes, he removed from Athens to Egypt, and ſucceeded Zenodotus in the office of librarian to the famous library at Alexandria. This office he retained under three ſucceſſive princes, diſcharging his truſt with ſingular honour, and acquiring high reputation for literature and ſcience by his writings and diſcoveries. Availing himſelf of the multitude of hiſtorical memoirs, which the library furniſhed, he was both prompted and enabled to determine the dates of many diſtinct facts, by laying down certain chronological canons, for which ſee CHRONOLOGY. He alſo employed his eminent abilities and learning, with equal ſucceſs, in reducing geography to a regular ſyſtem, and laying its foundation upon clear and ſolid principles. He likewiſe firſt introduced into his map a regular parallel of latitude, which was a geographical outline traced over certain places, whoſe longeſt day was obſerved to be exactly of the ſame length. He began it from the ſtraits of Gibraltar, and it thence paſſed through the Sicilian ſea, and near the ſouthern extremities of Peloponneſus, and was continued through the iſland of Rhodes and the bay of Iſſus, and then entering Cilicia, and ſo croſſing the Euphrates and Tigris, was extended to the mountains of India. By means of this line he endeavoured to rectify the errors in the ancient geographical map, ſuppoſed to be that of Anaximander. In drawing this parallel, he was regulated by obſerving when the longeſt day conſiſted of 14½ hours, which Hipparchus afterwards determined to be the latitude of 36°. The running of this parallel through Rhodes was a happy thought of Eratoſthenes, becauſe it not only encouraged him to trace upon his map other parallels at certain intervals from his firſt, ſuch as one through Alexandria, another through Syene, and another through Meroe, but he undertook to trace at right angles to theſe a meridian paſſing through Rhodes and Alexandria down to Syene and Meroe. His progreſſion this way enlarged his ideas with regard to the ſciences of geography and aſtronomy, and induced him to attempt a more arduous taſk, which was that of determining the circumference of the globe by an actual meaſurement of one of its great circles, making his computation upon the whole by uniting certain accurate obſervations made in the heavens with a correſponding diſtance carefully ſurveyed, and taken upon a meridian of the earth. The ſegment of the meridian which he fixed upon for this purpoſe, was that between Alexandria and Syene, the diſtance of which was meaſured, and found to be 5000 ſtadia, and the angle of the ſhadow upon the ſcaphia, or ſun-dial, which was obſerved at Alexandria, was equal to the 50th part of the circle; for at Syene there was no ſhadow from the gnomon at the mid-day of the ſummer-ſolſtice; and that this might be more accurately taken, they dug a deep well, which being perpendicular, was completely illuminated at the bottom, when the ſun was vertical. The ſubſtance of this account was taken from Cleomedes, who ſeems to have extracted it from Eratoſthenes's original work, entitled Μετρήσεις. (See Fabr. Bell. Græc. vol. ii. p. 477.) And it is publiſhed as ſuch at the end of the Oxford edition of Aratus in 1672, though under the title of Μέτρον τῆς γῆς περιφερείας. By this account Eratoſthenes made the circumference of the earth amount only to 250,000 ſtadia, whereas a multitude of original authors, (ſuch are Strabo, Geminus, Vitruvius, Macrobius, Pliny, Capella, and Cenſorinus,) have uniformly given the numbers to be 252,000. In order to reconcile theſe differences, Dr. Murdoch (Enquiries concerning Meaſures of length, prefixed to Buſching's Geography, vol. i.) has ingeniouſly ſuppoſed, that inſtead of 7° 12′, the difference of latitude was 7° 8½′, which was the $\frac{1}{50\frac{2}{5}}$th of the circumference, which would bring the calculation to 252,000 ſtadia, and that Cleomedes neglected the ſmall fractional part of the denominator; but that the principal miſtake was in meaſuring the diſtance, and finding it to be 5000 ſtadia. Eratoſthenes, by making the circumference to be 250,000 ſtadia, allowed 700 ſtadia to a degree, which, by the reduction of 8 ſtadia to a Roman mile of 5000 feet, amounted to 87½′ Roman miles to each degree. We ſhall return from this digreſſion, after obſerving, that the map of Eratoſthenes appears to have contained little more than the ſtates of Greece, and the dominions of the ſucceſſors of Alexander, digeſted from preceding ſurveys. He had ſeen indeed, and has quoted the voyages of Pytheas into the great Atlantic ocean, which gave him ſome faint idea of the weſtern parts of Europe: but they were ſo imperfect, that they could not be realized into the outline of a chart. Strabo tells us that he was extremely ignorant of Spain, Gaul, Germany, and Britain, as well as of the Gæti and Baſtarni; he was equally ignorant of Italy, the coaſts of the Adriatic, of Pontus, and of all the countries towards the north. And he mentions in another paſſage, that Eratoſthenes had made the diſtance from Epidamnus, or Dyrrhachium, on the Adriatic, to the bay of Thermæ on the Ægean ſea, quite acroſs Epirus, to be only 900 ſtadia, when it was really above 2000 ſtadia; and in another inſtance he had enlarged the diſtance from Carthage to Alexandria to be 15,000 ſtadia, whereas it amounted to no more than 9000 ſtadia.

Eratoſthenes alſo obſerved the obliquity of the ecliptic, which, in the year 230 B. C. he makes 23° 51′ 20″. (See ECLIPTIC.) In an epiſtle to king Ptolemy he gave a ſolution of the problem for the duplication of the cube; and he invented a convenient method of diſcovering the primary numbers, that is, ſuch as have no common meaſure but unity, which has been called the ſieve of Eratoſthenes. He wrote alſo numerous treatiſes in grammar, aſtronomy, hiſtory, and geography, together with dialogues on the philoſophical ſects, and poems. Fragments merely of his different pieces have reached our times, ſome of which were publiſhed at Oxford in 1672, with brief annotations, in 8vo. Theſe fragments were alſo printed in the Uranologium of Petavius at Paris in 1630, and afterwards at Amſterdam in 1703. The moſt valuable remnant of his works is his "Catalogue of the kings of Thebes in Egypt, from Menes, who firſt peopled Egypt after the deluge, to the time of the Trojan war." This contains a ſeries of 38 kings in a direct line of ſucceſſion, taken not only from the records in the Alexandrian library, but from the ſacred archives in Dioſpolis, or Thebes itſelf, and probably intended for ſupplying the defects, and correcting the errors of Manetho's dynaſties. This has been uſed by ſome of our ableſt chronologers as an authority for ſettling the Egyptian chronology. Eratoſthenes died at the advanced age of 80 or 81, having, as ſome authors report, ſtarved himſelf to death, becauſe he was unable to bear the depreſſion of ſpirits occaſioned by the decay of his ſight. Suidas. Voſſ. de Hiſt. Græc. Fab. Bib. Græc. Moreri. Anc. Un. Hiſt. Gen. Biog.

ERBACH, in *Geography*, a ſmall town of Germany, in the circle of Franconia, anciently called Erdtpach, with an old caſtle, belonging to the counts of Erbach, who, before the diſſolution of the German empire, had two voices at the diet of Ratiſbon, in the college of the imperial counts of Franconia. The whole county is about 25 miles in length, and 20 miles in breadth; its population does not exceed the number of 30,000 individuals. It is a mountainous country, but tolerably fertile, and producing both corn and wine; of the latter, that of Schonberg, near the Bergſtraſſe, is reckoned the beſt.

ERBAT, a town of Aſiatic Turkey, in the province of Diarbekir; 58 miles S.E. from Diarbek.

ERBAZ, a town of Aſiatic Turkey, in the province of Natolia; 36 miles W.S.W. from Degnizlu.

ERBITA, in *Ancient Geography*, a town of Sicily, written Herbita by Cicero. It is thought to be the modern *Nicoſia*.

ERBLSPACH, or ERLSBACH, in *Geography*, a town of Germany, in Lower Bavaria; 34 miles E.S.E. from Ingolſtadt.

ERCABUM, in *Ancient Geography*, a town of European Sarmatia. Ptolemy.

ERCE', in *Geography*, a town of France, in the department of the Ille and Vilaine, and diſtrict of Bain; 5 miles E. from Bain.

ERCEUS, of ερκος, *ſeptum*, in *Mythology*, the name by which thoſe who were appointed to guard the walls of a city invoked Jupiter. This appellation, ſometimes written *Herſæus*, was given to Jupiter, becauſe his altars, eſpecially in the houſes of princes, ſtood under the open air in places incloſed with walls.

ERCHEE, in *Geography*, a town of Perſia, in the province of Adirbeitzan; 60 miles E.N.E. of Tauris.

ERCILLA Y ZUNIGA, DON ALONZO DE, in *Biography*, an eminent Spaniſh poet, was born at Madrid in 1533. His father, deſcended from a noble family, purſued the profeſſion of the law, but dying while Alonzo was an infant, the child and his mother were received into the houſehold of Iſabella, wife of Charles V. Alonzo, as ſoon as his years permitted, was made page to the infant don Philip, whom he attended in his progreſs through the Low Countries, and part of Germany and Italy. He afterwards accompanied the ſame prince to England, to celebrate his marriage with queen Mary. During their ſtay here intelligence was received of a revolt in Chili, upon which troops were immediately ſent off, with whom Ercilla embarked and proceeded to Lima. His duty required him perſonally to engage in a ſubſequent war with the Araucanians, whoſe courage and love of liberty he admired, and even applauded, though he was under the neceſſity of uſing all his efforts in ſubduing them. The intervals of warfare he employed in recording, in heroic verſe, the intereſting ſcenes to which he was witneſs. After he had eſcaped the dangers of the expedition, he had nearly loſt his life at a tournament exhibited in honour of the acceſſion of Philip II. During the fête a diſpute aroſe between Ercilla and another gentleman; ſwords were drawn, and many joined in the conflict, which being conſtrued into a plan of mutiny by the governor, he haſtily, and without examining into the matter, condemned the principal diſputants to be beheaded. Ercilla was led to the ſcaffold, and his innocence was demonſtrated but juſt in time to ſave him from an ignominious death. He returned to Spain with his health very much impaired, in his twenty-ninth year; but after a very ſhort ſtay at home, he commenced a tour through various parts of Europe; but with what particular view has never been aſcertained. In 1570 he married, and was made gentleman of the bed-chamber to the emperor Rodolph II. Ten years after this, he was found reſiding at Madrid, in retirement and poverty. The king whom he had ſerved, and to whom he dedicated his poem "Araucana," made him no requital for his ſervices, and little more is known of him, than the mention made by a contemporary of his being engaged, in 1596, in celebrating the victories of the marquis of Santa Cruz, in a poem that has never been publiſhed.

The "Araucana" is an hiſtorical poem, containing a narrative of real events, interſperſed with fabulous circumſtances. It contains 37 cantos, is formed on no regular plan, but is an unconnected ſeries of adventures. The verſe is ſaid to be flowing and ſpirited, though ſometimes it is proſaic and inſipid. Mr. Hayley, in his Eſſay on Epic Poetry, has taken pains to make Ercilla known to the Engliſh reader, by tranſlations of ſelect parts, and an analyſis of the whole poem. Gen. Biog. Hayley on Epic Poetry.

ERCTA, in *Ancient Geography*, a mountain of Sicily, near mount Erix. Diod. Sic. Polybius.

ERCYNA, a river of Greece, in Bœotia, not far from the cave of Trophonius.

ERDENI-TCHAO, in *Geography*, a town of Chineſe Tartary, in the country of the Eluths; 680 miles N.W of Pekin.

ERDER, a town of Germany, in the circle of Weſtphalia, and country of Lippe; 12 miles N.N.E. from Lemgow.

ERDMANSDORF, a town of Germany, in the circle of Upper Saxony, and circle of Erzgeburgh; 5 miles E. of Chemnitz.

EREBENNUS, ερεϐεννὸς, a name given by Galen and ſome other of the Greek writers, as a diſtinctive epithet for the black chamæleon thiſtle, which was eſteemed poiſonous, and was by this word diſtinguiſhed from the ægleus, or ἄιγλὴς, or white chamæleon, which was an eſculent plant, and uſed by ſome as an antidote. It has happened, however, that the white chamæleon thiſtle has been by ſome called a poiſon, as well as the black; but this is only owing to a miſtake of Pliny, in ſuppoſing the effects of birdlime to have been attributed to this plant, becauſe of its yielding a viſcous, but ſafe gum, at its root. It was called by ſome *ixias chamæleon*. See IXIAS.

EREBINTHUS, in *Botany*, (ερεβινθος, an ancient Greek name for ſome kind of vetch or legume), was applied by Mitchel to a ſuppoſed new genus of his own, which is the *Galega virginiana* of Linnæus. The latter in his Sp. Pl. inaccurately quotes Mich. Gen. which ſhould mean Micheli, and profeſſor Martyn, under his *Galega*, ſp. 4, has Mant. Gen. both which would be unintelligible without an explanation

EREBUS, Ερεϐος, from ערב, *night*, in *Mythology*, a term denoting darkneſs. According to Heſiod, Chaos engendered Erebus and Night, from whoſe mixture was born æther and the day. Ariſtophanes, ridiculing ſome ancient ſyſtem of theogony, in his comedy of the Birds, introduces one of his actors as ſaying, that in the beginning were the Chaos, the black Erebus, and the vaſt Tartarus; but as yet there was neither earth, nor air, nor heavens. Night, with her ſable wings, laid the firſt egg in the womb of Erebus, whence ſprung, after ſome time, beneficent love, adorned with golden wings. From the union of love with chaos, aroſe men and animals. This was alſo the name of part of the inferi among the ancients: they had a peculiar expiation for thoſe who were detained in Erebus.

Erebus was properly the gloomy region, and diſtinguiſhed both from Tartarus, the place of torment, and Elyſium, the region of bliſs: according to the account given of it by Virgil, it forms the third grand diviſion of the inviſible world beyond the Styx, and comprehends ſeveral particular diſtricts, as the limbus infantum, or receptacle for infants; the limbus for thoſe who have been put to death without cauſe; that for thoſe who have deſtroyed themſelves; the fields of mourning, full of dark groves and woods, inhabited by thoſe who died for love; and beyond theſe, an open champaign country for departed warriors. *Æn.* lib. vi. p. 427. &c.

EREC, or Erech, in *Ancient Geography*, a town of Chaldæa, which is mentioned in the book of Geneſis (ch. x. v. 10.) as one of the places in which Nimrod began to eſtabliſh his kingdom. This was probably the Aracca, placed by Ptolemy in Suſiana, on the river Tigris, below its confluence with the Euphrates. Ammianus calls it Arecha. From this city the Arectæan fields, which abound with Naphta, and ſometimes take fire, derive their name.

> "Ardet Arectæis aut unda per hoſpita campis."
>
> Tibull.

Erec, a province of Aſia, which extended on both ſides along the common bed of the Tigris and Euphrates, from their junction to the ſea.

ERECT Flowers, in *Botany*, are ſuch as grow upright, without hanging or reclining the head. See Flower.

Erect *leaf*, *erectum folium*. See Leaf.

Erect, in *Fortification*. The defences of a face, in fortification, are ſaid to be erect when the ſeveral works bear directly and regularly upon the approaches, in ſuch manner as to tend uniformly towards the capital, from which they are drawn reſpectively. Thus, when the two baſtions which defend a curtain are equal and ſimilar, and the raveline, with all its dependencies, ſtands evenly upon the line, or capital, of that face, without obliquity, or curve, the whole of ſuch defences are ſaid to be erect. It will be readily underſtood, that in every regular fortification the whole of the defences will be of this deſcription: and that in all irregular fortifications there will probably be a mixture of erect and of oblique defence. The latter is by no means to be conſidered a defect; ſince innumerable caſes might occur in which the prolongation, or the curtailment of any particular part, ſuch, for inſtance, as the face or flank of a baſtion, might be indiſpenſably neceſſary, either to make way for ſome natural advantage, or to prevent that kind of weakneſs which might otherwiſe be entailed by the proximity of ſome height, whence enfilading might be ſucceſsfully practiſed. When, therefore, the two baſtions are diſſimilar, or when they are unequal, ſo as to render the flanked angle of either leſs diſtant on the capital, if a line of defence were to be drawn upon, and formed from, the two extremities of ſuch unequal baſtions, the raveline muſt either ſtand a little obliquely, or the baſtions muſt be unequally protected by it. This kind of obliquity is extremely rare, and is often neglected where great acceſſion of ſtrength might otherwiſe, by its adoption, be given to weak parts: it is peculiarly appropriate to fortreſſes, of which only one or two faces are underſtood to be ſubject to approach.

Erect *Viſion*, in *Optics*. See Vision.

Erect, *direct*, and *declining*, &c. *dials*, &c. See Dial.

ERECTHEUS, in *Biography*, is reckoned the 6th king of Athens, from Cecrops its founder, and is ſuppoſed to have ſucceeded his father Pandion about the year 1397 B. C. Some have referred to this reign the arrival of Ceres in Attica, after the rape of her daughter Proſerpine, who taught the cultivation of corn, about the year 1383 B. C. and the inſtitution of the Eleuſinian myſteries. Erectheus reigned 50 years, and was ſlain in a battle with the Eleuſians.

ERECTHIA, in *Ancient Geography*, a municipal place of Greece, in Attica, belonging to the Egeid tribe, and deriving its name from king Erectheus. It was the native place of the orator Iſocrates.

ERECTION, the act of raiſing or elevating a thing in a right line.

The erecting of a perpendicular on a line given, is a popular problem in geometry. See Perpendicular.

The term erection is alſo uſed figuratively; as the erection of a marquiſate into a duchy; biſhoprics can only be erected by the king.

Erection, in *Phyſiology*, is the change in the ſtate of the male penis, by which that organ is rendered capable of entering the vagina of the female, for the purpoſes of ſexual intercourſe. See Generation.

ERECTOR, in *Anatomy*, a name given to two muſcles ſuppoſed to poſſeſs the power of bringing the organs with which they are connected into an erect ſtate. They are the erector penis of the male, and erector clitoridis of the female ſubject. See Generation.

ERECTUM, Folium, in *Botany*. See Leaf.

ERECTUS, Caulis, an upright ſtem. See Caulis, *n.* 6.

EREGEM, in *Geography*, a town of Flanders; 10 miles S.W. of Bruges.

EREGMOS, from ερεικω, *I break*, a word uſed by the ancients to expreſs a bean decorticated and broken into ſmall pieces, in order to be boiled in ptiſans; and alſo applied indifferently to all the leguminous fruits broken in the ſame manner.

EREKLI, in *Geography*, a town of Aſiatic Turkey, in the province of Caramania; 60 miles E. of Cogni.

EREMEGIKE, a town of Aſia, in Thibet; 25 miles S. of Tourfan.

EREMIT. See Hermit.

ERES, or Eris, in *Geography*, a town of Perſia, in the province of Schirvan, on the borders of Armenia; 80 miles S.W. of Derbend, and 120 S.E. of Teflis.

ERESIA, in *Botany*, a name given by Plumier to a new American genus, Nov. Gen. 8. t. 25, in honour of the Grecian botaniſt Theophraſtus Ereſius; but Linnæus, and all ſucceeding writers, have, with the greateſt poſſible propriety, called the plant *Theophraſta*, which ſee.

ERESMA, in *Geography*, a river of Spain, which runs into the Duero, between Simancas and Tordeſillas.

ERESÓS, in *Ancient Geography*, a town of the iſland of Leſbos, which was the native place of Theophraſtus.

ERESUS, or Ebusus, a town of the iſland of Ebuſus, founded by a colony of Carthaginians. Its harbour was commodious, its walls very large, and its houſes well built.

ERETENUS, a river of Italy, in Venetia, famous, according to Ælian, for its excellent eels, and ſuppoſed to be the preſent Retona.

ERETHISMUS, (from ερεθιζω, to *irritate*, or *excite*). Medical writers extend the general meaning of this term to every kind of irritation which has a tendency to weaken and deſtroy the vital powers.

In this article we intend to take particular notice of a dangerous affection of the conſtitution, well known among ſurgeons by the name of the *mercurial* erethiſmus.

Mr. Pearſon acquaints us, that on his firſt ſucceeding to the ſituation of ſurgeon to the Lock hoſpital, he had occaſion to remark, that almoſt every year one, and ſometimes two inſtances of ſudden death occurred among the patients of that charity. No cauſe could be aſſigned for theſe events, but the ſubjects were commonly obſerved to be men who had either nearly, or completely finiſhed a courſe of mercury. Meſſrs. Bromfield and Williams, on being conſulted by Mr. Pearſon, concerning theſe extraordinary caſes, confeſſed themſelves ignorant of the cauſe, mode of prevention, and treatment, and explained, that they had never been able to detect any diſeaſed appearances in the bodies of ſuch perſons as had died in this ſudden and unexpected manner.

Mr. Pearſon at length aſcertained, that theſe unfortunate accidents were to be aſcribed to mercury acting as a poiſon on the ſyſtem, quite unconnected with its operation as a remedy; and that its deleterious qualities were neither in proportion to the inflammation in the mouth, nor to the actual quantity of mercury abſorbed into the conſtitution. The diſordered ſtate of the ſyſtem, implied by the mercurial erethiſmus, comes on after a long employment of mercury, and tends to a fatal termination. According to Mr. Pearſon, it is characterized by great depreſſion of ſtrength, a ſenſe of anxiety about the præcordia, irregular action of the heart, frequent ſighing, partial or univerſal trembling, a ſmall, quick, and ſometimes an intermitting pulſe, occaſional vomiting, a pale contracted countenance, a ſenſe of coldneſs; but the tongue is ſeldom furred, and the vital and natural functions are not much diſordered.

Mr. Pearſon obſerves, that when theſe, or the greater part of theſe ſymptoms are preſent, a ſudden and violent exertion of the animal power will ſometimes prove fatal. Walking haſtily acroſs the ward; riſing up ſuddenly in the bed to take food; or ſlightly ſtruggling with ſome of the other patients, are circumſtances noticed by the above gentleman as having commonly preceded the ſudden death of ſuch perſons as have died of the mercurial erethiſmus.

In order to avert the perilous effects of this peculiar affection, Mr. Pearſon ſtates, that the employment of mercury is, at all events, to be diſcontinued, whatever may be the ſtage, extent, or violence of the venereal ſymptoms. Every conſideration muſt yield to the great object of extricating the patient from a ſtate of impending deſtruction; nor would a perſeverance in the uſe of mercury, under theſe circumſtances, be of any avail, in regard even to the ſyphilitic complaints.

The patient ſhould be expoſed to a dry, cool air, without being ſubjected to any more fatigue than can be avoided. Mr. Pearſon contends, that ſitting in a room with a window open is not ſufficient, but that the patient ſhould go into a field or garden, and live as much as poſſible in the open air, till the above ſymptoms have diſappeared. This plan ſhould be conjoined with a generous diet. In this way patients have often been ſufficiently relieved in the ſhort ſpace of ten or fourteen days, to re-commence the employment of mercury, and to bear its exhibition effectually, without any bad conſequences.

The gradual approach of the mercurial erethiſmus is commonly indicated (according to Mr. Pearſon's account) by paleneſs of the countenance, a ſtate of general inquietude, and frequent ſighing: the reſpiration becomes quicker, ſometimes accompanied with a ſenſe of conſtriction acroſs the cheſt; the pulſe is ſmall, frequent, and often intermitting, and there is a ſenſe of fluttering about the præcordia. In this early ſtage the further progreſs of the mercurial erethiſmus may be frequently prevented by the exhibition of the camphor mixture with large doſes of the volatile alkali, the employment of mercury being at the ſame time ſuſpended. Alſo, when the ſtomach is not oppreſſed by ſarſaparilla, this medicine is productive of infinite benefit to perſons afflicted with the mercurial erethiſmus. See Pearſon on the "Effects of various Articles of the Materia Medica in the cure of Lues Venerea," edit. 2. p. 155 to 159.

ERETRIA, in *Ancient Geography*, a town of Greece, in the Phthiotide, a country of Theſſaly.

Eretria, a town of the iſland of Eubœa, ſituated on the ſea-coaſt at ſome diſtance to the ſouth-eaſt of Chalcis, oppoſite to the mouth of the Oropus, which, on the continent, ſeparates the limits of Bœotia from thoſe of Attica. This town was probably built by the Athenians, as Strabo ſays, before, but according to Herodotus, after the war of Troy. It was for a long time a conſiderable place, and remained in a flouriſhing ſtate under the reign of Darius, ſon of Hyſtaſpes. It was deſtroyed by the Perſians in the war of Greece, but was afterwards rebuilt, became very rich, and ſubſiſted in the time of Strabo. It was amply furniſhed with pictures, ſtatues, and ſuch ornaments. We cannot trace any remains, except a perſuaſion that it exiſted in a place called by the modern Greeks *Gravelinas*.

Eretria *terra*, *Eretrian earth*, in the *Materia Medica*, the name of a very peculiar kind of alkaline bole, dug in the Negropont, near the ancient Eretria, and once in great uſe as an aſtringent and a ſudorific.

The ancient writers in medicine all mention the Eretrian earth, and Dioſcorides and Galen deſcribe two kinds of it, a grey and white. The grey is what is properly diſtinguiſhed by this name, being an earth of a different kind from all the other boles. The white, though the ancients ſeem not to have obſerved it, yet was plainly, from their own deſcriptions, the ſame with the white bole armenic, though found in a different place. Hill's Hiſt. of Foſſ. p. 5.

The grey or genuine Eretrian earth is a fine and pure greyiſh white earth, moderately heavy, naturally of a ſmooth ſurface, of a friable texture, eaſily crumbling to pieces between the fingers, but not ſtaining the ſkin in handling; it ſticks firmly to the tongue, but melts to a butter-like ſubſtance in the mouth; it burns to a perfect ſnow-white, and efferveſces violently with aqua-fortis. But what abundantly diſtinguiſhes it from all other earths is, that if a little be wetted, and drawn over a plate of braſs or copper, ſo as to mark a line, the mark will in a little time appear blueiſh. This is recorded of it ſo early as in the writings of Dioſcorides, and experiment proves it to be true. It ſeems plainly to be owing to an alkaline quality in the earth; this it plainly manifeſts by its fermenting ſo ſtrongly with acids; and it is as well known that alkalines draw a blue tincture from copper.

The ancients all eſteemed it a great medicine, and were particularly careful in their way of preparing it for uſe, by frequent waſhing. It is now unknown in the ſhops, but its highly alkaline quality, in which it is ſo much ſuperior to all the earths in uſe, might make it worth the bringing into uſe again; and it may ſtill be had in its old place, in almoſt any quantities.

ERETRIAC School, in the *Hiſtory of Philoſophy*. See Eliac *School*.

ERETRUM, in *Ancient Geography*, a town of Italy, in the country of the Sabines, N. E. of Rome, and S. W. of Cures. Strabo preciſely marks its ſituation, when he ſays that it was on the Via Salaris, and that the Via Nomentana terminated there. It was at a ſmall diſtance from the Tiber, near the 18th mile ſtone, according to the tables of Antonine and Peutinger.

EREUATIS, a town of Aſia Minor, in Lycia.

EREUM, a town in the iſland of Sardinia.

EREWASH-Canal, in *Geography*, is the parliamentary name of an important line of canal navigation, which nearly divides the counties of Derby and Nottingham for about twelve miles, of which an account has been given under our article Canal, to this it may be neceſſary to add, that by the act of the 29th George III. for Cromford canal, the tolls on this canal for all articles, except coals and coke, were lowered to one-half of thoſe mentioned in the original act, it being provided that no ſupplies of water to the canal ſhould be taken for the uſe of the Cromford canal, except at thirty feet below the ſummit level of this. Upon this canal the very important experiment was tried, at Ilkerton common, of ſuffering the coal-owners to work their coal under the canal inſtead of paying large ſums in order to have the ſame left, as the act had provided, and a great length has been thus excavated and the ground ſettled, with only a trifling and temporary inconvenience to the canal, in raiſing the banks: on the Nottingham canal the ſame was alſo ſucceſsfully tried, even under the locks, on the recommendation of Mr. Thomas Walker; ſee *Nottingham canal.* A rail-way branch conducts from the head of this canal to Beggarlea and another to Old Brinſley collieries in Nottinghamſhire; and another, conſtructed in 1808, to the new collieries in Cotmanbury-wood in Derbyſhire.

EREZEE, a ſmall town of France, in the department of the Sambre and Meuſe, chief place of a canton in the diſtrict of Marche, with a population of 640 individuals. Its canton has a territorial extent of 272½ kiliometres, 13 communes, and 4519 inhabitants.

ERFA, a town of the iſland of Corſica; 25 miles N.N.W. of Baſtia.

ERFURT, or Erfort, anciently called *Erpes,* or *Erpisfurt,* a very old town of Germany, in Thuringia, on the river Gera, 60 miles N. by E. of Coburg. N. lat. 51° 6′. It appears to have been founded in the beginning of the fifth century. The emperor Lewis held a diet at Erfurt in the year 852. The emperor Henry I. did the ſame in 935, and Rudolph I. in 1289. The laſt diet of the empire held at Erfurt was that of the year 1566. Erfurt was not an immediate free imperial city, but it enjoyed ſeveral conſiderable lordſhips and immunities, firſt under the protection of the landgraves of Thuringia, then of the princes of Brunſwick, and laſtly, from the year 1483, of the electoral houſe of Saxony: but the archbiſhops of Mentz claiming the ſovereignty over Erfurt, it was at laſt agreed, in 1667, that they ſhould keep a governor in the city, on the expreſs condition that the Proteſtant doctrine and worſhip ſhould be reſpected. The profeſſors' chairs of the univerſity, which had been eſtabliſhed in 1392, were allowed to be filled half with Roman Catholic and half with Proteſtant teachers. In 1754 an academy of ſciences was founded, to which were ſubſequently added a botanical garden, an anatomical theatre, an aſtronomical obſervatory, a riding ſchool, and a ſociety of natural hiſtory. The beſt public libraries are thoſe of the Jeſuits, of the Scottiſh convent, and of the Lutheran miniſtry, which contained ſome valuable ancient manuſcripts of the Hebrew bible.

The moſt remarkable public building at Erfurt is its cathedral church, which is reported to have been built in the year 752. Its celebrated great bell weighs 275 cwt. In more ſuperſtitious times, pilgrims uſed to flock to Erfurt from all parts of Germany on a particular day, to dance the *dance of Death* (den Todtentantz.)

At the peace of Luneville, in 1801, the city of Erfurt, its territory and dependencies, and all the rights of ſovereignty poſſeſſed by the eccleſiaſtical elector of Mentz, or Mayence, were ceded to the king of Pruſſia, as part of the indemnities to which this monarch was entitled for his loſſes on the right ſhore of the Rhine. The population of Erfurt and its territory, together with the Eichsfeld, was, in 1802, reckoned at 121,200 individuals, and in the territory of Erfurt in particular, incluſive of the town, there were 3517 individuals to the German ſquare mile. The city of Erfurt, without the garriſon, contained 16,500 inhabitants.

But Pruſſia having declared war againſt France in 1806, Erfurt was one of the firſt towns which ſurrendered to the French after the unfortunate battle of Jena or Auerſtädt, in October 1806. The fort of Peterſberg, which protects the city, and which had always been conſidered as very ſtrong, did not even attempt a defence. At the peace of Tilſit, in 1807, Pruſſia was ſtripped of all the new acquiſitions and old poſſeſſions beyond the Elbe; and Erfurt, by the conqueror's decree of the 18th of Auguſt, 1807, was to form part of the new kingdom of Weſtphalia. But the French emperor having had a conference with the emperor Alexander I. of Ruſſia at Erfurt in the month of October, 1808, this city was again transferred, by way of compliment, to the Ruſſian emperor's brother-in-law, the preſent duke of Saxe-Weimar, who is a member of the Confederation of the Rhine. There is at Erfurt a conſiderable manufacture of ribbands, which employs above 500 individuals.

ERGALIA, of εργον, *opus,* a word uſed by the *Alchemiſts,* to expreſs that part of their treatiſes which explains the inſtruments employed in their operations.

ERGANE, in *Mythology,* the *Inventreſs,* an epithet of Minerva, becauſe to her was aſcribed the invention of ſeveral arts; ſince, beſides that of the art of war, Lucian aſcribes to her that of architecture; the art of ſpinning, of making cloth, tapeſtry, ſilk and woollen ſtuffs, is alſo aſcribed to her by the ancients. She was alſo reckoned the firſt who taught man to plant and cultivate the olive. She is likewiſe honoured with the invention of chariots, and of the uſe of trumpets and the flute, &c.

ERGASIMA, a name given by Dioſcorides and other of the ancients to a very foul and coarſe kind of myrrh.

ERGASTERIUM, a word uſed by the writers in *Chemiſtry,* ſometimes to expreſs the whole elaboratory, and ſometimes that part of a furnace on which the bottom of the retort, copel, or crucible, is to reſt in an operation.

ERGASTINÆ, Εργαστιναι, in *Antiquity,* a ſelect number of virgins employed in weaving Minerva's peplos or robe, which was carried in proceſſion at the Athenian feſtival Panathanæa. See Peplos, and Panathanea.

ERGASTULUM, among the *Ancients,* a houſe of correction, or workhouſe, where ſlaves, by the private authority of their maſters, were confined, and kept at hard labour for ſome offence. It was likewiſe called ſophroniſterium.

ERGATIA, Εργατια, in *Antiquity,* a Laconian feſtival, in honour of Hercules.

ERGAVIA, in *Ancient Geography,* a town of Spain, in the Tarragonenſis. Ptol.

ERGAVICA, a town of Hither Spain, S. of Bilbilis. This appears to have been a conſiderable place when it was taken by Gracchus in his campaign. Several medals were ſtruck here, which repreſented Auguſtus and Tiberius, with an ox upon the reverſe.

ERGENE, in *Geography,* a river of European Turkey, which runs into the Mariza, near Demotica, in Romania.

ERGERS, a river of France, which runs into the Ill, about two miles eaſt from Griſpoltheim, in the department of the Lower Rhine.

ERGETIUM, in *Ancient Geography,* a town of Sicily. Ptol. and Steph. Byz.

ERGINUS, a river of Thrace, in the vicinity of the Athyras, which ran before Sarpedon.

ERGITIUM, a town of Italy, in that part of Magna Græcia called Apulia, ſituated on the Appian way, between Teanum N.W. and Sipontum S. E.

ERGOT, in the *Manege,* is a ſtub, like a piece of ſoft horn, about the bigneſs of a cheſnut, placed behind and below the paſtern joint, and commonly hidden under the tuft of the fetlock. To diſ-ergot, or take it out, is to cleave it to the quick with an inciſion-knife, in order to pull up a bladder full of water that lies covered with the ergot. This operation is ſcarcely practiſed at Paris, but in Holland is frequently performed upon all four legs, with intent to prevent watery ſores and foul ulcers.

ERGOT, in *Agriculture*, is a vegetable diſeaſe which affects different ſorts of grain, and other crops, ſhewing itſelf, according to the author of Phytologia, by the ſeeds growing out into large horns, having a black appearance without, as in ſea-cale, rye, and in carex. It very often attacks the rye in France, and occaſionally in this country in ſuch ſeaſons as are very moiſt; the grain in theſe caſes becoming conſiderably elongated, being either ſtraight or crooked, containing a black meal along with the white; and is aſſerted to have the appearance of being pierced or perforated by inſects, which are believed by ſome to be the cauſe of the affection. It has frequently other different appellations, ſuch as clavus, or the ſpur, and horn ſeed. No certain remedy or method of preventing it has, we believe, been yet diſcovered. See next article.

ERGOT, in *Medicine*, a term originally applied, as we have ſeen, to a peculiar diſeaſe of corn, eſpecially of rye, from the reſemblance of the grains thus affected, to the ſpur of a cock: and, by metonymy, uſed to denote a diſeaſe in the human body, occaſioned by taking this diſeaſed, or *ergoted* rye as food.

The earlieſt account of this diſeaſe of rye, and of its pernicious influence on the human body, with which we are acquainted, is contained in a letter from M. Dodart to the editor of the Journal des Savans, publiſhed in March, 1676. (See vol. iv. part ii. p. 79.) The facts were communicated a few years before by the phyſicians and ſurgeons of Sologne, in which diſtrict the diſeaſe had been very prevalent. The grains of rye, affected by the ergot, according to M. Dodart, are of a blackiſh colour externally, but white within, and when dry, they are harder and of a more compact ſubſtance than the natural grains, and have no bad taſte. They are conſiderably longer than the other grains, ſome of them being fourteen or fifteen lines in length, and two in breadth; and ſeven or eight of them are ſometimes ſeen in one ear. They are obviouſly not foreign ſubſtances engendered between the grains of rye, M. Dodart adds, but the true grains, ſurrounded with their proper coats, in which the place of the germ is diſcernible. Theſe grains were called *ergots*, *ſpurs*, in Sologne; in Gaſtinois, where they alſo were known, they were termed *bled cornu*. In various other places this diſeaſed rye has been called ſecale cornutum, or corniculatum, ſecale luxurians, clavus ſecalinus, mater ſecalis, or *mutterkorn*, (by the Germans), &c. It is ſtated by Tiſſot, on the authority of Haller, that the ergot affects rye only, or two or three other Alpine plants of the graſs-kind. (See Philoſ. Tranſact. vol. lv. for 1765, p. 110. A minute deſcription of the ergot was publiſhed by C. N. Langius in 1717, the ſubſtance of which may be found in the Acta Eruditorum for 1718, p. 309.)

The learned Tiſſot, in his letter to ſir George Baker, juſt referred to, ſtates that there are two other diſeaſes which affect rye and wheat, and which have been confounded with each other, as well as with the ergot, or ſecale cornutum, *viz.* the *rubigo*, or mildew, and the *uſtilago*, *bruſure*, or blight; the former being characterized by the appearance of a reddiſh yellow powder, of a glutinous nature, adhering to the ſtalk and head of the corn; and the latter by a blackneſs and degeneration of the corn. (See Fontana on this ſubject, and ſir Joſ. Banks on the diſeaſes of corn.)

The ergot was particularly obſerved in rye in wet ſeaſons, and more eſpecially when a wet ſpring was ſucceeded by exceſſive heat. M. Dodart remarks that the bread, which was made of ergoted rye, did not differ from ordinary bread in point of taſte; that this rye was moſt particularly pernicious when new; but that its effects were not obſerved until it had been eaten for a conſiderable time. M. Noel affirms that it loſes its deleterious qualities altogether after being kept a few months in ſheaf. (See a letter in Queſnay's Traité de la Gangrène, ſeche, p. 407, Paris, 1749.) And writers in general agree in ſtating, that the diſeaſe, which the ergoted rye induces, is prevalent only at the concluſion of harveſt, and ceaſes before the commencement of winter; and that it was chiefly obſerved among the poor, who were unable to procure wheaten bread in thoſe ſeaſons of humidity and ſcarcity. (See Muller in Comment. Lipſiæ, anno 1752, p. 634, &c.)

The ſymptoms of the ergot in the human body are deſcribed ſomewhat differently by different writers; but they coincide in repreſenting a dry gangrene, and ultimately death, as the ordinary reſults of the diſeaſe. It commences with a laſſitude and debility, but with little interruption to the functions in general. A degree of torpor in the lower extremities is then obſerved, accompanied, according to ſome of the writers, with a ſenſe of prickling, and of the creeping of inſects (formicatio) upon the ſkin; a ſlight degree of ſwelling, but without inflammation, enſues, often accompanied by the moſt excruciating pains, and with a ſenſe of burning heat; ſoon ſucceeded by that of extreme cold; the ſkin of the feet and legs becomes ſhrivelled, and of a dark hue, as if dried in ſmoke, afterwards black and deſtitute of feeling; in fact the limb dies, or is gangrenous, but in a dry ſtate, which has been compared to that of a mummy. By degrees the dead parts ſeparate from the living, as if they had been deſtroyed by cauſtic. In this mutilated condition, deprived of one, ſometimes of both legs, more rarely of the hands or arms, ſome individuals have ſurvived for months, or even years.

Beſides this ſpontaneous gangrene of the limbs, another ſpecies of diſeaſe has been aſcribed to the uſe of *ergoted* rye by Hoffmann, Tiſſot, and ſome other writers; but with what juſtice or propriety may perhaps admit of a queſtion. The diſeaſe alluded to was a febrile diſeaſe, ſaid to be of a contagious and malignant nature, and to be accompanied and principally characterized by various ſpaſmodic and convulſive ſymptoms, by which, or by a general epilepſy, the patients were frequently carried off. This diſeaſe is ſaid to have been epidemic in Heſſia, Weſtphalia, and other parts of Germany, at ſeveral different periods, in the 16th and 17th centuries; and a deſcription of it by the profeſſors of the univerſity of Marpurg, in the year 1597, is generally referred to, as the firſt complete account of the diſeaſes. But in that account, of which a tranſlation is given by Gregorius Horſtius, no alluſion whatever is made to the ergot, or ſecale cornutum; bad bread is mentioned only among other ſorts of crude and unwholeſome aliment, to which the diſeaſe (occurring in a time of dearth) is there aſcribed. The whole of what is ſaid reſpecting the exciting cauſes of that epidemic is contained in the compaſs of theſe few lines. "Cauſas hujus affectus quod attinet, ex ægrotantium relatione ſcire licet, quod externa cauſa communiter in alimento, ad nutriendum minus idoneo et improportionato, conſiſtat, dum pauperes rebus ad vitam neceſſariis deſtituti, panem impurum et male coctum longo tempore, in ſummâ famis urgentiâ, devorant, interdum etiam poma acerba et auſtera, fungoſque et ſimilia deglutientes, ſeſe eduliis crudis, immaturis, et aſtringentibus ingurgitant, de quorum depravatâ concoctione cruditates obortæ, &c." (See Greg. Horſt. Opera, vol. ii. lib. viii. obſ. xxii.) A ſimilar ſtatement, reſpecting the origin of this epidemic, is given by Sennertus in his chapter, "De febre Malignâ cum Spaſmo," probably upon the authority of the Marpurg profeſſors. The diſeaſe he ſuppoſed to be excited by a malignant vapour or humour, vellicating the brain and nerves. "Malignus autem ille vapor et humor ortum habuit ex victu pravo, dum, ob annonæ caritatem, panem non bonum, fructus corruptioni obnoxios, fungos, et id genus alia, ad explendam famem, pauperes devorabant. Ex quo victu pravo vitioſos humores in corpore colligi neceſſe eſt, &c." (Sennert. de Febribus, lib. iv. cap. 16.) The diſeaſe, therefore, is obviouſly conſidered by the original writers as originating from defect of nutritious food, and the ergot is not in any way alluded to. The ſymptoms of this fever, which was called by the Germans *die kriebel-kranckheit, oder ziehende ſeuche*, the convulſive peſtilence, are thus briefly enumerated by Hoffmann. "The diſeaſe in its commencement occupies the limbs and the extremities of the hands and feet, in which a ſenſe of formication is felt. In ſome inſtances it begins with ſickneſs and vomiting. Then follow violent ſpaſmodic contractions of the fingers and toes, which at length alſo attack the knees, ſhoulders, elbows, and even the face, eyes, and lips, accompanied by an intolerable pain, and ſometimes with a ſenſe of extreme coldneſs, ſometimes with that of a burning heat. Theſe ſymptoms return at ſtated periods, and ſometimes continue for ſeveral weeks. As the pains diminiſh, the patients fall into a ſtate of drowſineſs and torpor, often into an alienation of mind, and are affected with giddineſs and deafneſs, the limbs remaining ſtiff, and deſtitute of the power of motion. In the extremities of the limbs large veſicles, filled with ſerum, often appear, and ſometimes other tumours, which paſs into a gangrenous condition, but by a very ſlow progreſs, by which ultimately even the bones have been gradually deſtroyed. A ſtate of general convulſion, or epilepſy, occaſionally ſupervenes, and proves fatal, eſpecially in children." (Hoffmann. Med. Rat. vol. ii. par. ii. cap. 9. § xvi.) A more detailed account of the ſymptoms is given by Sennertus, loc. cit. Dr. Cullen has followed Linnæus and Vogel in denominating this diſeaſe *Raphania*; (See Amœn. Academ. vol. vi.) but queſtions whether it be the ſame diſeaſe as the *Necroſis uſtilaginea*, by which term Sauvages has deſignated the ergot. (See Cullen Noſol. Meth. gen. 52. Sauvage Noſol. Meth. claſs x. gen. 39.) There is, in fact, much confuſion in the accounts of authors upon this ſubject; and it ſeems probable that the true effects of the ergoted rye are to be found only in the dry gangrene, and not in the epidemic fevers, which have been aſcribed to it.

It was long ago known that corrupted corn was poiſonous to the animal body. Galen remarked, that the ſeeds of colium temulentum mixed with wheat, or the degenerated grain, called black wheat, would produce fever, head-ache, delirium, and gangrenous ulcers. (De Aliment. facultat. lib. i. cap. 37.) Moſt of the writers on the ſubject, from M. Dodart downwards, have ſtated, that the ergoted rye, when given to fowls, hogs, and other animals, as food, produces the ſame ſymptoms as in man, and deſtroys life. More lately the Abbé Teſſier made a ſeries of experiments upon this ſubject, and has given a minute deſcription of the ergot in rye. He found that by feeding or cramming turkies and other animals with this diſeaſed rye, he could produce in all of them the dry gangrene and death. (See Memoires de la Soc. Roy. de Medecine for 1776, p. 303. Hiſt. de l'Acad. des Sciences for 1710. Acta Erudit. Lipſ. 170 et 1752. Saviard Obſ. Chirurg. The Treatiſe of M. Teſſier, &c.

The dry gangrene occurs from other cauſes than the ergoted rye. An account of a whole family conſiſting of eight perſons, who were ſeized and mutilated or deſtroyed by gangrene of the lower extremities, preceded by pain and ſome ſwelling, at Wattiſham in Suffolk, is given in the Philoſ. Tranſ. vol. lii. part ii. The ſtate of the family, three months after the commencement of the diſeaſe, is thus repreſented: "1. Mary, the mother, æt. 40. The right foot off at the ancle; the left leg mortified, a mere bone, but not off. 2. Mary, æt. 15. One leg off below the knee; the other perfectly ſphacelated; but not yet off. 3. Elizabeth, ætat 13. Both legs off below the knees. 4. Sarah, æt. 10. One foot off at the ancle. 5. Robert, ætat. 8. Both legs off below the knee. 6. Edward, ætat 4. Both feet off at the ancles. 7. An infant, four months old, dead." The father alſo ſuffered ſlightly in the fingers. Although the ſymptoms were exactly thoſe of the ergot, yet, in this caſe no rye was eaten, nor could any other circumſtance in the diet or economy of the family be diſcovered, to which the gangrene could be attributed. See GANGRENE.

ERIACH, in *Antiquity*, the name of a recompenſe aſſigned by the Iriſh Brehon law, in caſe of murder, to the friends, or to the child or wife of him that was ſlain, as a kind of compoſition between the murderer and his proſecutors.

ERIAMBO, in *Geography*, a river of Ruſſia, which runs into the Oby; 30 miles above Obdorokoi.

ERIANTHUS, in *Botany*, from εριον, *wool*, and ανθος, *a flower*, Michaux Fl. Boreali-Amer. v. 1. 54. A genus of graſſes eſtabliſhed by Michaux, in its character very near *Saccharum*, but more naturally allied to *Andropogon*, to which, if the character of that genus were reformed, Michaux himſelf ſuſpects the preſent might be referred. *Andropogon* indeed ſeems to require a thorough inveſtigation, and probably a diviſion into more than two genera.

ERIBANUM, in *Ancient Geography*, a town of Italy, in Campania, upon the Vulturnus. Polybius.

ERIBŒA, a town of Macedonia, in the country of the Parthæans. Ptol.—Alſo, a mountain of Macedonia, in the ſame country.—Alſo, a town of Aſia, in Bithynia.

ERIBOLUM, the port of Nicomedia, a town of Bithynia.

ERIC, king of Denmark, in *Biography*. There were ſeveral princes of this name, though but few of them have any claim to notice in this place. Eric the Firſt was poſſeſſed of ſo many virtues that he was ſurnamed the "Good." A muſician, celebrated for his great ſkill on the harp, aſſerted that he could deprive his hearers of their underſtanding by the powers of his inſtrument. Eric challenged him to the trial, and in the paroxyſm of phrenzy into which the performer threw the monarch, he killed four of his guards. Grieved at what he had done, he made all the recompenſe he was able to the relations of the deceaſed, and to do penance for the bloody deed, he determined to undertake a pilgrimage to the Holy Land. His ſubjects remonſtrated againſt his deſign, but he was not to be diſſuaded from his purpoſe, ſet out on his journey, and died at the iſle of Cyprus. This event took place in the year 1107.

ERIC X., king of Sweden and Norway, as well as of Denmark, the ſon of Wratiſlaus VII. duke of Pomerania, was declared ſucceſſor to the crowns of Denmark and Norway in the year 1388, by his great aunt, queen Margaret; and when, in 1396, ſhe annexed the crown of Sweden to her dominions, Eric was, by the treaty of the "Union of Calmar," declared ſucceſſor to that alſo. This celebrated treaty conſiſted of three articles 1. "That the three kingdoms of Denmark, Sweden, and Norway, ſhould thence forward have but one king, who ſhould be choſen alternately by each of them, and approved in a general aſſembly. 2. That the monarch ſhould divide his reſidence equally between the three kingdoms, and appropriate the revenues of each to its particular exigencies. 3. That each kingdom ſhould retain its own laws, cuſtoms, ſenate and privileges; and that the ſubjects of the one ſhould not be elevated to offices of profit or power in another." Theſe conditions ſeemed, at firſt ſight, to have been dictated by wiſdom, but they proved to be the ſource of wars that continued to rage during a whole century between the three kingdoms. On the death of the queen in 1412, Eric ſucceeded without oppoſition to the three united crowns. He had married the daughter of Henry IV. king of England, with whom he had a large portion, and thus might be regarded as one of the moſt potent kings of his time. Eric was ſoon involved in a war with the princes of Holſtein, which for ſome time was carried on with doubtful ſucceſs, but in 1424 the whole of South Jutland, including Sleſwick and Gottorp, was adjudged to the Daniſh crown. This award, which was made by the emperor Sigiſmund, at Buda, determined Eric upon a pilgrimage to the Holy Land. During the expedition, he was made captive, and obliged to pay a large ranſom for his liberty. His abſence from home was attended with other evils. From his acceſſion he had diſpleaſed the Swedes by refuſing to call a general diet for the confirmation of their liberties, which excited much diſcontent, that at length broke out into open rebellion. In 1435 he met the Swediſh diet at Stockholm, and agreed to a full redreſs of grievances. His promiſes, however, were of little avail to his people, who, after enduring much from his miſconduct, depoſed him in 1439, and choſe, in his ſtead, his nephew Chriſtopher of Bavaria. For ten years he made many attempts to regain his ſituation, but without ſucceſs. After this he employed himſelf in compiling a hiſtory of Denmark from the public regiſters, comprizing the period from the commencement of the monarchy to 1288. He afterwards repaired to the iſle of Rugen, where he died in 1459. Eric poſſeſſed quick natural parts, and was a lover of learning; but he was ambitious, deſpotic, irreſolute, and inſincere, qualities which led him into many difficulties, and which rendered his reign truly diſaſtrous. Univer Hiſt.

Eric XIV., king of Sweden, ſon of Guſtavus Vaſa, aſcended the throne of Sweden in 1560, at the age of twenty-ſeven, and was poſſeſſed of all the accompliſhments proper to his elevated ſituation. He ſpoke the modern languages, danced gracefully, ſhewed animation in all his actions, and was eloquent and polite. But he ſuffered himſelf to be hurried away with guſts of paſſion, which ſometimes obliterated every trace of reaſon, and rendered him furious. His father, who had witneſſed theſe fits of rage, had once formed the deſign of excluding him from the throne, and of conferring the crown on his ſecond ſon. For the ſame reaſon he refuſed to permit him to viſit England to pay his court to the princeſs (afterwards queen) Elizabeth: but negotiated the buſineſs by means of his ambaſſador and ſecond ſon John. Eric, however, almoſt immediately after his acceſſion, determined to obtain an interview with Elizabeth, and ſet ſail with a large fleet and ſplendid train, but the veſſels being overtaken by a violent ſtorm, were driven back upon his own coaſt, where he ſuffered ſhipwreck, and for a time relinquiſhed his matrimonial project. He next ſent propoſals of marriage to Mary queen of Scotland, and almoſt before he could obtain any anſwer, ſolicited from the emperor the hand of the princeſs of Lorraine, daughter of Chriſtian II. with whom he was enamoured by the deſcription of ſome of his courtiers. He received a favourable anſwer, but in the mean time he had changed his mind in favour of Elizabeth. His political conduct was as capricious as his amours, and involved him in continual quarrels with his neighbours, and a confederacy was formed againſt him by Muſcovy, Poland, Denmark, and Lubeck. His brother John, who had married Catharine, daughter of the king of Poland, fell under his ſuſpicion, and was driven to an open rupture. John was cited to Stockholm, to vindicate his conduct, and refuſing to appear, an army was ſent into Finland with orders to ſeize him and his wife, and to bring them to the capital. He was immediately thrown into priſon, accompanied by his wife, who voluntarily choſe to ſhare in his ſufferings. It is ſaid that the king went frequently to the priſon with the deſign of murdering his brother, but that on ſeeing him he felt his heart ſo moved with pity, as to prevent him from ſtriking the fatal blow. Sometimes with tears in his eyes he would confeſs the ſanguinary deſign which had prompted his viſit, and added, "I know that the crown of Sweden is intended for you, and I requeſt that, when you are in poſſeſſion of it, you will pardon my errors." This circumſtance ſtrongly diſplays the violence of contending paſſions in the mind of Eric, and has been brought to prove his inſanity.

The early years of his reign were ſpent in wars chiefly with Denmark, carried on with vigour on the part of Eric, though without any permanent advantage. Domeſtic troubles at length withdrew his attention from foreign wars, and his capricious conduct deſtroyed all reſpect for him in the breaſts of his ſubjects. Diſappointed in his matrimonial projects, he entertained a number of concubines, one of whom, a peaſant's daughter, gained ſuch an aſcendancy over him that he married her. He was under the influence of his miniſters and domeſtics of mean rank, who frequently excited his jealouſies of the great families. He entertained a particular hatred of the Stures, an illuſtrious family, deſcended from the ancient regents. Eric had taken one of them into favour, though he had, on a former occaſion, diſgraced him, and made him contemptible in the eyes of the populace. He now ſent him in the quality of embaſſador to Stralſund, but he became once more the object of the king's abhorrence, who conceived that he was conſpiring againſt his life and crown. The king took pains to convince the ſtates that Sture carried on dangerous intrigues at Stralſund, and he ſuborned witneſſes to accuſe him of treaſonable deſigns. An infamous favourite, named Peerſon, perſuaded Eric to extirpate the whole family; ſentence of death was accordingly pronounced againſt thoſe unfortunate men, together with twenty-ſix nobles, who were the pretended accomplices of a conſpiracy laid to their charge. A public trial was afterwards allowed them, in which the Stures were able to vindicate their cauſe ſo completely, and to prove their innocence ſo undeniably, that the king himſelf apologized to them for their detention and long impriſonment: nevertheleſs, in a very ſhort time, he ſtabbed Nils Sture with his own hand. The unfortunate man drew the dagger from his breaſt, and preſented it to the monarch, who, with the moſt ſavage barbarity, ordered his guards to accompliſh that which he had failed to perform himſelf. The reſt of the priſoners were alſo cruelly murdered at the ſame time. No ſooner was this bloody ſcene over than Eric felt the pangs of a wounded conſcience. He grew frantic, and, as if purſued by the avenging furies, fled into the woods, where he wandered for many days like a wild beaſt, refuſing to take food or repoſe. On his return he endeavoured to compenſate for his cruelty, by beſtowing large ſums upon the friends and relations of the victims; and by giving up Peerſon to the hands of juſtice, who was condemned but not executed. Being threatened by the king of Denmark, Eric ſet at liberty his brother John, to whom and to his other brother he propoſed aſſigning lands in Livonia, in lieu of thoſe left them by their father Guſtavus. Shortly after he formed a deſign of putting them to death, and of conciliating the friendſhip of the czar of Muſcovy, by delivering him the wife of duke John, to whom that prince had paid his addreſſes before her marriage. His intentions were diſcovered in time to defeat the purpoſe, and the brothers began to raiſe forces in their own defence. Eric made a ſtand, and an accommodation was effected, but by the treaty he bound himſelf to give up Peerſon, his favourite, who, being put to the torture, confeſſed a plot contrived by himſelf and the king, of pillaging Stockholm, burning part of the ſhips in the harbour, and proceeding with the reſt loaded with ſpoil to Narva. The dukes now felt themſelves juſtified in breaking the treaty, and they obliged Eric to capitulate in the citadel. He was put under confinement, ſolemnly depoſed by the ſtates, and duke John elected in his ſtead. His children were declared incapable of ſucceſſion, and himſelf was condemned to perpetual impriſonment. His keepers were appointed from among the relations of thoſe whom he had cruelly maſſacred, and who did not fail to ſubject him to various inſults and indignities, and not unfrequently to the evils of cold and hunger. After nine years impriſonment, he finiſhed a wretched life in 1578, in conſequence, it was ſuppoſed, of a doſe of poiſon adminiſtered by order of his brother John, who dreaded the poſſibility of his being liberated, and again ſet upon the throne. Eric was not deficient in talents; and he poſſeſſed great perſonal bravery: under his conduct the Swediſh troops repeatedly diſtinguiſhed themſelves in contending with and overcoming the Daniſh armies, and it has been thought that he would never have ſubmitted to the hard conditions which Denmark at length impoſed on his ſucceſſor. (See JOHN.) Univer. Hiſt.

ERICA, in *Botany*, ερεικη of Dioſcorides, the ſame name, variouſly corrupted, being applied to the ſeveral ſpecies of this genus among the modern Greeks at preſent, according to Dr. Sibthorp. See Prod. Fl. Græc. 256, 257.—Heath or Ling.—Linn. Gen. 192. Schreb. 258. Willd. Sp. Pl. v. 2. 356. Ait. Hort. Kew. v. 2. 14. Sm. Fl. Brit. 417. Mart. Mill. Dict. v. 2. Juſſ. 160. Gærtn. t. 63. Tourn. t. 373. Claſs and order, *Octandria Monogynia.* Nat. Ord. *Bicornes,* Linn. *Ericæ,* Juſſ.

Gen. Ch. *Cal.* Perianth of four ovate-oblong, permanent, upright, often coloured leaves. *Cor.* of one petal, permanent, four-cleft, regular, with an ovate or cylindrical tube, more or leſs inflated. *Stam.* Filaments eight, capillary, equal, inſerted into the receptacle; anthers cloven at the ſummit, opening by two pores, by which they laterally cohere while young. *Piſt.* Germen ſuperior, roundiſh; ſtyle thread-ſhaped, ſtraight, longer than the ſtamens; ſtigma capitate, in four or eight lobes. *Peric.* Capſule roundiſh, ſmaller than the calyx, which covers it, of four cells and four valves. *Seeds* numerous, affixed to the columella.

Eſſ. Ch. Calyx of four leaves. Corolla four-cleft. Stamens inſerted into the receptacle. Anthers with two pores. Capſule ſuperior, of four cells. Seeds numerous.

Obſ. Some ſpecies appear to have a double calyx, but the lowermoſt was by Linnæus latterly eſteemed rather of the nature of bracteas. The ſhape of the corolla is extremely different in different ſpecies, its tube being in ſome globular, in others ovate, in others again cylindrical and much elongated; ſometimes dilated at the orifice, ſometimes contracted, in ſome inſtances curved. The anthers, either included within the tube or projecting beyond it, are in ſome ſimply cloven at the top, without any appendage at the baſe; in ſome this latter part bears a pair of briſtles, in others a pair of notched leaflets, termed a creſt, which, as Mr. Saliſbury remarks, originate rather from the filament than from the anther.

This extenſive and moſt elegant genus is confined to Europe and the ſouthern part of Africa, the country about the Cape of Good Hope being, of all others, moſt abundant in Heaths, whence the green-houſes of Britain are continually ſupplied with new ſpecies or varieties, to the great profit of nurſerymen, ſome of whom find it worth while to keep a collector reſident there. No *Erica* is found in America, in New Holland, nor ſcarcely in the Torrid Zone. The habit of the whole genus is ſhrubby, very rarely arboreſcent, with ſmall, oppoſite or whorled, uſually narrow, leaves, and bracteated ſtalked flowers, whoſe colours partake of all the moſt exquiſite tints of red, purple, yellow or orange, occaſionally variegated with green or white. Some are entirely white, but the anthers are commonly dark brown or purpliſh.

It is difficult to gueſs at the number of the real ſpecies of *Erica.* Willdenow has 137, ſome of which are duplicates. Our gardeners reckon about 300, many of which are merely varieties, but there are ſeveral others only known hitherto in a dried ſtate, and probably not a few yet remain to be diſcovered in the wilds of ſouthern Africa.

The greater part bloſſom with us in the ſpring, but many at various ſeaſons. They are for the moſt part inodorous, though a few of them are delightfully fragrant. They commonly keep well in an herbarium, provided they are dried ſuddenly, ſo as not to throw off their leaves during the proceſs.

Few good figures of this genus, except of the European kinds, are found in the older botanical works, but many appear to great advantage in the more recent works of Ventenat, Wendland, Curtis's Botanical Magazine continued by Dr. Sims, and eſpecially in a folio publication by Mr. Andrews, entirely devoted to the ſubject, as well as an octavo one, equally uſeful, by the ſame artiſt. The moſt ſuperb of all, however, are two thin faſciculi, publiſhed by Mr. Aiton, of coloured plates by Mr. Frederick Bauer, but unhappily without any deſcriptions or even ſpecific characters.

In the ſcientific definition of the ſpecies of *Erica* much yet remains to be done. The labours even of Linnæus and Thunberg are very far from perfection. Mr. Saliſbury, who has paid much attention to the ſubject, has given an arrangement of 246 ſpecies, according to their natural affinities, in the ſixth volume of the Linnæan Society's Tranſactions, with often expreſſive, if not claſſical, ſpecific characters, but with an unlicenſed change, and frequent perverſion, of names. This writer includes the Linnæan genus *Blæria,* like Thunberg, under his *Erica,* while he excludes *E. vulgaris* as a genus, by the name of *Calluna,* and ſeparates a few ſpecies (which have an irregular calyx, and fleſhy fruit, with three cells and three ſeeds) into another genus, named, from its large ſtigma, *Salaxis.* To him we are indebted for remarking that the corolla of *Erica* is permanent, which is not the caſe in *Andromeda* and *Menzieſia,* and that the anthers are united laterally to each other by their pores before they diſcharge the pollen. He alſo conſiders all true *Ericæ* as having the partitions of the fruit originating from the centre of each valve.

Linnæus and his followers diſtribute the ſpecies of this genus into three principal ſections by the ſtructure of the anthers; firſt, anthers ariſtated or furniſhed with a pair of briſtles at their baſe; ſecondly, anthers creſted, as above deſcribed; thirdly, anthers ſimple, or deſtitute of any of thoſe appendages. The latter are ſubdivided into ſuch as have the anthers included within the corolla, and ſuch as have them projecting beyond its border. All theſe ſections are moreover ſeparated into ſubordinate ones by the ſituation of the leaves, whether oppoſite, or in three, four, or more rows, or ſcattered, of which laſt *E. glutinoſa* is perhaps the only example. All theſe characters, however combined, unfortunately prove but artificial, ſeparating ſpecies naturally allied to or reſembling each other; nor are ſome of them, derived from the creſted anthers, or number of leaves, conſtant or invariable, even in the ſame ſpecies. Still, as no natural ſubdiviſions have yet been ſuggeſted, we may be glad of artificial and imperfect ones in ſo vaſt a genus. Mr. Saliſbury, though he diſpoſes the ſpecies in order, according to what he conceives to be their natural affinity or reſemblance, eſpecially in the form and proportion of the corolla, has not attempted to define or characterize many ſubdiviſions of the genus. As, however, it is very inſtructive to contemplate the ſpecies of ſuch a genus in this light, and as this writer's is the only attempt of the kind, we ſhall give examples of each of his ſubdiviſions in the order in which he places them. It is neceſſary to premiſe that theſe ſubdiviſions are conſidered as having in general no peculiar connection, and that one or more ſpecies often come between two of them, almoſt equally diſtinct from both and from each other. Thus, in the very beginning, *E. ſcoparia*, (E. coris folio quarta; Cluſ. Hiſt. v. 1. 42. f. 3.);—and *E. ſpiculifolia*, (Sm. Fl. Græc. Sib. t. 353. Prod. v. 1. 257.); ſtand as diſtinct from each other, and from three ſpecies immediately following them, among which are *abſinthoides* of Linnæus;—and *ſetacea*, Andrews, t. 62.—Next come *planifolia*, Linn. (Pluk. t. 347. f. 1.) and *oxycoccifolia* of Mr. Saliſbury, agreeing in their ovate dilated leaves, in which they are very unlike their neighbours. Then again *ſtrigoſa*, Ait. Hort. Kew. v. 2. 17;—and *ſicæfolia*, Saliſb. (rather *ſicifolia*), a new ſpecies, each ſtand ſeparate, as not immediately allied to any other.—We ſhall, in ſeparate paragraphs, mention one or more ſpecies of Mr. Saliſbury's ſubdiviſions, noticing likewiſe the ſeparate anomalous ſpecies, and introducing two or three new ones, to the beſt of our judgment, according to their ſeveral affinities. Many ſtill unſettled remain in every collection.

After *ſicifolia* follows an aſſemblage of eight ſpecies. Among theſe is *E. pubeſcens*, Linn. Sp. Pl. ed. 2. 506, *pallida* of Mr. Saliſbury, thus characterized by him.—Leaves three in a whorl. Anthers creſted, included. Flowers terminal. Leaves linear. Sides of the calyx doubled back. Corolla two lines long, downy on both ſides. Creſts ſhort.—Alſo *E. urceolaris*, Berg. Cap. 107. Ait. and Bau. Ic. t. 16. (*pentaphylla*, Linn.)

Then 13 ſpecies with little or no affinity to each other, among which are *arborea* (E. coris folio prima; Cluſ. Hiſt. v. 1. 41.); and *Thunbergii*, Linn. Suppl. 220, Curt. Mag. t. 1214, a moſt beautiful ſpecies, conſpicuous for its globoſe white tube and large deep-orange limb, very rare at preſent in the gardens.

Next appears a collection of eight, among which is *melanthera*; another of three, including *capitata* and *bruniades* (Andr. t. 61.); and a third of 18, amongſt which are *ſexfaria*, Ait. and Bau. Ic. t. 11, with *nigrita* of Linn. and Thunberg, ſo called from its conſpicuous dark anthers, elegantly contraſted with the white corolla and calyx. This laſt Mr. Saliſbury is pleaſed to denominate *volutæflora*. Theſe three ſubdiviſions he indicates as not ſo diſtinct or diſſimilar as moſt.

The following ſection compriſes five new ſpecies of Mr. Saliſbury's, named by him *fabrilis*, *dianthifolia*, *brevifolia*, *chlamydiflora*, and *ſelaginifolia*. They have all creſted included anthers, and terminal flowers.

His *pannoſa*, with a woolly corolla, ſtands alone.

Then follow 15 ſpecies, moſtly *Blæriæ* according to Linnæus, having but four ſtamens; ſee Blæria. Nor can we much object to the union of theſe two genera, except that in ſo vaſt a tribe, we may be glad of even ſo ſlight a circumſtance as number to make a genus, when there is moreover ſuch a difference in habit as this very arrangement of Mr. Saliſbury's implies. If indeed a few ſpecies of *Erica*, here and there in the different natural ſubdiviſions, were tetrandrous, nobody would think of ſeparating them for ſuch a reaſon.

E. nudiflora, Linn. Mant. 2. 229. Sm. Plant. Ic. t. 57, (accompanied by two others) follows. Mr. Saliſbury exults in having diſcovered its bracteas, which eſcaped Linnæus, Dryander, and the author of the preſent article, who in this inſtance readily ſubmits to his correction. They are in the form of two or three exceſſively minute woolly ſcales, near the baſe of each flower-ſtalk.

The next five, or rather we would ſay ſeven, uniting two of Mr. Saliſbury's ſections, are *herbacea*, Linn. Sp. Pl. 501, Curt. Mag. t. 11, not at all different from *carnea*, Sp. Pl. 504; (this, according to Dr. Sibthorp, is the genuine ἐρείκη of Dioſcorides, extremely common every where in Greece);—*mediterranea*, Linn. Mant. 2. 229, Curt. Mag. t. 471;—*multiflora*, Sp. Pl. 503, (Garidel. t. 32.), another beautiful native of the ſouth of Europe, long confounded with *vagans*;—*manipuliflora*, Saliſb. (Sm. Fl. Græc. Sibth. t. 352.);—*vagans*, Linn. Mant. 2. 230, (Engl. Bot. t. 3.) common on all the heaths of Cornwall, either with red, fleſh-coloured, or white flowers;—*umbellata*, Linn. Sp. Pl. 501, (Ait. and Bau. Ic. t. 5.);—and laſtly *nutans*, Wendland. Eric. faſc. 3. 5.—The native country of this laſt we know not, nor have we ſeen Wendland's publication. The reſt of this very natural aſſemblage grow in Europe only.

Filiformis and *turgida*, Saliſb. we have not aſcertained to our ſatisfaction.

Nine ſpecies, very naturally allied, having exceſſively long anthers, projecting from an elongated tubular corolla, are placed next. Among theſe are *E. Plukenetii*; *Petiveri*; *Bankſii*, Andr. t. 26; *Sebana*, Dryand. in Ait. and Bau. Ic. t. 10; &c. moſtly familiar to collectors.

Nine more comprehend *imbricata*, Linn. Sp. Pl. 503;—and *flexuoſa*, Andr. Eric. t. 33;—with *leucanthera*, Linn. Suppl. 223;—and *milleflora*, Berg. Cap. 96, which laſt name is well retained by Mr. Saliſbury, in preference to the inaccurate one, *paniculata*, given by Linnæus.

An aſſemblage of ſix more contains the beautiful *baccans* Linn. Mant. 2. 233. Curt. Mag. t. 358, a good ſpecimen of the reſt.

Five following ones are ſuppoſed to be little, if at all, related. Among them are the beautiful *glauca*, Andr. t. 47. Curt. Mag. t. 580; in the ſame ſection with which the *elegans*, ibid. t. 966, ſhould be inſerted. The flowers of the latter are larger, and differently coloured, but they cloſely agree in ſtructure with thoſe of *glauca*.—*E. Monſoniæ*, Dryand. in Ait. and Bau. Ic. t. 7, (E. Monſoniana; Linn. Suppl. 223.), one of the moſt magnificent of all, is placed by Mr. Saliſbury, with a ſign of incomplete affinity, after *glauca*.—*E. halicacaba*, Linn. Sp. Pl. 507, Ait. and Bau. Ic. t. 2, follows alone. Its corolla is of a pale uniform yellowiſh green.

Ten ſpecies, with a long tubular corolla and ſhort included anthers, are needleſsly, we think, divided into three parcels. Theſe are moſtly handſome flowers, very frequently to be ſeen in gardens. Among them are *verſicolor*, Andr. t. 12, which comprehends as a variety his *coſtata*, t. 46;—*diſcolor* of the ſame author, t. 3;—*cruenta*, Ait. and Bau. Ic. t. 13;—*abietina*, Linn. Sp. Pl. 506, (*E. Patterſonia* of Andr. t. 7, and the gardeners), remarkable for its thick-ſet leaves and crowded golden bloſſoms, as well as its pulpy ſeed-veſſel;—and *concinna*, Ait. Hort. Kew. v. 2. 23, miſtaken by Andrews, t. 64, for *abietina*. For this laſt (*concinna*) Mr. Saliſbury has, in our opinion with advantage, adopted the name *paludoſa* from Hermann, which indicates its place of growth, and conſequently its requiſite treatment in a garden.

E. pyramidalis, Ait. Hort. Kew. v. 3. 491. Curt. Mag. t. 366, with two others unknown to us, conſtitute the next ſubdiviſion.

Then follow 12 fine plants, needleſsly, we again preſume, divided into two parcels. Among them are *tubiflora; curviflora; conſpicua*, Ait. Hort. Kew. v. 2. 22. Ait. and Bau. Ic. t. 12; and *ſordida*, Andr. t. 56; with ſeveral often confounded with theſe, (for it is rather an indiſtinct and perhaps variable tribe,) all which contribute much to adorn our green-houſes, and are in general eaſily cultivated.

E. faſcicularis, Linn. Suppl. 219. Ait. and Bau. Ic. t. 6; and *E. Maſſoni*, Linn. Suppl. 221. Curt. Mag. t. 356; occupy a ſection by themſelves. Theſe are two of the moſt highly prized of the whole genus. The flowers of both are tipped with green.

The 12 next are, in general, ſcarcely leſs ſplendid, witneſs *pharetriformis*, Saliſb. (exſurgens, Andr. t. 13.);—*grandiflora*, Linn. Suppl. 223. Curt. Mag. t. 189;—and *longifolia*, remarkable for its tremulous leaves and the variation of colour in its flowers, inſtances of which are diſplayed in Andrews, t. 8, t. 20, and t. 33; likewiſe in Curt. Mag. t. 402. The deep ſcarlet is juſtly the moſt admired variety.—We cannot but think *pinea*, Andr. t. 57, muſt be a diſtinct ſpecies.

To theſe are nearly allied the next five, comprehending *ſeſſiliflora*, Linn. Suppl. 222, (*ſpicata*, Thunb. Diſſ. 43. t. 4. Andr. t. 6);—*alveiflora*, Saliſb. called in the gardens *gelida*, which name aptly expreſſes the cool aſpect of its ſnow-white corolla tipped with pea-green, and ſurely ought to have been retained;—and *mammoſa*, Linn. Mant. 2. 234. Andr. t. 58. (abietina, Schneev. Ic. t. 23.); of which a beautiful ſcarlet variety is moſt common with us, called *ſpecioſa* in Schneevooght, t. 3, and *verticillata* by Andrews, t. 21.

Of Mr. Saliſbury's *brachialis*, a ſolitary ſpecies, we have only ſeen a doubtful ſpecimen.

Four ſpecies follow, among which are *E. Sparmanni*, Linn. Fil. Suppl. 219. Stockh. Tranſ. for 1778. t. 2; and the noble *cerinthoides*, Linn. Sp. Pl. 505. Curt. Mag. t. 220.

E. cernua, Montin Nov. Act. Upſ. v. 2. 292. t. 9. f. 3. Linn. Suppl. 222, ſtands alone; as does Mr. Saliſbury's *doliiformis*, (*mammoſa*, Thunb. Diſſ. de Ericâ, ed. Saliſb. 42. f. 21.)

E. auſtralis, Linn. Mant. 231, not uncommon in gardens;—and *ciliaris*, Linn. Sp. Pl. 503. Curt. Mag. t. 484. follow next. Theſe are both European ſpecies, and are immediately followed by two others, our elegant Engliſh *E. Tetralix*, Curt. Lond. faſc. 1. t. 21. Engl. Bot. t. 1014, (a name changed by Mr. Saliſbury to *botuliformis*, ſauſage-ſhaped);—and his *multicaulis*, the *ſtricta* of Donn and Willdenow, native of Corſica.

Next comes by itſelf our common Britiſh *cinerea*, Curt. Lond. faſc. 1. t. 25. Engl. Bot. t. 1015, more happily, but without any neceſſity, altered to *mutabilus*.

E. regerminans, Linn. Mant. 2. 232, only known in the Linnæan herbarium;—and *pulchella*, Andr. t. 51, occupy two ſeparate ſections.

A very diſtinct and natural aſſemblage of four ſpecies next occurs, in which are *empetrifolia*, Linn. Sp. Pl. 507, known by its hairy corolla;—and *malleolaris*, Saliſb. (*empetrifolia*, Curt. Mag. t. 447.)

The four next ſeem ſcarcely to be ſeparable from them, if we may judge by *viſcaria*, Linn. Mant. 2. 321. Andr. t. 55, the only one of the four with which we are acquainted.

A difficult family of ſeven ſpecies, with a hoary habit, and ſmall turgid downy flowers, is placed next, of which *tardiflora*, Saliſb. (*pubeſcens*, Curt. Mag. t. 480.);—and *hirtiflora*, Curt. Mag. t. 481, are examples. Both are diſtinct from, though nearly allied to, the real *pubeſcens* of Bergius and Linnæus, as well as from his *parviflora*.

A ſomewhat ſimilar tribe, but ſmooth, and with larger more bell-ſhaped flowers, contains ten ſpecies. Amongſt them is *margaritacea*, Ait. Hort. Kew. v. 2. 20. Andr. t. 54, very pretty when laden with its pearly bloſſoms.

E. Bergiana, Linn. Mant. 2. 235, remarkable for its reflexed calyx, with two others, come next, and lead inſenſibly to the following ſection.

This comprehends *pilulifera*, Linn. Sp. Pl. 407;—*obliqua*, Thunb. Diſſ. 44. Ait. and Bau. Ic. t. 3;—and *phyſodes*, Linn. Sp. Pl. 506. Curt. Mag. t. 443; with four more.

E. cernua, Andr. t. 48, ſtands alone, but between it and *phyſodes* we would introduce a new ſpecies, communicated by Mr. G. Hibbert among the reſt of his dried ſpecimens of this genus from the Cape, and by Meſſrs. Lee and Kennedy from their garden, where it firſt bloſſomed in 1808. We would name it

E. roſaria. Leaves in four rows, obtuſe, recurved, toothed. Anthers ſimple, included, with long pores. Corolla ovate, viſcid. The leaves reſemble thoſe of *phyſodes*, but are more diſtant and recurved. Flowers about the ends of the branches, on moſtly axillary, long, viſcid ſtalks, with two or three oblong, pellucid, concave bracteas towards their middle; the flowers droop a little, and are remarkable for their fragrant ſcent, reſembling ottar of roſes. The calyx-leaves are like the bracteas, and about one-third as long as the corolla, which is of a pale ſtraw-colour, ovate, inflated, viſcid, its ſegments obtuſe, crenate, but little ſpreading. Stamens about the length of the calyx; their filaments purple at the ſummit, without any creſt or appendages; anthers brown, oblong, with pores two-thirds of their length. Germen turbinate, furrowed, ſmooth; ſtyle twice as long as the ſtamens; ſtigma capitate, dark coloured.

E. pulchella, Saliſb. a new ſpecies, ſtands alone, the author being unacquainted with its affinity to any other.

Two others, unknown to us, occupy a ſection with *glutinoſa*, Berg. Cap. 98. Ait. and Bau. Ic. t. 17. (*Andromeda droſeroides*, Linn. Mant. 2. 239.) This is a beautiful plant, with all the habit of an *Erica*, nor any thing but an occaſional luxuriance of number in the parts of the flower to make it an *Andromeda*.

A very ſplendid and diſtinct aſſemblage follows, of ſix ſpecies, diſtinguiſhable by their large flowers, with a long tube, always contracted at its mouth, and more or leſs inflated below. The border is ſpreading and ornamental. Among theſe are *retorta*, Linn. Suppl. 220. Curt. Mag. t. 362, firſt found at the Cape by Maſſon, not by Thunberg;—*ampullacea*, Curt. Mag. t. 303;—and *Aitonia*, Curt. Mag. t. 429. This laſt varies a little in the ſize and hue of its border, but ſo ſtrikingly reſembles the Catalonian Jaſmine, that we long ago named it *jaſminea*, nor is there any occaſion for the uncouth preciſion of *jaſminiflora*.—We have ſtill ſome of this tribe, which appear to be nondeſcripts.

Ten ſpecies with flowers of a ſomewhat ſimilar form but ſmaller, and more ſlender needle-ſhaped leaves, conſtitute the next parcel. To this belongs *faſtigiata*, Linn. Mant. 66, of which there are ſeveral elegant varieties, named *E. Humea*, &c. in the gardens. Alſo *E. Muſcari*, Andr. t. 1. ſmelling like the Muſky Hyacinth, which it imitates in colour;—and *comoſa*, Linn. Mant. 234, Ait. and Bau. Ic. t. 18.

A tribe more ſplendid in general, of nine ſpecies, ſucceeds. To theſe belong *inflata*, Thunb. Diſſ. 41. t. 2;—*ventricoſa*, ibid. 27. t. 1. Curt. Mag. t. 350;—*lutea*, Linn. Mant. 234. Andr. t. 11;—*articularis*, Linn. Mant. 65. Curt. Mag. t. 423;—and *taxifolia*, Ait. and Bau. Ic. t. 19.

Two ſpecies, indicated as nearly related to the laſt, cloſe Mr. Saliſbury's liſt of 246 in all. Theſe are *tetragona*, Thunb. Diſſ. 14. t. 4;—and *albens*, Linn. Mant. 231. Curt. Mag. t. 440.

We truſt, that thoſe who may have occaſion to deſcribe new heaths in future, will, as far as they are competent, keep the above arrangement in view, as they will find it very inſtructive, however they may differ from Mr. Saliſbury in principles of nomenclature. To this ſubject we have ſcarcely found it neceſſary to advert, except occaſionally, and we rather paſs over in ſilence what we cannot approve. This botaniſt rejects all names of perſons as applied to the ſpecies of any genus. Mr. Dryander once began a more uſeful reformation in ſuch names of *Ericæ*, making thoſe which commemorate a writer on the ſubject end in *ana*, as *Sebana*; thoſe which apply to a collector only, in the genitive caſe, as *Maſſoni*. The greateſt and moſt correct information is ſtill to be expected from this able botaniſt, in the intended new edition of Mr. Aiton's *Hortus Kewenſis*, where the genus of *Erica* muſt always make a principal figure. S.

Erica, in *Gardening*, comprehends plants of the evergreen, flowery, ſhrubby kind; moſtly exotics; of which the ſpecies moſt in cultivation, according to Martyn, are: the croſs-leaved heath (E. tetralix); the fine-leaved heath (E. cinerea); the double-anthered heath (E. didyma); the tree heath (E. arborea); the Spaniſh heath (E. auſtralis); the many-flowered heath (E. multiflora); the Mediterranean heath (E. Mediterranea); the yellow heath (E. lutea); the purple-ſtalked heath (E. halicacaba); the bladder-flowered heath (E. monſoncana); the mucous heath (E. mucoſa); the hairy-flowered heath (E. urceolaris); the marum-leaved heath (E. marifolia); the bloody-flowered heath (E. cruenta); the ſlender-branched heath (E. rumentacea); the bluſh-flowered heath (E. perſoluta); the three-flowered heath (E. triflora); the arbutus-flowered heath (E. baccans); the ſlender-twigged heath (E. corifolia); the crow berry-leaved heath (E. nipetrifolia); the woolly heath (E. capitata.); the tube-flowered heath (E. lubiflora); the long-tubed yellow heath (E. conſpicua); the honeywort-flowered heath (E. cerinthioides); the tufted-flowered heath (E. comoſa); the tall downy heath (E. Maſſoni); the ſmooth-twigged pencil-flowered heath (E. Plukenetii); the downy twigged pencil-flowered heath (E. Petiveri); the early-flowered dwarf heath (E. herbacea); and the great flowered heath (E. grandiflora). But there are many other ſpecies equally deſerving of cultivation.

Concerning the firſt of theſe ſpecies, it is obſerved by the editor of Miller's dictionary, that it is not inferior to many of the foreign heaths in the beauty and delicacy of its flowers. It is diſtinguiſhed from the other Britiſh heaths not only by the flowers growing in a kind of pendulous cluſter on the tops of the ſtalks, but by the leaves growing in fours, and forming a ſort of croſs.

The whole of the different ſpecies of heaths which are mentioned above, are plants of conſiderable beauty and elegance, but moſtly tender and delicate in their habits of growth.

Method of Culture.—Theſe very elegant plants muſt be treated in different methods, according to their nature and habits of growth.

The firſt three Britiſh ſorts are capable of being propagated by ſowing the ſeeds either in the places where they are to remain, or in pots filled with peaty earth, in either the autumn or ſpring ſeaſons; but this is a tedious method of practice. The better method is, therefore, to take them up from the places where they grow naturally, in the early autumn, with good balls of earth about their roots, planting them again immediately where they are to grow and remain for ornament.

They are found to ſucceed beſt where the ſoil is of the peaty or moory kind, and where it has not been enriched by manure; and as they protrude their roots chiefly near the top, it ſhould be as little dug about them as poſſible, the ſurface only being kept clean and free from rubbiſh.

And the four following ſorts may be increaſed in the ſame manner as the above; but the beſt practice is by layers, cuttings, or ſlips, which ſhould be laid down or planted out in pots filled with boggy earth either in the early ſpring or the latter end of ſummer, plunging them in a moderate hot-bed, and giving them proper ſhade and water. When they have taken full root, they ſhould be carefully removed with balls of earth about them into ſeparate pots, being replaced in the hot-bed till they become well eſtabliſhed, when they will be capable of bearing the open air in mild weather when the ſeaſon is ſuitable.

All the other ſpecies may be increaſed either by cuttings or layers, but moſt of them by the former. The cuttings ſhould be made from the beſt young ſhoots, and be planted in the ſpring ſeaſon in pots filled with a compoſition of light boggy and loamy earth, being placed in the hot-bed, and covered with bell-glaſſes, and duely ſhaded from the ſun, ſlight waterings being given when neceſſary; the layers are beſt laid down in the autumn, being managed in the ſame way as the cuttings. When the plants have become perfectly rooted, they ſhould be removed into ſeparate pots filled with the ſame ſort of mould, being then put in the dry ſtove or green-houſe, where ſome of them require to be conſtantly placed.

But the ninth, twentieth, and twenty-ſixth ſpecies muſt be raiſed by layers, as they have not yet been increaſed by planting their cuttings in the manner directed above.

Where ſeeds are made uſe of in producing theſe plants, they ſhould be ſown in pots filled with the above ſort of earth in the early ſpring, and plunged in the hot-bed of the ſtove. When the plants have acquired a few inches growth, they ſhould be removed into ſingle pots with a little earth about their roots, and be replunged in the hot-bed in the ſtove, being preſerved in it, or the warmeſt part of the green-houſe, during the winter ſeaſon, and whenever the weather is bad.

The firſt three ſorts afford an agreeable variety in the borders and clumps, as they continue long in flower. The four following kinds are likewiſe hardy, and afford variety among other potted plants in the open air during the ſummer months.

All the other ſpecies are more tender, but produce as agreeable an effect among the ſtove and green-houſe collection, from the great beauty and continuance of the flowers in many of the ſorts.

Erica *marina*, *ſea-heath*, a name given by many authors to a very beautiful zoophyte of the fucus kind, called by Mr. Ray and ſome others the fucus ericæ folio.

Erica, in *Ichthyology*, a name given by Gaza and ſome others, as the interpretation of the chalchis of Ariſtotle, that is, as the name of the common herring.

ERICÆ, in *Botany*, the third natural order in the ninth claſs of the ſyſtem of Juſſieu, ſo named from the genus *Erica* which makes a part of it. This order conſiſts of ſuch dicotyledonous monopetalous plants as have perigynous ſtamens, and the following diſtinguiſhing characters. *Calyx* of one leaf, permanent, ſometimes ſuperior, more frequently inferior and deeply divided. *Corolla* of one petal, ſometimes deeply divided, inſerted either into the upper part of the calyx, more commonly into its lower part, or into a gland at its baſe; moſtly withering and permanent. *Stamens* of a definite number, diſtinct, inſerted into the ſame part, or rarely originating from the lower part of the corolla; anthers moſtly with two horns at the baſe. *Germen* ſuperior, or rarely inferior; ſtyle ſolitary; ſtigma generally ſimple. *Fruit* either ſuperior or inferior, with many cells and many ſeeds, either pulpy, or more generally dry with many valves, fixed by their baſes to the central axis, the partitions originating from the middle of each valve. *Seeds* generally minute. *Stem* ſhrubby, of a more or leſs elevation, or herbaceous. *Leaves* alternate, or oppoſite, or whorled.

This order is in a great meaſure analogous to the Linnæan *Bicornes*, excluſive of the *Rhododendra* of Juſſieu, which differ from his *Ericæ* chiefly in having the partitions of the capſule formed of the inflexed margins of its valves, and not originating longitudinally from their centre. Ventenat retains the name of *Bicornes* for the *Ericæ*.

The *Ericæ* are divided by Juſſieu into two ſections, 1. *Germen* ſuperior, conſiſting of *Cyrilla*, Linn. (which being of the ſame genus as *Itea*, and having the capſule of the *Rhododendra*, is to be removed thither); *Blæria*; *Erica*; *Andromeda*; *Arbutus*; *Clethra*; *Pyrola*; *Epigæa* (removed by Ventenat to *Rhododendra*); *Epacris* (omitted by Ventenat); *Gaultheria*; and *Broſſæa* (likewiſe omitted by Ventenat, a very uncertain plant).

2. Germen wholly or partly inferior, *Argophyllum*, Forſt. and Linn. fil.; *Mæſa*, Forſk; and *Vaccinium*.

A third ſection contains two genera allied to *Ericæ*, or ſuppoſed to be ſo, *Empetrum* and *Hudſonia*.

ERICALE, from ηρ, the *ſpring*, and καλη, *beautiful*, a name given by Renealm in his Specimen Hiſt. Plant. 75. t. 68. to the *Gentiana verna*, a moſt elegant vernal plant. Linnæus erroneouſly prints it *Ericoila*.

ERICERUM, a name given by Aetius and other authors to a ſort of collyrium, uſed in weakneſſes of the eyes, in which the herb erica or heath was an ingredient.

ERICEYRA, in *Geography*, a town of Portugal, in the province of Eſtremadura, on the ſea-coaſt; 20 miles N. W. of Liſbon.

ERICHTHONIUS, in *Aſtronomy*, a conſtellation, the ſame as Auriga.

ERICOILA, in *Botany*. See Ericale.

ERICU, a name given in Rheede's Hortus Malabaricus, v. 2. 53. to the *Aſclepias gigantea*. It is corrupted from the Sanſcrit name *Roey*.

ERICUSA, in *Ancient Geography*, one of the ſeven Æolian iſlands, now *Alicuda*.

ERIDANUS, in *Aſtronomy*, a conſtellation of the ſouthern hemiſphere, in form of a river.

The ſtars in the conſtellation Eridanus, in Ptolemy's Catalogue, are 34; in Tycho's, 19; in the Britiſh Catalogue, 84. See Constellation.

Eridanus, in *Ancient Geography*, a river of Italy, in Ciſalpine Gaul, now the Po, which ſee. Virgil deſcribes it as the largeſt river of Italy, calling it the king of rivers:

> "Fluviorum rex Eridanus."

—Alſo, a ſmall river of Greece, in Attica, which purſuing its courſe to the W. of Athens, united with the Iliſſus below that city.—Alſo, a river of Celtica, near the Pyrenées.

ERIE, Fort, in *Geography*, a ſtrong fortification in the townſhip of Bertie, Upper Canada, ſituated on the N. ſhore of lake Erie, at its eaſtern extremity, and the W. bank of Niagara river; 27 miles S. by E. from Niagara fort, 18 above the carrying place of the Falls of Niagara, and 45 from fort Chippeway. This is a ſmall ſtockaded fort, ſomewhat ſimilar to that at Chippeway; and adjoining it are extenſive ſtores as at Chippeway, and about half a dozen miſerable little dwellings. It has a barrack for troops and a block houſe; and a company of ſoldiers is quartered here for the purpoſe of tranſporting the public ſtores. The lake narrows here into the Detroit ſtrait, which carries the waters over the great falls of Niagara. The new fort is projected on a ſmall height in the rear of the preſent garriſon. The harbour is capable of accommodating veſſels of any ſize, which lie oppoſite to the fort, at the diſtance of about 100 yards from the ſhore, expoſed to the violence of the weſterly winds; but the anchorage is good, and they ride in perfect ſafety. The little fort, with the ſurrounding huts built on the rocky ſhore, the veſſels lying off at anchor before it, the rich woods, the diſtant hills on the oppoſite ſide of the lake, and the vaſt lake itſelf, extending to the fartheſt part of the horizon, altogether form an intereſting and beautiful ſcene. N. lat. 42° 53′ 17″. W. long. 78° 20′ 30″.

Erie, *Lake*, called alſo *Eric*, *Erige*, or *Erike*, or the lake of the Cat, is a lake of the fourth magnitude in North America, through which runs the line between the United States and Upper Canada. Detroit river on the weſt brings the waters of the great lakes with which lake Erie has a communication on the north-weſt; and Niagara river on the eaſt forms its communication with the waters of lake Ontario and the river St. Lawrence. It is ſituated between 41° and 43° N. lat. and between 78° 48′ and 83° W. long. It is of an elliptical form, being about 300 miles in length, and about 90, at the wideſt part, in breadth. The depth of water in this lake is not more than 20 fathoms, and in calm weather veſſels may ſecurely ride at anchor in any part of it; but when ſtormy, the anchorage in an open part of the lake is not ſafe, the ſands at the bottom not being firm, and the anchors being apt to loſe their hold. At this time the water becomes turbid, by the waſhing up of the yellow ſand from the bottom of the lake; but in calm weather it is clear, and of a deep greeniſh colour. The northern ſhore of the lake is very rocky, which is alſo the caſe with the ſhores of the iſlands, of which there are ſeveral cluſters towards the weſtern extremity of the lake; but along moſt parts of the ſouthern ſhore there is a fine gravelly beach. The height of the land bordering the lake is very unequal; in ſome places long ranges of ſteep mountains riſe from the very edge of the water; in others, the ſhores are ſo flat and ſo low, that when the lake is raiſed a little above its uſual level, in conſequence of a ſtrong gale of wind ſetting in towards the ſhore, the country is deluged for miles. To the very great inſularity of the height of the land on both ſides of it, is attributed the frequency of ſtorms on this lake; the coaſt, however, on both ſides, is generally favourable for the paſſage of batteaux and canoes. A peninſula, called Longpoint, runs upwards of eighteen miles into the lake, and being compoſed of ſand, is convenient for hauling boats upon it, when the lake is too rough for ſailing and rowing. Towards the ſouth ſide, however, on both ſides of the lake, it would be impoſſible to land, on account of the perpendicular height of the rocks. There is a great deficiency of good harbours along the ſhores of this lake: on its northern ſide there are but two places which afford ſhelter to veſſels drawing more than ſeven feet water, *viz.* Long Point, and Point Abineau, and theſe afford only a partial ſhelter. On the ſouthern ſhore, the firſt harbour you come to in going from fort Erie is that of Preſqu'tele, which is ſituated at the diſtance from that fort of about ſix miles, and where veſſels drawing eight feet water may ride in perfect ſafety. Beyond this, about midway between the eaſtern and weſtern extremities of the lake, there is another harbour, capable of containing ſmall veſſels at the mouth of Cayahega river, and another at the mouth of Sanduſky river, which falls into the lake within the N. W. territory of the States. Britiſh ſhips ſeldom uſe theſe harbours, but trade almoſt ſolely between fort Erie and Detroit river, and in caſe of contrary winds, they return to fort Erie, if bound to Detroit river; or to ſome of the bays amidſt the cluſters of iſlands ſituated towards the weſtern extremity of the lake, if bound to fort Erie. The navigation of this lake is very uncertain; and veſſels are often detained, at a conſiderable expence to paſſengers, in ſome of the harbours. Lakes Huron and Michigan afford communication with lake Erie, by veſſels of eight feet draught. There are portages into the waters of this lake from the Wabaſh, Great Miami, Muſkingam, and Alleghany, from two to ſixteen miles. The iſlands at the weſtern end of the lake, of various ſizes, lie very cloſe to each other, and exhibit a very pleaſing ſcenery; the largeſt of them are not more than fourteen miles in circumference, and many of them are very ſmall. The largeſt iſlands produce a variety of fine timber, amongſt which are found oaks, hiccary trees, and red cedars, which latter, being large, are ſent for even from the Britiſh ſettlements on Detroit river, at the diſtance of forty miles. Lake Erie has a great variety of fine fiſh, ſuch as ſturgeon, eel, white fiſh, trout, perch, &c. Amongſt the woods are found racoons and ſquirrels, and alſo bears, in the winter ſeaſon, when the lake is frozen between the main land and the iſlands. All the iſlands are dreadfully infeſted with ſerpents, and on ſome of them rattleſnakes are ſo numerous, that in the height of ſummer it is dangerous to land. Two kinds of rattleſnakes are found in this part of the country; the one is of a deep brown colour, clouded with yellow, about thirty inches in length, which frequents marſhes and low meadows, and does great miſchief among cattle: the other ſort is of a greeniſh yellow colour, clouded with brown, and nearly twice the ſize of the former. Many different kinds of ſerpents, beſides rattleſnakes, are found on the iſlands in lake Erie. The ponds and marſhes in the interior parts of theſe iſlands abound with ducks and other wild fowl, and the ſhores ſwarm with gulls; among the woods are a few ſmall birds, remarkable neither for their ſong nor plumage. Weld's Travels, vol. ii.

Erie, a county of Pennſylvania, on the ſouth ſide of lake Erie, containing 639,400 acres, and 1468 inhabitants. Its chief town is Erie.

ERIEUX, a river of France, which runs into the Rhone, at Beauchaſtal.

ERIFFS, a name given to canary birds when about two years old. See Canary *Bird.*

ERIGENA, John Scotus, in *Biography*, who flouriſhed in the ninth century, was probably born in Ayrſhire Scotland, though ſome writers make him a native of Herefordſhire, in England, and others ſuppoſe his birth-place to be Ireland. He poſſeſſed an ardent thirſt for literature, and ſpared no pains in rendering himſelf accompliſhed in the learning of the Eaſt, and from the extent of his erudition he obtained the name of "Scotus the Wiſe." He ſtudied ſome years at Athens, and became very converſant in Greek philoſophy. Upon his return, he accepted an invitation from Charles the Bald of France, and lived for ſeveral years in habits of intimacy and familiarity with his royal patron, who aſſigned to him the direction of the univerſity of Paris. To the ſovereign he was not only an inſtructor in literature and ſcience, but an adviſer in the affairs of government. The high rank which he obtained excited much jealouſy, particularly among the bigotted prieſts, who accuſed him of maintaining heretical opinions. In the year 824, the Greek emperor, Michael the Stammerer, ſent to the Weſtern emperor, Lewis the Pious, a copy of the treatiſes of the ſuppoſed Dionyſius the Areopagite, which had long been held in great veneration among the Greek Chriſtians. Dionyſius was ſuppoſed to be the firſt Chriſtian teacher in France, and, on that account, the work in queſtion was deemed of great value, and the king, who was unable to read the original Greek, employed Erigena to tranſlate it into the Latin language. Unfortunately this was performed without licence from the pope, who, when he found the tranſlation eagerly read, inſiſted that the French king ſhould not only baniſh Erigena from Paris, but ſhould ſend him to Rome. Charles refuſed to act in this ungenerous manner, nevertheleſs, it was deemed adviſable, that Erigena ſhould leave the capital of France, and in a ſhort time after he took refuge in England. This tranſlation of Dionyſius's treatiſes is ſaid to have cauſed the revival of the knowledge of the Alexandrian Platoniſm in the Weſt, and to have laid the foundation of the myſtical ſyſtem of theology which afterwards ſo generally prevailed. Of the original works of Erigena, the principal was his treatiſe "On the Diviſion of Nature, or the Nature of Things," which was publiſhed from the author's MS. by Dr. Thomas Gale, at Oxford, in 1681, under the title of "Joannis Scoti Erigena de Diviſione Naturæ, Libri quinque, diu deſiderati." Erigena was employed by our great king Alfred in the reſtoration of learning at Oxford, where he was appointed profeſſor of mathematics and aſtronomy. In this ſituation he remained only about three years, when ſome differences that took place in the univerſity obliged him to retire to the abbey of Malmſbury in Wiltſhire, where he opened a ſchool. Here, it is aſſerted, by moſt writers, that he was murdered by his own ſcholars, either on account of his harſhneſs and undue ſeverity; or at the inſtigation of the monks, who hated Erigena as being a heretic, and much more learned than themſelves. The particular time and place of his death have been the ſubjects of ſome diſpute. Certain writers contend that his death took place about the year 864 or 866, and others, who are generally followed, make it in 883. Some ſay he died in England, and others, among whom is Dr. Henry, think that it happened in France. He was certainly a very extraordinary man for the times in which he lived, and after his deceaſe his name was, for a conſiderable time, to be found in the liſt of the ſaints of the Romiſh church, till it was ſtruck out of the calendar, by Baronius, on account of the heterodoxy of his opinions concerning tranſubſtantiation. Biog. Brit. Enfield's Hiſt. Phil.

ERIGENS Penis. See Erector.

ERIGERON, in *Botany*, ηριγερων of the ancient Greeks, from ηρ, *the ſpring*, and γερων, *an old man*, becauſe it is hoary in the ſpring. Linn. Gen. 422. Schreb. 553. Willd. Sp. Pl.

Pl. v. 3, 1952. Sm. Fl. Brit. 876. Mart. Mill. Dict. v. 2. Juſſ. 180. Gærtn. t. 170. Claſs and order, *Syngeneſia Polygamia-ſuperflua*. Nat. Ord. *Compoſitæ diſcoideæ*, Linn. *Corymbiferæ*, Juſſ.

Gen. Ch. *Common calyx* oblong, cylindrical, imbricated; ſcales awl-ſhaped, erect, gradually longer, nearly equal in breadth. *Cor.* compound, radiated; *florets* of the diſk all perfect, tubular, funnel-ſhaped, with an equal five-cleft limb; thoſe of the radius female, ligulate, linear, awl-ſhaped, erect, for the moſt part entire. *Stam.* (in the tubular florets) Filaments five, capillary, very ſhort; anthers forming a cylindrical tube. *Piſt.* (in the tubular florets) Germen minute, crowned with hairs longer than its own corolla; ſtyle thread-ſhaped, the length of the hairs; ſtigmas two, oblong, revolute: the female or ligulate florets differ in having their corolla about as long as the hairs, and very ſlender ſtigmas. *Peric.* none, except the cloſed permanent calyx. *Seeds*, in the florets of the diſk as well as of the radius oblong, ſmall. *Down* long, capillary. *Recept.* naked, flat.

Obſ. Dillenius obſerves that the innermoſt or central florets of the diſk are generally males. One ſpecies has thoſe of the radius deſtitute of a corolla.

Eſſ. Ch. Receptacle naked. Down ſimple. Florets of the radius linear, very narrow, numerous. Calyx imbricated.

This genus comprehends ſeveral plants called *Conyza*, *Virga-aurea*, *Aſter*, and *Senecio* by former writers, but is a very natural one, characterized by the erect very narrow florets of its radius, uſually coloured blue or white. The lateſt edition of Linnæus has 22 ſpecies, Willdenow 32. Three are natives of Britain.

1 E. *canadenſe*, Engl. Bot. t. 2019. "Stem hairy, panicled. Leaves lanceolate; the lower ones toothed."—To all appearance perfectly wild in Glamorganſhire, (Mr. Middleton), though ſuppoſed by Ray to have come over from North America, where it abounds. It is an annual plant, of mean appearance, with innumerable ſmall flowers, whoſe radius is white or pale red, their diſk yellow.

2. E. *acre*. Engl. Bot. t. 1158. Curt. Lond. faſc. 1. t. 60. "Stem racemoſe. Stalks moſtly ſingle-flowered. Leaves lanceolate or tongue-ſhaped, ſeſſile."—Common on a dry gravelly or chalky ſoil, flowering in July and Auguſt. The flowers are larger and fewer than in the former; their radius blue. Root biennial.

3. E. *alpinum*. Engl. Bot. t. 464. "Stems almoſt ſingle-flowered. Calyx ſlightly hairy. Radius ſpreading."—Found in moiſt parts of the highland mountains of Scotland, flowering in July. This has ſeldom more than one flower on a ſtem, which is much larger than in E. *acre*, with a longiſh blue radius, which ſpreads more than is conſiſtent with the generic character, and, perhaps, might authorize the removal of this ſpecies to *Aſter*, where Linnæus originally placed its near ally E. *uniflorum*, Fl. Lapp. n. 307. t. 9. f. 3.

ERIGONUS, in *Ancient Geography*, a river of Macedonia, which, according to Livy, ran from Illyria through Pæonia into the Axius; called *Erigon* by Strabo and Ptolemy.

ERINACEA, in *Botany*, Tourn. Inſt. 646, ſee ANTHYLLIS, ſp. 15. Tournefort eſtabliſhed it as a genus, (diſtinct from his *Geniſta-Spartium*, which conſiſts of *Ulex* and the prickly *Geniſtæ*,) merely becauſe the buſh is all over armed with prominent ſtrong ſpines, like a hedge-hog.

ERINACEUS, a name given by Dillenius and Micheli to a genus of *Fungi*. Linnæus, perceiving the inconvenience and abſurdity of adopting a generic denomination, already univerſally appropriated to an animal, changed it to *Hydnum*.

ERINACEUS, in *Zoology*, a genus of the Feræ order, the hedge-hog of Engliſh authors. This tribe is diſtinguiſhed principally by the teeth. The fore-teeth in the upper jaw are two, and diſtant, in the lower two approximate; the tuſks in the upper jaw five each ſide, in the lower three; grinders four each ſide above and beneath; body above covered with ſpines.

Species.

EUROPÆUS. Ears rounded; noſtrils creſted. Linn. Fn. Suec. *Erinaceus auriculis erectis*, Briſſ. *Echinus terreſtris*, Geſn. *Igel*, Knorr. *Heriſſon*, Buff. *Common hedge-hog*.

The common hedge-hog, or as it is ſometimes called erroneouſly the European hedge-hog, appears to be a native of the temperate parts of Aſia, and to be found in Madagaſcar as well as Europe. It lives in thickets and buſhes, forming a neſt of moſs, graſs, or leaves, of large ſize. When diſturbed it rolls itſelf up into a globular form, preſenting on every part a formidable armament of ſpines, and this is indeed its principal means of defence; upon being immerſed in cold water it expands, and ſwims with perfect facility. During the winter it is ſuppoſed to remain in a ſtate of torpidity.

Vegetables of various kinds, as the roots of plants, or fruits, reptiles, ſmall birds and inſects, conſtitute the principal food of this animal; the Calmucs tame and keep it in their dwellings like the cat; and in this reſpect they become uſeful, as they deſtroy the cockroaches, and other obnoxious inſects. They produce from three to five young at a birth. The fleſh is very indifferent, yet is ſpoken of among the old writers as an article of food, with inſtructions for roaſting or otherwiſe preparing it for the table.

The hedge hog is conſidered as an inoffenſive animal, notwithſtanding the vulgar ſuppoſition, that it ſucks the teats of cattle by night, and occaſions ulcerations in thoſe tender parts with the irritation of their prickles. The animal has a muſky ſmell. Length ten inches.

INAURIS. Without external ears. Linn. Seba. *Gaiana hedge-hog*.

Length eight inches. Inhabits South America. The head is thick, ſhort; ſpines cinereous tinged with yellow; hair ſoft, whitiſh cheſnut over the eyes; tail ſhort; claws long and crooked. Deſcribed on the authority of Seba.

AURITUS. Ears oval, long. *Auriculis ovalibus longis, naribus criſtatus*, Pallas. Nov. C. Pet. *Siberian hedge-hog*.

Inhabits the lower parts of the Volga and Ural and extends from thence to the eaſtern parts beyond the lake Baikal. Its form reſembles that of the common hedge-hog, but is ſmaller, the eyes larger, wiſkers diſpoſed in four rows; the feet longer, more ſlender; tail ſhorter, conic, annulated, and nearly bald. The female is ſaid to breed twice a year, and to produce from four to ſeven each time.

MALACCENSIS. Ears pendulous. Briſſ. *Hyſtrix brachyura*, Linn. *Porcus aculeatus, ſ. Hyſtrix malaccenſis*, Seba. *Malacca hedge-hog*.

Extremely allied in its general appearance to the porcupine, and referred to the hedge-hog tribe chiefly on account of the number and arrangement of the teeth. Its ſize is ſuppoſed to be equal to that of the common porcupine. This animal is ſaid to inhabit Aſia, and to produce the precious ſtone called Piedra del Porco, the imaginary virtues of which are ſo highly extolled in the old materia medica.

SETOSUS. Ears ſhorter; top and hind head and ſhoulders beſet with ſpines; tail very ſhort and ſpinous. *Erina-*

ceus ſetoſus, Gmel. Schreber. *Tendrac*, Buff. *Petit tendrac de Madagaſcar.* Sonner. *Aſiatic hedge-hog.*

Native of India and Madagaſcar; length ſix inches; wallows in the mire, and grunts like a hog, and forms burrows. Remains torpid for ſix months, during which the hair falls off.

Ecaudatus. No tail; ſnout very long and acute. Schreber. *Tanrec, et le jeune tanrec*, Buff. *Madagaſcar hedge-hog.*

Inhabits India and Madagaſcar. In habit reſembles the former, but is larger, meaſuring in length eight inches. The mouth and eyes are ſmall; ears rounded and longer than in the ſetoſus; the ſpines black, and covering the whole back and ſides; hair yellowiſh and feet tawny.

The two laſt mentioned animals are conſidered by Pennant as the ſame ſpecies, on the preſumption that the former is the adult ſtate, the other in a leſs advanced ſtage of growth. Dr. Shaw ſeems inclined to adopt this ſuppoſition. There, nevertheleſs, appears in our mind no plauſible reaſon for ſuch conjecture, unleſs the deſcriptions be defective in the moſt eſſential particular; for, if one has a tail and the other none, they muſt be diſtinct. That the animal deſcribed by Buffon had not obtained its full growth is rendered extremely probable by the explanation afforded, but the production of a tail cannot be ſuppoſed to depend on the age of the animal. The tanrec feeds on fruits, and remains torpid during about three months of the year.

ERINÆI, in *Ancient Geography*, a people of Aſiatic Sarmatia. Ptolemy.

ERINDES, a river of Aſia, towards Hyrcania or Sparta, according to Tacitus.

ERINEUS, one of the four cities of Doris, ſituate on the moſt northern verge of the kingdom, near the foot of the hills which part Doris from Macedonia.—Alſo, a port of the ſea of the Peloponneſus, in Achaia, between Ægium and the promontory Rhium. Pliny.—Alſo, a river of Sicily, according to Thucydides, called *Orinos* by Ptolemy.

ERINGO. See Eryngo.

ERINNA, in *Biography*, a Greek poeteſs, mentioned by different writers as a native of Leſbos, of Teios, of Rhodes, and of Tenos in Laconia, is ſuppoſed to have been contemporary with Sappho, about the year 600 B.C. but ſhe is placed by the Chronicle of Euſebius 250 years later. She was celebrated in ancient Greece, and ſeveral epigrams were written upon her, one of which ſpeaks of her as inferior to Sappho in lyrics, and ſuperior in hexameters. Some fragments are extant in her name, which are inſerted in the "Carmina Novem Poetarum Fœminarum." Antw. 1568. Voſſ. Poet. Græc.

ERINUS, in *Botany*, a name adopted by Linnæus from Dioſcorides, the etymology of which is unknown. Neither is his ερινος the ſame with the Linnæan plant, but rather, we preſume to think, ſomething which has hitherto eluded the ſagacity of commentators. His deſcription accords in ſome points with *Samolus Valerandi*.—Linn. Gen. 318. Schreb. 4 7. Willd. Sp. Pl. v. 3. 332. Mart. Mill. Dict. v. 2. Juſſ. 100. Gærtn. t. 55.—Claſs and order, *Didynamia Angioſpermia*. Nat. Ord. *Perſonatæ*, Linn. *Pediculares*, Juſſ.

Gen. Ch. *Cal.* Perianth in five deep, lanceolate, erect, nearly equal, permanent ſegments. *Cor.* of one petal, unequal; tube cylindrical, ſomewhat ovate, the length of the calyx, reflexed; limb flat, in five deep, nearly equal, inverſely heart-ſhaped ſegments. *Stam.* Filaments four, very ſhort, within the tube of the corolla; two of them (the uppermoſt) a little longer than the others: anthers ſmall. *Piſt.* Germen nearly ovate; ſtyle very ſhort; ſtigma capitate. *Peric.* Capſule ovate, inveſted with the calyx, of two cells and two valves, the latter cloven half way down when ripe; partition double. *Seeds* numerous, ſmall. *Recept.* compreſſed.

Eſſ. Ch. Calyx of five leaves. Limb of the corolla in five, nearly equal, notched ſegments. Capſule of two cells. Seeds numerous.

Obſ. By an unaccountable error in the Eſſ. Char. in all the editions of Linnæus the upper lip is ſaid to be very ſhort and reflexed, though the whole limb of the corolla is juſtly deſcribed as (nearly) equally five-cleft. Willdenow copies this, though the Hortus Kewenſis had corrected it.

E. *alpinus* is the beſt-known ſpecies. "Flowers racemoſe. Leaves ſpatulate."—Linn. Sp. Pl. 878. Curt. Mag. t. 310. Native of the alps of Switzerland, and the Pyrenæan mountains, flowering in the middle of ſummer. It forms tufts, with ſeveral dwarf ſtems, bearing numerous purple flowers, and is a very ornamental plant for rock-work, requiring protection againſt ſevere froſt and exceſſive moiſture, like moſt alpine rock plants. It is increaſed by parting the roots, or by ſeed.

E. *africanus*. "Flowers axillary, ſeſſile. Leaves lanceolate, ſlightly toothed."—Linn. Sp. Pl. 878. (Lychnidea villoſa, foliis ex alis floriferis, &c.; Burm. Afr. t. 50. f. 1.) Native of the Cape of Good Hope. This has a taller, more branched ſtem, more oblong leaves, and axillary flowers, of what colour we know not, with a very long ſlender curved tube. It has not yet appeared in our gardens.

E. capenſis. "Flowers ſpiked. Leaves linear, toothed."—Linn. Mant. 252, excluding Burman's ſynonym. Gathered by Sparmann in ſandy ground at the Cape of Good Hope. This is alſo a ſtranger to our gardens. The flowers are ſaid to be yellow and very fragrant. In the dried plant they are black. The tube is an inch and half long; the ſegments of the limb deeply cloven, the lobes dilated, obtuſe and divaricated.

E. *fragrans*. "Leaves lanceolate-oblong, toothed. Segments of the limb undivided."—Ait. H. Kew. v. 2. 357. (Selago Lychnidea; Linn. Sp. Pl. 877. Lychnidea villoſa, foliis oblongis, &c. Burm. Afr. t. 49. f. 4.) Native of the Cape, rarely ſeen in our green-houſes. The flowers are yellow or browniſh, and fragrant.

E. *triſtis*. "Leaves oblong, cut, toothed. Segments of the limb ſlightly cloven."—Linn Suppl. 287.—Found by Thunberg at the Cape. The flowers are ſaid to be ſweet-ſcented, and of a dull colour.

E. *peruvianus* and *laciniatus* of Linnæus, are both nearly related to *Verbena Aubletia*, and the former at leaſt ſeems to be the very ſame ſpecies.

ERIOCALIA, from εριον, *wool*, and καλια, *a neſt*, in alluſion to the ſingularly woolly involucrum in the midſt of which the flowers are ſeated as in a bird's neſt. Sm. Exot. Bot. v. 2. 37. Intr. to Bot. 373. (Actinotus; Labillard. Nov. Holl. 67.) Claſs and order, *Pentandria Digynia*. Nat. Ord. *Umbellatæ*.

Gen. Ch. *Umbel* ſimple, of many ſhort rays. *Invol.* of many lanceolate, equal, undivided, coloured leaves, longer than the rays of the umbel, and denſely clothed with wool. *Cal.* Perianth ſuperior, in five deep, equal, concave, ſometimes coloured, externally hairy, permanent leaves. *Cor.* none. *Stam.* Filaments five, about as long as the calyx, equal, awl-ſhaped; anthers roundiſh, of two lobes. *Piſt.* Germen inferior, obovate, compreſſed, furrowed, very hairy; ſtyles two, capillary, ſpreading, longer than the ſtamens; ſtigmas ſimple. *Peric.* Fruit ovate, obtuſe, compreſſed, furrowed, hairy, crowned with the calyx and ſtyles. *Seed* ſolitary?

Eſſ. Ch. Umbel ſimple. Involucrum of many lanceolate,

late, equal, woolly, coloured leaves, longer than the umbel. Fruit compreſſed, hairy. Petals none. Many flowers abortive.

This New Holland genus bears the moſt ſtriking analogy to the European *Aſtrantia*, from which it differs in its woolly, not ſmooth, involucrum, but more eſſentially in having no petals, and in its hairy, not muricated, fruit. M. Labillardiere had, unknown to us, previouſly named it *Actinotus*, but that name being already long ago occupied in mineralogy, is untenable in botany.

The only ſpecies known are two.

1. E. *major*. Sm. Exot. Bot. v. 2. 37. t. 78. (Actinotus helianthi; Labill. Nov. Holl. 67. t. 92.) "Segments of the leaves bluntiſh, flat, woolly on both ſides. Flower-ſtalks ſomewhat corymboſe."—Native of the ſandy country about Port Jackſon, New South Wales, as well as of the weſt coaſt of New Holland, flowering in October. The *root* appears to be annual; it is woody and branching. *Stem* ſolitary, about two feet high, erect, leafy, round, woolly, but little branched except at the upper part, where the long flower-ſtalks, more or leſs numerous, grow in a corymboſe form. *Leaves* alternate, ſtalked, three-cleft, lobed and pinnatifid; their ſegments ſpreading, linear, entire, flat, a little dilated upward, and bluntiſh; clothed with denſe wool, whiter beneath. *Stipulas* none. *Flowers* terminal, large and ornamental, all over white with a green or rufous tinge. *Involucrum* of eight or ten ſpreading leaves, each an inch or more in length, peculiarly ſoft and pliable, like velvet. *Flowers* very numerous, forming a convex compact ſort of diſk, thoſe of the circumference males. *Calyx* whitiſh, ſo as to reſemble petals. No aromatic or pungent flavour is perceptible in any part of the plant.

2. *E. minor*. Sm. Exot. Bot. v. 2. 39. t. 79. "Segments of the leaves acute, revolute; ſmoothiſh above; ſilky beneath. Flower-ſtalks ſcattered."—Found near Port Jackſon, in a ſandy or gravelly ſoil, flowering in March.—Much ſmaller than the laſt, and bearing the ſame analogy to it that *Aſtrantia minor*, Sm. Exot. Bot. t. 77, does to the *major*, t. 76.—*Root* woody, branched, perhaps perennial. *Stem* a foot or two high, much branched, leafy, round, clothed with cloſe-preſſed hairs. *Leaves* on long foot-ſtalks, divided into three or five deep, ſpreading, dilated, acute, revolute, pinnatifid or three-cleft lobes; green, ſmooth, or ſlightly hairy, above; denſely clothed with white ſilky hairs beneath. *Flowers* on long, ſolitary, terminal, naked ſtalks, ſcarcely a quarter ſo large as in the other. *Calyx* green, and not coloured. *Involucrum* almoſt naked underneath; hairy, ſomewhat ſilky, white or reddiſh above. This ſpecies is likewiſe without any peculiar flavour.

ERIOCAULON, from εριον, *wool*, and καυλος, *a ſtem*, becauſe of the woolly or hairy ſtalk, which however is rarely the caſe. Linn. Gen. 40. Schreb. 56. Willd. Sp. Pl. v. 1. 485. Sm. Fl. Brit. 1009. Juſſ. 44. Gærtn. t. 83.—Claſs and order, *Monoecia Triandria*, Smith. (*Triandria Trigynia*, Linn.) Nat. Ord. *Junci*, Juſſ.

Gen. Ch. *Common calyx* globoſe, depreſſed, imbricated, many-flowered; its ſcales lanceolate or obovate, obtuſe, ſcarioſe, equal, permanent; perianth inferior, of two or three obtuſe, permanent, muricated leaves. *Male flowers* ſeveral, in the middle of the diſk. *Cor.* funnel-ſhaped; tube about as long as the calyx; limb in two deep, obtuſe, muricated lobes. *Stam.* Filaments three or four, equal, inſerted into the tube of the corolla, and rather longer than the limb; anthers vertical, roundiſh, of two lobes. *Piſt.* Germen obſolete; ſtyle capillary, cloven; ſtigmas blunt. *Female flowers* ſeveral, in the circumference, between the calyx-ſcales. *Cor.* inferior, of two oblong, concave, obtuſe petals, muricated at the upper part externally. *Stam.* none. *Piſt.* Germen ſuperior, of two or three lobes; ſtyle thread-ſhaped, ſhorter than the corolla, cloven; ſtigmas two or three, acute. *Peric.* Capſule roundiſh, of two or three lobes, with as many cells and valves. *Seeds* ſolitary.

Eſſ. Ch. Common calyx of many leaves, many-flowered; perianth ſuperior, of two or three leaves. Male flowers central. Corolla of one petal, cloven. Female fl. in the margin. Corolla of two petals. Stigmas two or three. Capſule of two or three cells. Seeds ſolitary.

The characters of this genus were ſo ill defined in the works of Linnæus, that Hudſon conceived our Britiſh *Eriocaulon*, confounded by Linnæus with his *decangulare*, muſt be a diſtinct genus, and he therefore called it *Naſmythia*, in honour of ſir James Naſmyth, baronet; ſee Fl. Angl. ed. 2. 414. As however no genus can be more natural and diſtinct than *Eriocaulon*, and the fault appears to have been entirely in the deſcriptions of authors, its characters are now reformed. The above deſcription is made from the only Britiſh ſpecies, *E. ſeptangulare*, With. 184. Sm. Fl. Brit. 1010. Engl. Bot. t. 733.—"Stalk with ſeven angles. Leaves ſharp-pointed, with an internal network of cells. Male flowers with four ſtamens." It grows in ſeveral lakes in the iſle of Skye very abundantly, and was found in September 1801 by Dr. Wade, decorating the edges of all the lakes in Cunnamara, in the county of Galway, Ireland. The *root* is perennial, conſiſting of abundance of ſimple, white, ſhining fibres, compoſed internally of a ſeries of cells, frequently interrupted by tranſverſe partitions, which is the general ſtructure of the whole herb. *Stalk* a ſpan high, ſolitary, upright, ſimple, naked, twiſted, with ſeven angles and as many intermediate furrows, ſmooth, (ſo that in this inſtance the generic name does not well apply), inveſted with a tubular ſheath at the baſe. *Leaves* numerous, radical, ſword-ſhaped, ſmooth, taper-pointed, about two inches long. *Head* of flowers terminal, ſolitary, hemiſpherical, about three lines broad, prettily variegated with dark purple and white, the calyx and anthers being of the former colour, as well as a few ſpots on the white corolla. The ſnow-white club-ſhaped protuberances, with which the extreme parts of the calyx and corolla are muricated, give the whole an elegant feathery aſpect.

Linnæus knew about five ſpecies of *Eriocaulon*, but very imperfectly, and he was cautious of adopting Dr. Hope's accurate generic deſcription of the above plant, publiſhed in the Philoſophical Tranſactions, v. 59. 243. t. 12, leſt it ſhould not accord with every ſpecies. As far as ſubſequent examination of the ſeveral exotic ones has gone, it is found to confirm the account here given. Willdenow enumerates eight ſpecies in all; Lamarck deſcribes 12 in his Encyclopedie, v. 3. 274—277, and figures 4, rather imperfectly, in his t. 50. This laſt author is, nevertheleſs, the beſt we have on the ſubject, though Willdenow heſitated to follow him, and Vahl, in his Sp. Pl. v. 2. 210, removes his *E. ſpadiceum*, perhaps rightly enough, to *Schoenus*.

Authors are very much confuſed in their accounts of the native countries of ſeveral ſpecies. The *repens* of Lamarck was gathered by Thierry de Menonville in Hiſpaniola, not by Commerſon in the iſle de Bourbon. *E. ſpadiceum* of the ſame author was found by Smeathman at Sierra Leone, from whom we have it in plenty, and whom Lamarck rightly quotes; yet Vahl mentions St. Domingo (Hiſpaniola) a its native country, on the authority of Lamarck's herbarium, without naming Smeathman.

The following 6 ſpecies we believe are hitherto entirely nondeſcript. They will probably appear, with others, more fully illuſtrated hereafter from the pen of Mr. R.

Brown, when he has time to reſume the ſtudy of this genus, of which we believe he has aſcertained about 30 ſpecies. In the mean while, to ſecure his ſpecific names and our own thus far, we ſhall attempt definitions of what we have determined from actual obſervation.

E. *pygmæum*, Soland. MSS.—Stalks aggregate, five-angled. Leaves and ſheaths rough; the latter longeſt. Head globoſe. Calyx-ſcales obovate, pointed.—Native of New Holland. *Herb. Linn. fil.* The *ſtalks* are about two inches high. *Leaves* about half an inch long, being rather ſhorter than the ſheaths of the ſtalks, which is unuſual. *Heads* browniſh.

E. *ſcarioſum*.—Stalks aggregate, five-angled. Leaves and ſheaths ſmooth, of equal length. Head globoſe. Calyx-ſcales obovate, acute.—Communicated from New South Wales in 1792, by John White, M. D.—*Stalks* five or ſix inches high. *Heads* of a ſilvery white, ſcarcely ſo large as a pea, being about twice as big as the former.

E. *ſtupeum*.—Stalk nearly ſolitary, five-angled. Leaves and ſheaths of equal length, denſely woolly at the baſe. Head hemiſpherical. Calyx-ſcales obovate, acute. Gathered by Sonnerat at the Iſle de Bourbon. *Stalk* ſometimes above a ſpan high. *Leaves* ſpreading, involute when dry, ſmooth, or nearly ſo, but enveloped at their baſe, as well as the ſheath of the ſtalk, by a denſe integument of ſilky wool. *Head* much like that of *E. ſeptangulare*.

E. *latifolium*.—Stalks ſomewhat aggregate, cylindrical, furrowed. Leaves ſmooth, taller than the ſtems. Head hemiſpherical. Outer calyx-ſcales rounded, obtuſe; inner lanceolate, acute.—Gathered at Sierra Leone by Dr. Afzelius. The very long and broad flat *leaves*, a ſpan in length, are remarkable. The *ſheaths* are alſo large, about half as long as the ſtalk. *Head* ſmaller than in the laſt, variegated with brown and white.

E. *fiſtuloſum*. Brown MSS.—Stalks aggregate, cylindrical, ſtriated. Leaves ſmooth, twice as long as the ſheaths. Head hemiſpherical. Inner calyx-ſcales obovate, pointed.—Native of New Holland.—*Stalks* a ſpan high. *Leaves* about half as long, or more, taper-pointed, ſmooth, rather turgid. *Heads* ſmall, browniſh.

E. *depreſſum*. Brown MSS.—Stalks aggregate, cylindrical, furrowed. Leaves ſmooth, as tall as the ſtalks. Head flattened. Calyx-ſcales wedge-ſhaped, obtuſe. Native of New Holland. *Stalks* about two inches high. *Heads* hemiſpherical beneath, nearly flat at the top, dark purpliſh brown.

We have in our deſcriptions ſubſtituted the word ſtalk (*ſcapus* or *pedunculus*) for ſtem, as being more correct. S.

ERIOCEPHALUS, ſo named by Dillenius from εριον, *wool*, and κεφαλη, *the head*, in alluſion to the remarkably woolly appearance, ſingular in the tribe to which it belongs, which this plant makes when in ſeed. Linn. Gen. 450. Schreb. 586. Willd. Sp. Pl. v. 3. 2384. Mart. Mill. Dict. v. 2. Juſſ. 186. Gærtn. t. 168.—Claſs and order, *Syngeneſia Polygamia-neceſſaria*. Nat. Ord. *Compoſitæ nucamentaceæ*, Linn. *Corymbiferæ*, Juſſ.

Gen. Ch. *Common calyx* erect, of ten ovate, equal, cohering ſcales; the five outermoſt keeled, the inner ones flat. *Cor.* compound, radiated; the perfect florets doubly numerous, conſtituting the diſk; female ones five, making the radius: that of the perfect florets funnel-ſhaped, with a five-cleft ſpreading border; of the radius flat, inverſely heart-ſhaped, with three terminal lobes. *Stam.* in the perfect florets, Filaments five, capillary, very ſhort; anthers united into a cylindrical tube. *Piſt.* in the perfect florets, Germen obſolete; ſtyle ſimple; ſtigma cloven, acute: in the female ones, Germen ovate, naked; ſtyle ſimple; ſtigma pointed, inflexed. *Peric.* none, except the ſcarcely altered calyx. *Seeds* in the diſk none; in the radius obovate, naked. *Recept.* flat, woolly, and the elongated wool which ſeparates the two rows of calyx-ſcales, is moreover introduced between the perfect and female florets.

Obſ. A ſmall compreſſed body adheres to the baſe of each ſcale of the calyx.

Eſſ. Ch. Receptacle woolly. Seed-down none. Calyx of ten equal leaves. Florets of the radius five, inverſely heart-ſhaped.

The ſpecies are two, both ſhrubs natives of the Cape of Good Hope, and to be met with, though rarely, in our green-houſes.

1. E. *africanus*. Linn. Sp. Pl. 1310. Ait. Hort. Kew. v. 3. 278. Curt. Mag. t. 833. (E. ſempervirens, foliis faſciculatis & digitatis; Dill. Elth. v. 1. 132. t. 110. f. 134.) "Leaves lobed or undivided. Flowers corymboſe."—The *leaves* are faſciculated, fleſhy, and nearly cylindrical, hoary and glaucous, moſtly undivided, ſometimes with two or three lobes or notches. *Flowers* reſembling many ſpecies of Yarrow, *Achillea*, having broad white radiant florets, and a ſmall purple and yellow diſk. The *ſeeds* are enveloped in the long ſoft hairs of the receptacle which come forth after the flowering is paſt. It is propagated by cuttings, and flowers from January to March.

2. E. *racemoſus*. Linn. Sp. Pl. 1311. Ait. Hort. Kew. v. 3. 279.—"Leaves linear, flat, undivided. Flowers racemoſe."—The *leaves* are ſhorter, flatter, and leſs faſciculated than in the former. *Flowers* in long cluſters or rather ſpikes. *Wool* of the receptacle very long.—Dr. Sims in Curt. Mag. juſtly refers Gærtner's ſynonym to the foregoing ſpecies, not to this.

ERIOGONUM, from εριον, *wool*, and γονυ, *a joint*, in alluſion to the woollineſs of the habit, and the jointed ſtructure of the ſtem. Michaux Fl. Boreali-Amer. v. 1. 246. Claſs and order, *Enneandria Trigynia*. Nat. Ord. *Holoraceæ*, Linn. *Polygoneæ*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, in ſix deep, obovate, coloured, ſpreading ſegments, of which the three innermoſt are ſomewhat the largeſt. *Cor.* none. *Stam.* Filaments nine, occaſionally eight or ten, rather longer than the calyx and inſerted into its baſe, hairy in their lower part; anthers roundiſh, verſatile, incumbent. *Piſt.* Germen ſuperior, oblong, triangular, with three furrows; ſtyles three, the length of the ſtamens; ſtigmas ſimple, obtuſe. *Peric.* Capſule triangular, membranous, not burſting. *Seed* ſolitary, triangular, ſharp at each end, black; with a ſnow-white, ſmall, farinaceous albumen, and large flat cotyledons.

Eſſ. Ch. Calyx inferior, coloured, in ſix deep ſegments, permanent. Capſule membranous. Seed ſolitary, triangular. Stigmas ſimple.

This genus in its parts of fructification very nearly approaches *Polygonum*, but the above characters are ſufficient to diſtinguiſh it, and the habit, more eſpecially the abſence of ſtipulas, renders it totally diſtinct. We are poſſeſſed of three ſpecies, one of which only has been hitherto mentioned.

1. E. *tomentoſum*. Michaux as above, t. 24. (Chryſoſplenium? oppoſitifolium; Walter Fl. Carolin. 140.) Calyx woolly, ſtem-leaves whorled, ſeſſile.—We have been acquainted with this plant ever ſince November, 1793, when a root brought by Mr. John Fraſer from Carolina, flowered for the firſt time in his garden at Chelſea. It was drawn by Mr. Sowerby, but the figure remains unpubliſhed. Michaux in the mean while has named and deſcribed this genus as above, giving an indifferent plate of the only ſpecies known to him, which, he ſays, grows in the dryeſt fir woods of

Carolina and Georgia, and which is the very ſame as Mr. Fraſer's, in whoſe herbarium we have ſeen a ſpecimen from Mr. Walter, who named it, with a mark of doubt, *Chryſoſplenium oppoſitifolium*, not being furniſhed with ſufficient materials to judge how far he was correct or not. Michaux has given a ſpecific character, a perilous attempt, and indeed an abſurd one, for a ſolitary ſpecies, as it can only by accident ſerve to contraſt that ſpecies with others as yet unknown. The *Root* is perennial, rather woody, ſtem a foot or more in height, erect, round, woolly, ruſty-coloured, leafy, branched and forked, many-flowered. *Leaves* nearly entire, ſomewhat undulated; green, ſcattered with looſe, deciduous, ruſty down above; denſely woolly and whitiſh, with ruſty veins, beneath: the *radical* ones cluſtered, obovate, two inches in length, on broadiſh woolly footſtalks about half as long, ſpreading: *ſtem-leaves* in numerous rather diſtant whorls, three or four in a whorl, ſeſſile, ſcarcely an inch long, unequal, pointed. *Stipulas* none. *Bracteas* either terminal or from the forks of the ſtem, ſolitary, ſeſſile, cup-ſhaped, bluntly toothed, woolly, containing eight, ten, or more inodorous *flowers* on ſimple, ſlender, woolly *ſtalks*, each joined in the middle, and ſwelling upwards. Segments of the *calyx* elliptical, broad, obtuſe, white at the edge, green clothed with ruſty wool at the back. The baſe of the *ſtamens*, and ſummit of the *flower-ſtalks*, are tinged with purple. *Fruit* covered by the cloſed internal ſegments of the calyx, become contracted at their baſe, and a little undulated.

2. E. *parvifolium*. Calyx naked. Stem-leaves ſtalked, alternate, ovate, revolute.—Gathered in California by Mr. Archibald Menzies. The *ſtem* is ſhrubby, branched, leafy, with a deciduous, nearly ſmooth bark. *Leaves* alternate or cluſtered, about a quarter of an inch long, ovate, obtuſe, revolute, almoſt if not quite entire; ſmooth and ſhining above; denſely clothed with ruſty wool beneath. *Footſtalks* half as long as the leaves, very woolly, dilated at their baſe, but not quite embracing the ſtem. *Flowers* very numerous, in denſe, globular, woolly tufts, one terminating each branch, and ſurmounted by another, on an elongation of the ſame branch, two inches above it. *Flower-ſtalks* ſmooth. *Calyx* ſmooth, or very ſlightly downy at the back, its ſegments oblong, obtuſe, keeled, entire, not wavy. We have not ſeen the radical leaves, nor been able to inveſtigate the *bracteas*. The round tufts of very copious flowers, and the ſtalked ſcattered ſmall leaves, at once diſtinguiſh this ſpecies.

3. E. *latifolium*. Calyx naked. Stem-leaves ſtalked, alternate, heart-ſhaped, undulated. Foot-ſtalks embracing the ſtem.—Gathered in California by Mr. Menzies, with the laſt. *Stem* ſhrubby. *Branches* round, woolly, leafy. *Leaves* alternate, two inches long, heart-ſhaped, bluntiſh, undulated and criſped at the edge; covered with a web of deciduous white down above; very woolly and white beneath. *Footſtalks* as long as the leaves, woolly, ſheathing the ſtem with their dilated baſes. Some leaves are cluſtered about the end of each branch. *Flowers* not larger than in E. *parvifolium*, and, as in that ſpecies, very numerous in globoſe woolly tufts, terminating elongated, naked, woolly branches. Segments of the *calyx* obovate, keeled, ſomewhat undulated.

The addition of theſe two ſpecies confirms the very natural genus of *Eriogonum*, which in the Linnæan ſyſtem ſhould immediately follow *Rheum*. Probably more ſpecies are to be found in the unexplored wilds of North America. Thoſe we have deſcribed would all certainly bear the climate of Britain, and though not ſplendid plants, are worthy of cultivation for their ſingularity. Their qualities cannot be ſuppoſed different from *Polygonum* and *Atraphaxis*. S.

ERIOPHORUM, from εριον, *wool*, and φερω, *to bear*, alluding to the woolly or cottony tufts borne by the plant when in ſeed. Cotton-graſs.—Linn. Gen. 30. Schreb. 41. Willd Sp. Pl. v. 1. 312. Sm. Fl. Brit. 58. Juſſ. 27. Gærtn. t. 2. Claſs and order, *Triandria Monogynia*. Nat. Ord. *Calamariæ*, Linn. *Cyperoideæ*, Juſſ.

Gen. Ch. *Spike*, or rather *Catkin*, imbricated every way: ſcales ovate-oblong, flat, ſlightly inflexed, pointed, membranous, looſe, ſeparating the flowers. *Cor.* none. *Stam.* Filaments three, capillary, anthers erect, oblong. *Piſt.* Germen ſuperior, very ſmall; ſtyle thread-ſhaped, the length of the calyx-ſcale; ſtigmas three, longer than the ſtyle, reflexed. *Peric.* none. *Seed* triangular, pointed, ſurrounded at the baſe with numerous hairs longer than the ſpike.

Eſſ. Ch. Glumes chaffy, imbricated every way. Corolla none. Seed one, inveſted with very long hairs.

Six ſpecies are deſcribed by Willdenow, four of which are found in Britain, *viz.* *E. vaginatum*, Engl. Bot. t. 873; *polyſtachion*, t. 563; *anguſtifolium*, t. 564, long confounded with the laſt; and *alpinum*, t. 311. The exotic ſpecies are, *E. virginicum*, Linn. Sp. Pl. 77; and *cyperinum*, ibid; both natives of North America. The latter has browner and ſhorter hairs to the ſeed than any other, ſo as to have nothing of their ſtriking appearance. The whole genus grows in a turfy ſoil, generally in wet places, to which the firſt ſpecies is an occaſional exception, being ſometimes found on dry mountainous heaths. Some German botaniſts have lately diſtinguiſhed from the *vaginatum*, one which they name *E. Scheuchzeri*. This is *Eriophorum*, n. 1332 β. Hall. Hiſt. v. 2. 175. (Juncus alpinus, capitulo tomentoſo majori; Scheuchz. Prod. 27. t. 7. f. 2.) It has creeping *roots*, ſolitary *ſtems*, not half ſo tall, but much ſtouter than thoſe of *vaginatum*, with a much leſs remarkable ſheath. The *leaves* alſo are very ſhort; the hairs of the *ſeed* very denſe and remarkably delicate. It grows in the moſt elevated marſhy paſtures of the Alps, or about the boggy borders of Alpine lakes, as mentioned by Scheuchzer, and is undoubtedly a diſtinct ſpecies.

ERIOPHORUS, Bulbus, the *Woolly Bulb*, βολβος εριοφορος of Theophraſtus, book vii. chap. 13, who mentions it as "growing on the ſhore, and having between its outer coats and the inner part, which is eatable, a woolly ſubſtance, of which various garments are woven." Pliny obſerves, that Theophraſtus does not inform us in what country this is practiſed. Dodonæus, among the moderns firſt inſtituted an inquiry into this bulb, Hiſt. Stirp. 692, giving a figure, communicated by a friend of whoſe fidelity he is very unwilling to doubt, of a plant hitherto unſeen by any other mortal. It has ſcaly bulbs, more reſembling tuberous roots inveſted with the permanent baſes of the foliage; long ſword-ſhaped leaves: and large ſolitary flowers, unlike every thing known in the vegetable world, being formed of five denſely ſhaggy ovate ſpreading petals, and a ſixth ſtanding upright in the place of the ſtamens and piſtils. This cut has always been judged fictitious, and, if true, it would not anſwer to the deſcription of Theophraſtus. Dodonæus, moreover, figures the *Scilla hyacinthoides* as one kind of *Bulbus eriophorus*, and refers to Cluſius, who, in his Hiſt. Plant. 173, gives *Scilla peruviana* for another. Both theſe bulbs, and, indeed, ſome others, have, in fact, a woollineſs about their upper part when the coats are torn aſunder, apparently conſiſting of their large and tenacious ſpiral-coated ſap-veſſels; but the quantity or quality of this wool is not, in any inſtance that has come under our inſpection, by any means adequate to the uſes mentioned in Theophraſtus.

ERIOSPERMUM, from εριον, *wool*, and σπερμα, *ſeed*. Jacq. Coll. v. 5. 72. Willd. Sp. Pl. v. 2. 110. Claſs and order, *Hexandria Monogynia*. Nat. Ord. *Coronariæ*, Linn. *Aſphodeli*, Juſſ.

Gen. Ch. *Cal.* none. *Cor.* bell-ſhaped, permanent, of ſix ovate, equal, keeled petals, three of which are exterior and moſt expanded. *Stam.* Filaments ſix, ſhorter than the corolla, awl-ſhaped, uniform, dilated at the baſe, ſmooth; anthers incumbent, oval, two-lobed. *Piſt.* Germen ſuperior, ovate, with ſix ribs; ſtyle erect, angular, as long as the ſtamens; ſtigma ſimple, obtuſe. *Peric.* Capſule of three cells and three valves; partitions from the centre of each valve. *Seeds* ſeveral, affixed to the lower part of each partition, roundiſh, inveſted with long prominent woolly hairs.

Eſſ. Ch. Corolla of ſix petals, bell-ſhaped, permanent. Filaments broad at the baſe. Capſule of three cells. Seeds inveſted with wool.

This genus, than which none can be more natural, either with reſpect to character or habit, was eſtabliſhed by Jacquin in the fifth or ſupplemental volume of his Collectanea, upon the *Ornithogalum capenſe* of Linnæus and Thunberg, with two other ſpecies. They all agree in their tuberous root; radical, ſtalked, ſolitary, elliptic-oblong, entire, involute leaves; and tall, naked, racemoſe, many-flowered ſtalks. The flowers are ſmall; petals white with reddiſh, brown, or greeniſh keels.—They are all delineated in Jacquin's Icones Plant. Rarior. v. 2, as follows.

1. E. *latifolium*, t. 420. (Ornithogalum capenſe; Linn. Sp. Pl. 441. Commel. Hort. v. 2. t. 88.) Leaves broadly elliptical, ſomewhat heart-ſhaped, recurved.—The *leaves* are of a dark ſhining green. Partial *flower-ſtalks* two inches long. *Petals* with a roſe-coloured rib.

2. E. *lancifolium*, t. 421. Leaves ovato-lanceolate, acute, erect.—The upper ſide of the *leaves* is repreſented glaucous by Jacquin, their backs of a graſs green. Partial *flower-ſtalks* but an inch long. *Petals* with a browniſh rib.

3. E. *parvifolium*, t. 422. Leaves elliptical, obtuſe, erect, flat. The *leaves* of this are glaucous, reticulated, and much ſmaller than in either of the former, being but from an inch and half to two inches long. *Petals* with a green rib. *Partial-ſtalks* an inch long, ſpreading.

All theſe ſpecies are natives of the Cape of Good Hope. We ſuſpect that Bengal and the coaſt of Guinea may afford one or two more, but we are not furniſhed with materials ſufficient to aſcertain them completely.

ERIOSTEMON, from εριον, *wool*, and στημων, *a ſtamen*, alluding to the fringed filaments. Sm. Tranſ. of Linn. Soc. v. 4. 221. Claſs and order, *Decandria Monogynia*. Nat. Ord. *Rutaceæ*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, in five deep ſegments, nearly equal, permanent. *Cor.* Petals five, ovate, ſeſſile, regular and equal, ſomewhat ſpreading, moſtly five times as long as the calyx, ſometimes rough, inſerted under a glandular nectary, which ſurrounds the baſe of the germen. *Stam.* Filaments 10, awl-ſhaped, flattened, clothed or fringed with fine ſpreading hairs; anthers on terminal ſtalks, roundiſh with a ſmall point, two-lobed, incumbent, ſmooth. *Piſt.* Germen of five lobes, ſuperior, ſtanding on the nectary, each lobe ſomewhat ovate, triangular, acute, ſoon ſpreading; ſtyle central, from the baſe of the germen, erect, cylindrical, elongated after flowering, ſmooth; ſtigma capitate, with five notches. *Peric.* Capſules five, connected by their baſe, ovate, compreſſed, coriaceous, of two valves, encloſing an elaſtic, cartilaginous, bivalve arillus. *Seeds* ſolitary, kidney-ſhaped, brown, ſmooth.

Eſſ. Ch. Calyx in five deep ſegments. Petals five, ſeſſile. Stamens flat, fringed. Anthers ſtalked, terminal. Style from the baſe of the germen. Capſules five, combined, ſeated on a glandular nectary. Seeds encloſed in an arillus.

Obſ. Some ſpecies have a four-cleft flower, with but eight ſtamens, and others have five of their 10 ſtamens imperfect and abortive.—This genus differs from *Boronia*, Sm. Tracts on Nat. Hiſt. 287. t. 4—7, in having the anthers upon terminal footſtalks, and the ſtyle from the baſe of the germen; not to mention the flowers being generally five-cleft and decandrous, and the leaves uſually alternate. From *Corræa* and *Crowea*, ſee vol. 10, its differences are evident from the characters there given of thoſe genera. We are happy here to mention that the long-deſired *Corræa rubra* flowered, for the firſt time in Europe, at Meſſrs. Lee and Kennedy's, Hammerſmith, in June 1809.

The ſpecies of *Erioſtemon* in our poſſeſſion are ſix.

1. E. *ſalicifolia*. Willow-leaved Erioſtemon.—Leaves linear-lanceolate, flat, ſtraight, naked on both ſides. Branches ſmooth. Flowers lateral. Gathered near Port Jackſon, New South Wales, by John White, M.D. who communicated dried ſpecimens to us in 1791, but it has not yet appeared in the gardens. This is a very handſome flowering ſhrub, with numerous, alternate, wand-like, leafy, ſmooth, angular *branches*, having indeed much of the habit of *Crowea ſaligna*. *Leaves* alternate, from one to two inches long, but little ſpreading, linear-lanceolate, entire, bluntiſh with a ſmall point, thick and coriaceous, naked and ſmooth on both ſides, beſprinkled with glandular dots, ſcarcely veiny, but marked with an obſolete central rib; their baſe tapering down into a ſhort flat *footſtalk*. *Stipulas* none. *Flowers* pink, reſembling thoſe of *Crowea ſaligna*, on ſhort, ſimple, ſolitary, axillary, angular, downy, bracteated ſtalks. *Bracteas* imbricated, roundiſh, obtuſe, concave, pale, downy, fringed. Segments of the *calyx* much reſembling the bracteas, about a line long, imbricated at their baſe. *Petals* alternate with them, and five or ſix times as long, obovate, ſpreading, bluntiſh, clothed with ſhort, denſe, ſcurfy pubeſcence, eſpecially on the outſide. *Filaments* about one-third as long as the corolla, red, all clothed from the baſe with denſe, white, ſpreading hairs, and terminated by a naked, club-ſhaped, obtuſe, red ſtalk, which in the five innermoſt alternate ones is much longer, thicker, and more glandular, than in the reſt, rendering thoſe ſtamens conſpicuouſly the longeſt; anthers at the top of each ſtalk, incumbent, uniform, all fertile, ovate, of two cells, burſting longitudinally on their inner ſide, tipped with a ſmall, pale, reflexed ſcale or creſt. *Style* ſhorter than the ſtamens.

2. E. *buxifolia*. Box-leaved Erioſtemon.—Leaves elliptical, keeled, revolute, with a recurved point. Branches hairy, round. Flowers lateral.—Gathered near Port Jackſon, by Dr. White. Of this we have two very diſtinct varieties, for conſidering the Proteus-like nature of the leaves in New Holland plants, in which alone theſe differ, we dare not call them diſtinct ſpecies. In one the *leaves* are obovate, narrow at the baſe, bluntly crenate and glandular at the edges; in the other they are broadly elliptical, heart-ſhaped, and embracing the ſtem at their baſe, generally even and entire at their edges, though occaſionally furniſhed, in the very ſame manner, with blunt glandular teeth. In both the *branches* are round, clothed with ſhort prominent hairs. *Leaves* numerous, ſcattered, ſcarcely half an inch long, coriaceous, nearly ſmooth, keeled, with a ſharp recurved point, and a thick, ſlightly revolute, margin. *Flowers* towards the ends of the branches, axillary, ſolitary. *Stalks* rather ſhorter than the leaves, thickened upwards,

ſlightly hairy, with ſeveral minute, crowded, roundiſh, ſmooth *bracteas* a little above their baſe. *Calyx* much reſembling the bracteas. *Petals* whitiſh or roſe-coloured, almoſt as large as in the former, but ſmooth or very ſlightly downy; more ſpreading and recurved. *Filaments* minutely fringed, their terminal ſtalks awl-ſhaped, bearing a few long ſcattered hairs; anthers much like the former but ſhorter, and with a ſhorter broader point. *Germen* ſmooth, with very pointed lobes; ſtyle ſhorter than the ſtamens.

3. E. *ſalſolifolia.* Saltwort-leaved Erioſtemon.—Leaves crowded, linear, obtuſe; flattened above; convex beneath; rough-edged, ſtraight. Flowers terminal.—Gathered by Dr. White near Port Jackſon, with the laſt. It ſeems a more humble ſhrub than either of the foregoing, and has angular *branches*, all over ſcarred where former leaves have ſtood; ſlightly hairy when very young. *Leaves* very numerous, ſomewhat imbricated, half an inch or leſs in length, fleſhy, linear inclining to obovate, obtuſe, flattiſh above, convex beneath, more or leſs rough-edged, and ſometimes otherwiſe pubeſcent, dotted with ſcattered glandular points, which in the dried leaves are prominent tubercles. The baſe tapers down into a very ſhort broad *footſtalk*, articulated with a decurrent prominence of the branch. *Flowers* few, terminal at the top of each branch, on ſhort, ſimple, ſmooth ſtalks, which are minutely bracteated at their baſe. Segments of the *calyx* ſhort, broad and acute. *Petals* recurved, downy, pale red with a darker keel. *Filaments* ſmooth at the baſe, their upper part, and terminal ſtalks, denſely clothed with long, upright, white hairs, almoſt concealing the anthers, which are oblong, with a very minute point or creſt. *Germen* ſmooth, with obtuſe lobes.—The ſtamens in theſe three ſpecies would afford beautiful ſpecific differences, were not thoſe of the leaves more commodious and obvious.

4. E. *uniflora.* Single-flowered Erioſtemon.—Leaves ſcattered, elliptic-lanceolate, ſmooth; paler beneath. Flowers ſolitary, terminal, on ſhort ſtalks. Five of the ſtamens abortive. (Dioſma uniflora; Linn. Sp. Pl. 287. Ait. Hort. Kew. v. 1. 276. Mart. Mill. Dict. v. 2. n. 17. Curt. Mag. t. 273. Schrad. Sert. Hannov. 16. t. 8.)—Native of the Cape of Good Hope, from whence it was ſent to the Kew garden, in 1775, by Mr. F. Maſſon, and is now not unfrequent in collections, being much eſteemed for its beautiful flowers, produced abundantly in the ſpring and early part of ſummer. This is a ſhrub from one to two feet high, much branched, ſtrongly, but not agreeably, aromatic in all its parts. *Branches* leafy, nearly ſmooth. *Leaves* ſcattered, on ſhort, rather hairy, *footſtalks*, elliptic-oblong, often nearly linear, obtuſe, very glandular, paler beneath, very obſcurely crenate, and ſomewhat fringed, varying in length from half an inch to an inch. *Flowers* ſolitary at the end of each branch, but from the number of the ſhort branches they ſometimes appear cymoſe. *Stalks* much ſhorter than the leaves, ſwelling upwards, downy, without bracteas. Segments of the *calyx* near half an inch long, lanceolate, purpliſh, fringed. *Petals* twice as long as the calyx, obovate, pointed, of a ſhining varniſhed white, like porcelain, or often bluſh-coloured above; purpliſh beneath. *Stamens* about the length of the calyx, their filaments all fringed; five of them ſhort, bearing large heart-ſhaped anthers, with greeniſh glandular tips; five much longer and more ſlender, each terminating in a ſmall round ſtalked gland, without any anther, varying in ſize and ſhape. *Germen* globular, clothed with numerous ſtalked nectariferous glands; ſtyle and ſtigma like the other ſpecies. Curtis and Schrader have well deſcribed this plant, but neither of them was ſufficiently acquainted with the real ſpecies of *Dioſma*, now numerous in our gardens, to diſcover that it was generically diſtinct, and that the curious nectary, eſſential to *Dioſma*, was wanting. Schrader endeavours to make his deſcription of that part agree with the generic character, but in vain, and his accuracy would ſoon have diſcovered the truth, had he ſeen a real *Dioſma*. The *Hænkea* of Schmidt in Uſter's Annals, faſc. 6. 117, to which Schrader refers, agrees in generic characters with *Dioſma barbigera* of Linnæus, and not with our *Erioſtemon*.

5. E. *marginata.* Bordered Erioſtemon.—Leaves ſcattered, lanceolate, paler beneath. Flower-ſtalks axillary, twice as long as the leaves, corymboſe. Five of the ſtamens abortive. (Dioſma marginata; Linn. Suppl. 155.). Native of the Cape of Good Hope, raiſed by Meſſrs. Lee and Kennedy, with whom it flowered in June 1809. It agrees very much in habit with the laſt, but has a more pleaſant ſmell, like ſaſſafras or myrrh, when rubbed, and differs very eſſentially in the great length of its *flower-ſtalks*, which are not terminal, but ſpring from the boſoms of ſeveral of the uppermoſt leaves, and riſing above the ſummit of the branch, make a ſort of corymbus. A pair of lanceolate *bracteas* grow either near the top of each ſtalk, or towards its middle, or in our garden ſpecimens, near the baſe. Their preciſe ſituation ſeems not characteriſtic of any ſpecific difference. The ſegments of the *calyx* vary in breadth, and are often fringed, ſometimes ſmooth. *Petals* moſtly notched at the extremity, but otherwiſe like thoſe of *E. uniflora*, as are alſo the *ſtamens*. The *leaves* vary greatly in length and breadth. Their membranous margin, whence the name is taken, is often very conſpicuous in the dried plant, but we cannot perceive it in the living one, nor even in our garden ſpecimens when dried, ſtill we would not preſume to change a name founded in truth, though not always applicable; otherwiſe *pedunculata* would be a more eligible one. Our remarks on this ſpecies are made from various ſpecimens named and unnamed in the Linnæan herbarium, which vary greatly in the hairineſs or ſmoothneſs of their branches and leaves, as well as the form and breadth of the calyx, but we can find no poſitive ſpecific diſtinction among them. The leaves in ſome are nearly oppoſite, but never conſtantly ſo. We know, from frequent obſervation, that the laſt ſpecies is extremely variable, and are perſuaded that this is ſubject to equal differences. The infloreſcence, however, of each is ſo conſtant, that they can never be confounded together.

6. E. *paradoxa.* Various-leaved Erioſtemon.—Leaves lanceolate, revolute, downy beneath; ſimple, ternate, or pinnate. Flowers lateral, four-cleft. Stamens eight. Sent from Port Jackſon, New South Wales, by Dr. White.—*Stem* ſhrubby, with numerous, oppoſite, round, rough, leafy *branches*. *Leaves* an inch, more or leſs, in length, lanceolate, obtuſe, entire, ſomewhat revolute; ſmooth and naked above; clothed with denſe, white, entangled or ſtarry pubeſcence beneath. In one variety they are ſimple, almoſt perfectly oppoſite, on ſhort footſtalks; in another ſmaller, ternate, ſeſſile on one common winged ſtalk, which is about half the length of the lateral pair; in a third they are as large as in the firſt, and are either ternate or conſiſt of two pair and an odd one, all ſeſſile on a ſimilar, but longer, winged ſtalk. The pinnate and the ternate kinds are unqueſtionably but varieties of each other, nor can we think the firſt a diſtinct ſpecies, however paradoxical our opinion may ſeem. The *flowers* of all are exactly alike. *Flower-ſtalks* copious, axillary, ſolitary, ſhorter than the leaves, ſimple, ſingle-flowered, angular, clothed with ruſty ſtarry ſcales or pubeſcence. *Bracteas* two, towards the middle of each ſtalk, obovate, ruſty, ſmall. *Calyx* downy and ruſty,

quadrangular at the baſe, its four ſegments ovate, broad, keeled. *Petals* four, thrice as long as the calyx, elliptical, keeled, roſe-coloured, ſmoothiſh above, downy beneath. *Filaments* eight, all nearly equal, rather ſhorter than the calyx, red, thick, obtuſe, glandular, fringed in their lower part; anthers ſhort and roundiſh, each on a ſhort, ſlender, white, terminal ſtalk, their white tip or creſt very minute. *Germen* reddiſh, with four blunt lobes.—We have heſitated whether to refer this plant to *Boronia*, with which genus it agrees beſt in habit, and number of parts in the fructification, but the inſertion of the anthers and of the ſtyle have always appeared to us rather like *Erioſtemon*. We have never ſeen it alive. Future obſervations on the living plant may correct our preſent determination. It appears to be one of the prettieſt ſhrubs that New South Wales affords, and would be a welcome acquiſition for the Engliſh conſervatories. S.

ERIOX, or Erox, in *Ichthyology*, a ſpecies of Salmo, called by Pennant, Willughby, and Ray the *Grey*. See Salmo.

ERISANA, in *Ancient Geography*, a town of Spain, in Luſitania.

ERISKAY, in *Geography*, one of the weſtern iſlands of Scotland, ſeparated from South Viſt by a narrow ſtrait, called "Eriſkay Sound;" about five miles in circumference.

ERISMA, in *Botany*, according to the author of the name, is derived from ερειδω, *to prop*, or *ſupport*, and not from εριζω, *to diſpute*, or *contend*. Rudge Pl. Guian. 7. Claſs and order, *Monandria Monogynia*. Nat. Ord. uncertain.

Gen. Ch. *Cal.* Perianth of one leaf, permanent, downy on both ſides, in four deep unequal ſegments, one of which is much the longeſt, irregular, obtuſe, behind the larger petal; the reſt ſharper, and half-lanceolate. *Cor.* Petals two, oppoſite, unequal, emarginate, the uppermoſt united with the calyx betwixt its leſſer ſegments, broad, roundiſh; its baſe ending in a horn-like, blunt *nectary*, the length of the petal, downy externally, like the calyx; the lowermoſt thrice as long as the other, and broader, inſerted into the receptacle behind the perfect filament. *Stam.* Filaments five; one of them fertile, as long as the upper petal, incurved, inſerted into the receptacle; the other four very ſhort, abortive; anther arrow-ſhaped, narrow. *Piſt.* Germen inferior, oblong, of one cell; ſtyle thread-ſhaped, as long as the filament, aſcending; ſtigma blunt. *Peric.* unknown. Rudiments of *ſeeds* two, oblong.

Eſſ. Ch. Calyx in four deep unequal ſegments. Petals two, unequal; the uppermoſt united with the calyx, ſpurred at its baſe; the lowermoſt inſerted into the receptacle. Fruit with two ſeeds.

E. *floribunda*. Rudge t. 1. Native of Guiana. A tree or ſhrub with round *branches*, when young clothed with ſtarry down of a brown colour. *Leaves* large, nearly oppoſite, elliptical or obovate, obtuſely pointed, entire, ſmooth, with numerous parallel veins. *Stipulas* ſmall, deciduous. *Panicles* large, terminal. *Bracteas* in pairs, very unequal, downy, the ſmalleſt about a line long, the other four lines long, broad and ovate. The *flowers* are very ſmall, and concealed by the *bracteas*. Of their colour or properties we have no account.

ERISMATOLITHUS, in *Natural Hiſtory*, and *Mineralogy*, is the name of a genus in the animal order of remains (*reliquia*, or relics) of a former race of beings, which inhabited the earth or its waters, and includes the *fulciments* or plant-like ſupports which certain animals fabricated for their ſupport and habitation, and which are preſerved in a foſſil ſtate. According to Mr. William Martin (Outlines of the Knowledge of extraneous Foſſils, p. 193.) the eſſential characters or diagnoſtics of the permanent ſpecies in this genus are to be ſought in various parts of the *reliquium*, *e. g.* "In reliquia of cellular fulciments, the ſtirp exhibiting the internal form or ſtructure of the cells: in reliquia of ſolid fulciments, the ſtirp exhibiting its external form." The temporary ſpecies of this genus are to compriſe ſuch cellular fulciments as do not ſhew the ſtructure of their cells, and ſuch ſolid imperfect ſpecimens as are not reducible to known ſpecies. The foſſil corals, corallines, ſponges, &c. rank under this genus. See Reliquia.

ERISTALIS, the name of a ſtone, mentioned by Pliny and the ancients, and of which a very memorable quality is recorded by them, which is, that though it was naturally white, it would occaſionally turn red.

ERISTICI, from ερις, *diſpute*, in *Botany*, ſuch authors as have attempted the ſtudy of that ſcience in a philoſophical way, and have been publicly engaged in diſputes about the true foundation of its ſeveral diſtinctions, &c.

ERITHACE, a name given by the ancients to the yellow matter collected on the hinder legs of the bees after their excurſions in ſearch of the materials for their hives; we uſually eſteem this to be real wax, and the French call it *cire*, brute, or rough-wax; it is certain, however, that though the matter of which wax is to be formed is contained in this ſubſtance, yet the Dutch and ſome other nations have the moſt juſt idea of it, in calling it *pain des abeilles*, or the food of the bees.

This ſubſtance is only the farina of flowers, and no experiment has been able to ſeparate real wax from it. The moſt probable opinion concerning it is, that it ſerves the bees as food, and that after this it is converted in their bowels into the ſubſtance called wax.

ERITHALIS, in *Botany*, Εριθαλις is an ancient name of ſome plant now unknown, derived from εριθαλης, *highly verdant*, or *beautifully leafy*. Browne adopted it for the preſent genus, and was followed by Jacquin and Linnæus.—Browne Jam. 165. Jacq. Amer. 72. Linn. Gen. 95. Schreb. 130. Willd. Sp. Pl. v. 1. 996. Mart. Mill. Dict. v. 2. Juſſ. 206. Gærtn. t. 26. Claſs and order, *Pentandria Monogynia*. Nat. Ord. *Rubiaceæ*, Juſſ.

Gen. Ch. *Cal.* Perianth ſuperior, of one leaf, cup-ſhaped, with five teeth, permanent. *Cor.* of one petal, deeply five-cleft; tube very ſhort; ſegments of the limb long, lanceolate, recurved. *Stam.* Filaments five, awl-ſhaped, ſpreading, ſcarcely ſo long as the corolla; anthers oblong. *Piſt.* Germen inferior, roundiſh; ſtyle thread-ſhaped, compreſſed in the upper part, the length of the ſtamens; ſtigma acute. *Peric.* Berry globoſe, crowned with the baſe of the calyx, of ten cells, (ſometimes but eight, *Gærtner.*) *Seeds* ſmall, ſolitary, pendulous.

Eſſ. Ch. Corolla in five deep recurved ſegments. Calyx cup-ſhaped. Berry inferior, of ten cells. Seeds ſolitary.

The ſpecies are,

1. E. *fruticoſa*. Linn. Sp. Pl. 251. (E. odorifera; Jacq. Amer. 72. t. 173. f. 23. E. fruticuloſa; Brown. Jam. 165. t. 17. f. 3. Sambucus ligno duro odoratiſſimo; Plum. Ic. 247. t. 249. f. 2.)—Leaves obtuſe. Flower-ſtalks all cymoſe, many-flowered.—Native of Jamaica, and other Weſt Indian iſlands, growing near the ſea-ſide, and very various in height and luxuriance, according to its ſituation. *Stem* ſhrubby, with round, ſmooth *branches*, leafy towards their extremities. *Leaves* oppoſite, ſtalked, obovate, entire, about two inches long, various in breadth, obtuſe, ſmooth and ſhining. *Flowers* white, ſmelling (according to Jacquin) like the common lilac, growing many together, in long-ſtalked, axillary, cymoſe panicles, about the ends of the branches, but they are not terminal as Willdenow deſcribes them. *Berries* purple, the ſize of a pea.—Jacquin

deſcribes another ſpecies or variety, he is doubtful which, with inodorous flowers, whiter berries, and a more humble diffuſe ſtem, growing on barren maritime rocks in the iſland of Curaçao. This we have never ſeen.

2. E. *polygama.* Forſt. Prod. 17.—Leaves acute. Male flowers cymoſe; perfect ones ſolitary.—Gathered by Forſter in the Society Iſlands.—That writer refers to the *Timonius*, Rumph. Amb. v. 3. 216. t. 140, as a narrower-leaved variety of his plant. This is, indeed, to all appearance, an *Erithalis.* Rumphius informs us that it grows in graſſy open hilly places in Amboyna, and the neighbouring iſlands.

The *ſtem* is the height of a man. *Leaves* four or five inches long, and as broad as two fingers, acute at each end. *Flowers* of a dirty white. *Berries* yellowiſh-black, eaten by ſtarlings and other birds. The *roots* are uſed by the natives to chew, along with a ſlight mixture of cloves, nutmegs and ginger, in their maritime excurſions, in which they ſuffer much from cold and other inconveniencies.

ERITRI, in *Geography*, a town of Aſiatic Turkey, in the province of Natolia; 36 miles W. of Smyrna.

ERITZKA, a town of Ruſſia, in the government of Irkutſch; 20 miles E. of Kirenſk.

ERIVAN, called *Perſian Armenia*, *Greater Armenia*, and *Eaſtern Armenia*, a province of Perſia, about 200 leagues in length, and 60 in breadth. See ARMENIA.

ERIVAN, *Irvan*, or *Irivan*, a city of Aſia, and capital of Greater Armenia, or Erivan; ſituated in a plain, ſurrounded with mountains, and watered by two ſmall rivers; large, dirty, and ill built, and but indifferently peopled: the ramparts are of earth; the fortreſs is encompaſſed with a wall of bricks, in which are a palace for the governor, and 800 houſes, inhabited only by Perſians; the Armenians have ſhops there, but muſt not remain during the night. The churches are ſmall, and half buried in the ground, reſembling catacombs; in the town and its environs they reckon 28 convents for devotees of both ſexes, but they are poorly endowed.

ERIX, or ERYX, in *Ancient Geography*, a mountain of Sicily, ſituated towards the weſtern part, near the ſea. Solinus ſays, that it was conſecrated to Venus. Polybius places it between Drepana and Palermo. According to Apollodorus, this mountain derived its name from a ſon of Venus, called *Erix*. It is now called "Monte St. Giuliano," or "Monte di Trapani."—Alſo, a town of Sicily, now "Trapani del Monte," ſituated on the ſummit of mount Eryx, difficult of acceſs, and famous for a temple of Venus, called Erycina. Polybius and Strabo mention this town. Minos decorated this temple with ſuperb ſculpture, and enriched it with ſuch noble offerings, as have claimed for him the honour of being its founder. The victims offered themſelves voluntarily at the altar. The moſt beautiful women in the world were the prieſteſſes, and the Roman ſenators, laying aſide their characteriſtic ſeverity, came hither to indulge in pleaſure with the beauteous Sicilian females, perſuaded they ſhould thus make their offerings acceptable to the goddeſs, and render her propitious. In the time of Strabo the town and temple were much decayed. It is ſaid that Eryx was deſtroyed by Hamilcar, who in the firſt Punic war, A. U. C. 493, removed its inhabitants to Drepanum, which he had built not long before. Nothing now remains but a paltry village, and ſome foundations of a temple.

ERIZZO, SEBASTIAN, in *Biography*, a noble Venetian, was particularly diſtinguiſhed for his knowledge of the medallic ſcience. He publiſhed, in 1559, in Italian, "A Diſcourſe upon Ancient Medals," which has been highly eſteemed for its erudition. He contended for the difference between the medals and coins of the ancients. Erizzo was the author of a treatiſe on "Logic;" a tranſlation of "Plato's Dialogues:" a diſcourſe on "Civil Governments," and ſome other pieces. He died in 1585. Gen. Biog.

ERKELENS, or EREKELENS, probably *Herculanum*, in *Geography*, in the days of the Romans, is an ancient town of France, in the department of the Roer, chief place of a canton, in the diſtrict of Créveldt, with a population of 1340 individuals. It is at a diſtance of about three miles from the river Roer, 15 miles north of Juliers; its ancient fortifications were demoliſhed by the French in 1674. The canton contains 48 communes, and 17,853 inhabitants.

ERLA, a ſmall town of the kingdom of Saxony, in the circle of the Ertzgebirge, at the foot of the mountain called Rothenberg, remarkable for a rich mine of excellent iron, the beſt of the whole of this mountainous diſtrict. Its iron works are celebrated for caſting the beſt ovens and frying-pans in Saxony; there is alſo a manufactory of cannon-balls. There was anciently a ſmall town of the ſame name in Ruſſia, in the government of Riga, not far from Dorpat; but it is now in ruins.

ERLACH, in French *Cerlier*, a ſmall town of Switzerland, in the canton of Berne, at a diſtance of about three quarters of an Engliſh mile from the upper part of the beautiful lake of Bienne, is ſituated on the declivity of the Julimont, or Julius' mountain, for it is proved beyond contradiction that Julius Cæſar eſtabliſhed upon this hill one of his ſtrong entrenched camps. This elevation is alſo called Jolimont, pretty mount, from the beauty of the proſpect, which can be no where more varied, or more intereſting, on account of the number of pictureſque contraſts which it affords. Travellers who wiſh to viſit the famous iſland of St. Pierre, in the lake of Bienne, generally take a boat at Erlach. It has an ancient caſtle, which gave the title of barons to the illuſtrious Swiſs family of the Erlachs, who, from the time of the intrepid Ulrich of Erlach, have held ſuch a diſtinguiſhed place in the annals of their country.

ERLANG, or ERLANGEN, a handſome town of Germany, in the circle of Franconia, in that part of the margraviate of Anſpach Baireuth which was called the principality of Culmbach, on the river Rednitz, 18 miles N.W. of Nuremberg, and 30 miles S. of Bamberg. N. lat. 49° 38′. Until the peace of Tilſit, concluded in July 1807, between France and Pruſſia, this town, and the whole margraviate of Anſpach Baireuth, belonged to the kings of Pruſſia, to whom it had been ceded by the laſt margrave, in 1792: but it is now at the diſpoſal of the French emperor.

Erlang is divided into the old and new town; the latter is alſo called Chriſtian Erlang, from the name of its founder, the margrave Chriſtian Erneſt, who built it in the year 1686 to accommodate ſeveral families of Proteſtant French refugees. The ſtreets of both towns are regular and ſpacious: there are two handſome ſquares, and ſome fine churches. The principal manufactures eſtabliſhed by the French refugees were thoſe of hoſiery and of hats, which are ſtill flouriſhing. In 1742 the univerſity of Baireuth was alſo removed to Erlang.

ERLAU, in Latin *Eger*, or *Agria*, a town of Upper Hungary, in the diſtrict of Heves, near which there is a fine hot mineral ſpring, which is uſed for bathing. It is the ſee of a biſhop, and the ſeat of an univerſity, the buildings of which are very fine: the profeſſors are well accommodated, the lecturing rooms very good, and the chapel, library, and public hall extremely elegant. The ſee of Erlau is one of the richeſt in the kingdom. The town is in general ill built, the only good houſes are thoſe of the canons of the cathedral. There is, however, a Turkiſh tower in good condition. The only remarkable manufactures are thoſe of wax and of leather. The neighbourhood of Erlau is famous for an excellent ſort of Hungary wine, little inferior to the beſt Burgundy.

ERLEBACH, a river of Germany, which riſes in the duchy of Stiria; 6 miles below Ips.

Erlebach, a town of Germany, in the circle of the Lower Rhine, and electorate of Mentz, on the Main; 3 miles N.N.W. of Clingenberg.

ERLENBACH, a town of Germany, in the circle of Franconia, and county of Wertheim; 10 miles N.N.E. of Wertheim.

ERMELAND, or Ermland, in Latin *Varmia*, one of the four ſubdiviſions of that part of the kingdom of Pruſſia which is called Eaſtern Pruſſia. In ancient times, two-thirds of this country belonged to the biſhops of Ermeland, who were princes of the German empire, and one-third to the chapter of the cathedral church of Frauenburg. The biſhop enjoys ſtill a very conſiderable income.

Ermeland is particularly remarkable for its hemp and flax, and its linen yarn, great quantities of which three articles are annually exported to England in time of peace. The principal towns are Frauenburg, the ſee of the biſhop; Braunſberg, the chief city, which alone exports yarn to nearly the annual amount of two millions of guilders; Heilſberg, Allenſtein, Röſſel, Wormdit, &c.

ERMENEK, a town of Aſiatic Turkey, in the province of Caramania; 63 miles S. of Cogni.

ERMENONVILLE, a ſmall town of France, in the department of the Oiſe, chiefly remarkable for its beautiful park, and a caſtle, which derives ſome celebrity from having belonged to the handſome Gabrielle, miſtreſs of king Henry IV. of France. But Ermenonville is become far more famous in modern times, for having been the laſt retreat of the eloquent and miſanthropic Jean Jaques Rouſſeau, who died here on the 2d of July 1778, and to whom a handſome monument has been erected in a ſmall iſland called the iſland of poplars, which is in the middle of a fine lake. This monument is remarkable for the beautiful ſimplicity of its inſcription.

> “ Ici repoſe l'homme de la nature et de la vérité.”
>
> “ Here repoſes the man of nature and of truth.”

ERMESIA, a name given to a compoſition uſed among the ancients, and famous for its effects in making people beget handſome children. It conſiſted of honey, myrrh, ſaffron, and palm-wine, all beaten together. This maſs was to be taken mixed in milk. The women took it as well as the men, and many had great faith as to its effects.

ERMIJA, in *Geography*, a town of Spain, in the province of Biſcay; 16 miles E.S.E. of Bilbao.

ERMIL, a town of Ruſſia, in the government of Tamboo; 44 miles S. of Tamboo.

ERMIN, or Ermine, in *Heraldry*, denotes a white field or fur, powdered or interſperſed with black ſpots, called powdering. See Fur.

It is ſuppoſed to repreſent the ſkin of an animal of the ſame denomination. In effect, there is no animal whoſe ſkin naturally correſponds to the herald's ermin.

The animal is milk white; and ſo far is it from having ſpots, that tradition reports, that it will rather die, or be taken, than ſully its whiteneſs. Whence its ſymbolical uſe.

But white ſkins having for many ages been uſed for the linings of the robes of magiſtrates and great men; the furriers at length, to add to their beauty, uſed to ſew bits of the black tails of thoſe creatures upon the white ſkins to render them the more conſpicuous. Which alteration was introduced into armoury.

The ſable ſpots in ermin are not of any determinate number, but they may be a greater or leſs, at the pleaſure of the painter or furrier.

Ermin, an order of knights, inſtituted in 1450 by Francis I. duke of Bretagne, and formerly ſubſiſting in France. The collar of this order was of gold, compoſed of ears of corn in ſaltier; at the end of which hung the ermin, with this inſcription, *a ma vie*. But the order expired when the dukedom of Bretagne was annexed to the crown of France.

ERMINE', a croſs erminé is a croſs compoſed of four ermine ſpots.

It muſt be obſerved, that the colours in ſuch arms are not to be expreſſed, becauſe neither the croſs nor the arms can be of any colour but a white and black.

Colombiere blazons it quatre queues d'ermine en croix. The editor of Guillim deſcribes it thus; a croſs of four ermines; or, more properly, four ermine ſpots in croſs. It is the coat of Hurſton in Cheſhire.

Ermine, *timbre of*. See Timbre.

Ermine, in *Zoology*. See Mustela *Erminea*.

Ermines is uſed by ſome Engliſh writers for the reverſe of ermine, *i. e.* for white ſpots on a black field; but on what foundation nobody can tell; for the French, from whom we have our heraldry, have no ſuch term; but call this black powdered with white contre-ermine; as denoting the counter, or reverſe of ermine, which is white powdered with black.

ERMINEUM Animal, *ſtoat*, or *ermine*, the creature whoſe ſkin is the ermine, ſo much eſteemed as a fine fur.

This creature is properly a ſpecies of weaſel, and is called by Mr. Ray, and other authors, muſtela candida, the white weaſel, and by Linnæus muſtela erminea. It is in all reſpects like the common weaſel, and is all over of a pure ſnow white, except the tip of the tail, which is of as beautiful a black, and it has a little yellowiſh grey about the eyes, and a mark or ſpot of the ſame colour on the head, another on the ſhoulders, and a third near the tail. Its colour is, however, very different in degree and elegance, according to the ſeaſon of the year. It is frequent about rivers, and in meadows, in thoſe countries which produce it, and feeds on moles, mice, and other ſmall animals. The ſkins and tails are a very valuable article of commerce in Norway, Lapland, and Ruſſia, and other cold countries, where they are found in prodigious numbers, and regularly change their colour in winter, becoming white. In Siberia, they burrow in the fields, and are taken in traps, baited with fleſh. In Norway they are ſhot with blunt arrows, or taken in traps. The ſtoat is ſometimes found white in Great Britain, and called the white weaſel. See Mustela.

ERMINITES ſhould ſeem a diminutive of ermines, and naturally to ſignify little ermines; but it is otherwiſe. Erminites expreſſes a white field powdered with black; only that every ſpot has a little red hair therein.

Some authors uſe the word erminites for a yellow field powdered with black, which the French expreſs much better by, or, ſemèe d'ermines de ſable.

ERMINOIS expreſſes an or field, with ſable powdering.

ERMS, in *Geography*, a river of Germany, which runs into the Danube, four miles S.W. of Nurtlingen, in the circle of Swabia.

ERMSLEBEN, a town of Germany, in the circle of

Lower Saxony, and principality of Halberſtadt; 14 miles S. E. of Halberſtadt.

ERNANI, a town of Spain, in the province of Guipuſcoa; 5 miles S. of Sebaſtian.

ERNATIA, a town of Aſiatic Turkey, in the province of Natolia; 16 miles N. W. of Satalia.

ERNE, the name of a river in Ireland, which riſes near the boundaries of the counties of Longford and Cavan, and paſſes through loughs Gawnah and Oughter in the latter county. From the laſt of theſe lakes it continues a northern direction till it flows into lough Erne, a little below Belturbet. The ſuperfluous waters of this lake are diſcharged by a rapid current of about ſeven miles, which is alſo called Erne, and which falls into the bay of Donegal, below Ballyſhannon.

Erne-*Lough*, a lake of the county of Fermanagh, Ireland, which is ſuppoſed to occupy above 45,000 acres. It conſiſts properly of two lakes connected by a broad winding channel of about ſix miles. The upper lake is nine miles long, and from one and a half to five wide; the lower lake extends in length about ten miles, and in breadth from two to eight. Both theſe lakes are full of iſlands, being ſaid to contain from three to four hundred, the number varying according to the ſeaſon, being more numerous in winter than in ſummer, on account of the greater height of the water. Some of theſe iſlands are large and inhabited, and many of them well wooded, ſo that the variety of intereſting proſpects afforded by them and the neighbouring coaſt is aſtoniſhing, and far ſurpaſſes the power of deſcription. A canal to open the navigation from the lough to the ſea has been projected, and would be attended with great advantage to the whole of Fermanagh and Cavan. It is alſo probable that a conſiderable part of the lake might be drained, and notwithſtanding its beauty, it is a pity that ſo many acres ſhould be unprofitable.

ERNE'E, a ſmall town of France, in the department of Mayenne, chief place of a canton, in the diſtrict of Mayenne, with a population of 4740 individuals. It is ſituated on the river Ernée, 15 miles W. of Mayenne. The canton contains 6 communes and 15,053 inhabitants, on a territorial extent of 232 kilometres and a half.

ERNES, in our *Old Writers*, ſignify the looſe ſcattered ears of corn that are left on the ground, after the binding or cocking of it.

It is derived from the old Teutonic *ernde*, harveſt; *ernden*, to cut or mow corn. Hence ern is, in ſome places, to glean.

ERNEST, in *Biography*. See Mansfeld.

Ernest *Town*, in *Geography*, a townſhip of Upper Canada, in the midland diſtrict, the fineſt above Kingſton, ſheltered from lake Ontario by Amherſt iſland, which lies in its front.

ERNESTI, John Augustus, in *Biography*, was born in Auguſt, 1707, at Tennſtadt, where his father was ſuperintendant. He ſtudied at Pforta, and ſoon diſplayed uncommon talents; he afterwards applied himſelf to the ſtudy of theology at Leipſic, and took his degree of M. A. in the year 1730. In 1734, having been elected rector of Thomas's ſchool in the room of Geſner, ancient literature, and thoſe branches of knowledge connected with it, became the principal objects of his purſuit. The ſucceſsful application of his talents in this department of knowledge cauſed him to be choſen, in 1742, extraordinary profeſſor of ancient literature, in 1756 he was elected public profeſſor of eloquence, and in 1758, he was made doctor and profeſſor of theology. He died in the year 1781, having, till within the laſt two or three years, been inceſſantly engaged in the laborious diſcharge of his public duties. For twenty years and more he paſſed the greater part of each day in inſtructing others, yet he found ample time for the publication of many original works, and for editing various ancient authors. Among the latter may be mentioned, 1ſt, the Memorabilia of Xenophon, which has been frequently republiſhed in this and other countries. 2d, Ciceronis Opera omnia cum clave, in 6 vols. The Clavis has been publiſhed ſeparately. Erneſti, in preparing this work for the preſs, employed the beſt and oldeſt editions of Cicero, as well as ſeveral MSS.; he examined critically the text of Gruter, corrected in it a great many faults, and in his ſhort notes, he has in various places illuſtrated, and in others reſtored the original. He alſo gave the world new editions with notes of Suetonius, Tacitus, Homer, &c. He publiſhed Ariſtophanis Nubes, cum ſcholiis antiquis et Prefat; Hederici Lexicon, multis vocabulorum millibus auctum; a New Theological Library, in 11 volumes; and "Inſtitutio interpretis Novi Teſtamenti," which has paſſed through ſeveral editions. Alberti of Leyden was ſo much delighted with this, that he called it "The Golden Work." A new edition of it was publiſhed in Holland within a few months after it was printed at Leipzic. The extenſive talents and ſober judgment of Erneſti enabled him not only to embrace every department of literature, but to examine and illuſtrate many of its obſcurities and difficulties. He poſſeſſed a ready and retentive memory, and, above all, an honeſt and upright heart. "Though," ſays his biographer, "the ſerioufneſs of his countenance beſpoke a character hoſtile to every kind of levity, and born for labours that require great vigour and exertion, he was a friend to chearfulneſs, and his company, on account of his eaſy behaviour and good humour, which was often heightened by Ciceronian wit, but confined within the boundaries of virtue and decency, made his converſation much ſought after, and highly agreeable." Gen. Biog.

ERNODEA, in *Botany*, from ἐρνώδης, *branched*, ſo that it ought rather to be written *Hernodea*. Swartz. Prod. 29. Fl. Ind. Occ. v. 1. 223. Schreb. 788. Willd. Sp. Pl. v. 1. 611. Mart. Mill. Dict. v. 2. Sm. Prod. Fl. Græc. Sibth. v. 1. 98. Claſs and order, *Tetrandria Monogynia*. Nat. Ord. *Rubiaceæ*.

Gen. Ch. *Cal.* Perianth ſmall, ſuperior, in four deep, upright, acute, equal, permanent ſegments. *Cor.* of one petal, ſalver-ſhaped; tube elongated, quadrangular; limb in four deep, lanceolate, recurved ſegments. *Stam.* Filaments four, inſerted into the tube towards the middle, awl-ſhaped, longer than the tube; anthers erect. *Piſt.* Germen ſquare, inferior; ſtyle thread-ſhaped, about as long as, or longer than the ſtamens; ſtigma obtuſe, notched. *Peric.* Berry roundiſh, crowned with the calyx, having a furrow at each ſide, and conſiſting of two cells. *Seeds* ſolitary, hemiſpherical, ſtriated.

Eſſ. Ch. Corolla of one petal, ſalver-ſhaped. Calyx in four deep ſegments. Style ſimple. Berry inferior, of two cells. Seeds ſolitary.

1. E. *littoralis*. Swartz. Fl. Ind. Occ. v. 1. 224. t. 4. Vahl. Symb. v. 2. 28. (Thymelæa humilior, foliis acutis atrovirentibus; Sloane Jam. v. 2. 93. t. 189. f. 1, 2.)—Stem ſquare, ſmooth. Leaves nearly ſeſſile, acute, with a ſpinous point. Gathered by Sloane, Browne, and Swartz, in Jamaica. The latter informs us that it grows in gravelly places by the ſhore, or on calcareous rocks. *Root* perennial. *Stems* procumbent, creeping, rather woody, with numerous, long, creeping or pendulous *branches*, which are ſtraight, ſquare, ſmooth, ſomewhat jointed, not much divided, but bearing numerous, alternate, ſhort, leafy, ſimple, lateral branches. *Leaves* crowded, oppoſite, croſſing each

other in pairs, nearly ſeſſile, about an inch or more in length, elliptic-lanceolate, acute at both ends, entire, very ſmooth, ribbed, rigid, of a dark green, tipped with a ſpinous point. *Stipulas* united with a ſtem between the very ſhort footſtalks, each crowned with three briſtles, the middle one longeſt. *Flowers* axillary, ſolitary, ſeſſile, yellowiſh. Many of them, according to Dr. Swartz, have no piſtils.

2. E. *montana*. Sm. Fl. Græc. Sib. v. 2. t. 143, unpubliſhed. Prod. n. 343. (Aſperula calabrica; Linn. Suppl. 120. Willd. Sp. Pl. v. 1. 577. L'Herit. Stirp. v. 1. 65. t. 32. Rubeola cretica fœtidiſſima fruteſcens myrtifolia, flore magno ſuaverubente; Tourn. Cor. 5.)—Stem round, downy. Leaves ſtalked, blunt, pointleſs.—Native of mountainous places in Crete, Sicily, and the ſouth of Italy. Much ſmaller than the laſt, except in its *flowers*, which are larger, cluſtered about the ends of the branches, and of a fine roſe-colour. The *ſtems* are much branched, woody, decumbent. *Leaves* on ſhort ſtalks, oppoſite, about half an inch long, elliptic-lanceolate, bluntiſh at both ends, entire, revolute, without any terminal ſpine, much more pliable than in the former; dark green above; pale beneath; roughiſh occaſionally. When bruiſed they have a very diſagreeable ſtercoraceous ſmell. *Stipulas* with a ſimple lanceolate point. *Branches* more or leſs downy when young.—Authors have greatly differed about the genus of this plant. By the older ones it has been taken for a *Rubia*, a *Valeriana*, a *Thymelæa*, and a *Nerium* or *Oleander*; by modern writers it has been referred to *Aſperula*, *Sherardia* and *Pavetta*. We hope to be nearer the truth than our predeceſſors; at leaſt its technical generic characters agree well with Swartz's *Ernodea*, nor do we find any great diſcordance in the habit.—This beautiful plant emulates the *Daphne Cneorum* in colour and general aſpect, and would be ſcarcely leſs admired in our gardens, to which it is, as yet, a ſtranger.

ERNSPACH, in *Geography*, a town of Germany, in the circle of Franconia, and principality of Hohenloe; ſix miles N. of Okringen.

ERNSTEIN, a caſtellated town of Germany, in the circle of the Lower Rhine, and electorate of Cologne; eight miles E. of Lintz.

ERNSTHOFEN, a town of Germany, in the circle of the Upper Rhine, and principality of Heſſe Darmſtadt; 10 miles S. of Darmſtadt.

ERNSTTHAL, a ſmall town of the kingdom of Saxony, in the county of Schonburg, cloſe by Hohnſtein, at the foot of a mountain called the Pfaffenberg, with a population of about 2000 individuals. It has a few cotton and linen manufactories.—Alſo, a ſmall town of Germany, in the duchy of Saxe-Coburg, which has a conſiderable glaſs manufactory; in the ſpace of thirteen weeks, or three calendar months, they make 216,000 glaſſes, 1000 of which uſed to be ſold, in 1788, for 3⅓ rix dollars, or not quite twelve ſhillings ſterling.

ERODINUM, a word uſed by ſome of the enthuſiaſtic writers in alchemy, to ſignify the prognoſtic, good or bad, of any operation.

ERODIUM, in *Botany*, from ερωδιος, *a heron*, becauſe the fruit reſembles the head and beak of that bird. For a ſimilar reaſon it is called in Engliſh Stork's-bill. L'Heritier. Geraniolog. unpubliſhed. Ait. Hort. Kew. v. 2. 414. Sm. Fl. Brit. 727. Willd. Sp. Pl. v. 3. 625. Sibth. Oxon. 211. (Geranium; Linn. Gen. 350. Schreb. 458. Juſſ. 268. Gærtn. t. 79, *moſchatum*.) Claſs and order, *Monadelphia Pentandria*. Nat Ord. *Gruinales*, Linn. *Gerania*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, of five ovate, pointed, concave, permanent leaves. *Cor.* Petals five, obovate, ſpreading, rather longer than the calyx, generally more or leſs irregular. *Nectary* of five glands between the petals. *Stam.* Filaments 10, awl-ſhaped, united by their baſe into a ſort of cup; five of them fertile, nearly as long as the petals; the alternate five ſhorter and barren; anthers five, oblong, verſatile. *Piſt.* Germen ſuperior, with five furrows, beaked; ſtyle central, awl-ſhaped, ſpirally furrowed, as long as the ſtamens, permanent; ſtigmas five, reflexed. *Peric.* Capſules five, aggregate, membranous, obovate, vertical, ſeparating at their inſide, ſharp-pointed at their baſe, each tipped at its ſummit with a long, linear, flat, pointed, rigid awn, hairy on its inſide, and at length ſpirally twiſted, adhering by its point to the ſummit of the ſtyle. *Seeds* one or two, erect, ovate-oblong.

Eſſ. Ch. Calyx of five leaves. Petals five. Nectariferous glands five. Barren filaments five. Fruit beaked, of five aggregate capſules, each tipped with a long ſpiral awn, bearded on the inſide.

Linnæus in his Genera Plantarum had long ago indicated a diviſion of his genus *Geranium* into ſeveral natural ſections, diſtinguiſhable by characters in their fructification and inflorescence. The late learned botaniſt Monſ. L'Heritier, purſuing the idea, divided that genus into three, each of them as naturally and diſtinctly defined as any in the whole ſyſtem, and although the convulſions of his country, and his own premature death, prevented his publiſhing an elaborate work on the ſubject, he had fortunately conferred by letter with the intelligent editors of the Hortus Kewenſis, and with the writer of the preſent article, ſo that his intention has been carried into effect, both in that work and the Flora Britannica. Of theſe three genera *Geranium* with its 10 fertile ſtamens, regular flower, and recurved naked awns, conſiſts of what are uſually called European Geraniums, bearing but one or two flowers on a ſtalk; *Pelargonium* with its ſeven fertile ſtamens, irregular flower, tubular nectary, and ſpiral bearded awns, comprehends what are generally called Cape Geraniums; while the preſent genus is made up of the Linnæan *Gerania cicutaria*.

Three ſpecies of *Erodium* are natives of Britain.

1. E. *cicutarium*. Engl. Bot. t. 1768. Hemlock Stork's-bill. (Geranium cicutarium; Linn. Sp. Pl. 951. Curt. Lond. faſc. 1. t. 51.) "Flower-ſtalks many-flowered. Leaves pinnate; leaflets ſeſſile, pinnatifid, cut." Common in waſte ground. In ſandy places near the ſea its petals are generally white, or their uſual roſe-colour is elegantly diverſied with a green ſpot on two or three of them. The *herb* is fetid, proſtrate and annual, with finely divided leaves.

2. E. *moſchatum*, Engl. Bot. t. 902. Muſky Stork's-bill. (Geranium moſchatum; Linn. Sp. Pl. 951.) "Flower-ſtalks many-flowered. Leaves pinnate; leaflets nearly ſeſſile, elliptical, unequally cut." Wild in the mountainous paſtures of Yorkſhire and Weſtmoreland, but in other places it is uſually the outcaſt of gardens, where it has often been cultivated for the ſake of the ſtrong muſky ſcent of its herbage. The *flowers* are ſmaller and leſs ornamental than thoſe of the preceding; *leaves* larger, paler, and more viſcid.

3. E. *maritimum*, Engl. Bot. t. 646. Sea Stork's-bill. (Geranium maritimum; Linn. Sp. Pl. 951.) "Flower-ſtalks barely three-flowered. Leaves heart-ſhaped, cut, crenate, rough. Stems depreſſed." Native of ſandy ſeaſhores in various places, flowering all ſummer long. When brought into a garden it becomes wonderfully luxuriant. The *root* is perennial. *Petals* white or reddiſh, for the moſt part much ſmaller than the calyx leaves.

Willdenow has 34 ſpecies of this genus in all. Moſt of them abound in the warmer countries of Europe, and the northern part of Africa, and ſeveral are cultivated with us for ornament, as *E. gruinum*, (Geranium creticum; Ger. em. 943), a hardy annual with large blue flowers; *E. hymenodes*; Andr. Repoſ. t. 413, which requires a green-houſe, and is perennial. Three ſpecies are natives of the Cape of Good Hope, *viz.* the moſt beautiful *E. incarnatum*, Ait. H. Kew. v. 2. 415. Curt. Mag. t. 261. (Geranium incarnatum; Linn. Suppl. 306.) This is a tender green-houſe plant, and therefore not very common, but worthy of all attention for the delicate hues, and eye-like pencilling, of its bloſſoms. The other two Cape ſpecies are *arduinum*, (Geranium arduinum; Linn. Sp. Pl. 952.) very little known to botaniſts, and never introduced into the gardens of Europe; and *ribifolium*, Jac. Ic. Rar. v. 3. t. 509.) an inconſpicuous flower, not much likely to excite the attention of cultivators.

ERODIUS, in *Entomology*, a genus of the Coleopterous kind, eſtabliſhed by Fabricius. Theſe inſects are generically diſtinguiſhed by the following character: the antennæ moniliform; feelers four; jaws horny, truncated, and bifid; lip horny and emarginate. This is the Fabrician definition, to which may be added that the body is roundiſh, gibbous, and emarginate; thorax tranſverſe; wing-caſes cloſely united, and longer than the abdomen.

Species.

Testudinarius. Black; wing-caſes rough, the ſides covered with whitiſh duſt. Fabr.

An inſect of large ſize, found at the Cape of Good Hope; the wing-caſes are very gibbous, with ſmall raiſed dots.

Gibbus. Black; wing-caſes with three raiſed lines. Fabr. Remarkable for the gibboſity of its form, and the obtuſity of the wing-caſes; it is of moderate ſize; and has the anterior ſhanks armed with a ſtrong tooth in the middle and at the tip. The ſpecies inhabits Arabia.

Planus. Black; wing-caſes with a ſingle raiſed line. Fabr.

Native of the ſame country as the former. The anterior ſhanks not armed with a ſpine.

Minutus. Black; wing-caſes perfectly ſmooth. Fabr. Small thorax with two impreſſed dots on the back; legs unarmed. Inhabits the eaſtern parts of the world.

Muricatus. Gibbous, black; wing-caſes muricate. Fabr.

A ſpecies deſcribed in the Fabrician Suppl. Ent. from the cabinet of Lund. It is a native of the Cape of Good Hope; in ſize and appearance reſembles E. gibbus. The head and thorax ſmooth.

EROPHEEVO, in *Geography*, a town of Ruſſia, in the government of Irkutſch; 60 miles N. of Balaganſkoi.

EROS, of ερως, *love*, in *Mythology*, one of the two chiefs over all the other cupids, being the cauſe of love. See Anteros.

EROSION, in books of *Surgery*, we often find this expreſſion uſed ſynonymouſly with the term ulceration.

Erosion, in *Geology*, according to Mr. Kirwan, (Geol. Eſſ. 230 and 285,) denotes a ſolution or melting of the ſofter calcareous particles by water, by which he accounts for the formation of the vaſt caverns and grottos to be found in the Derbyſhire lime-ſtone rocks, and thoſe of other countries. M. de Sauſſure, in his Agenda (Journal des Mines, N° 20.) directs the attention of geological travellers to the ſides of valleys (§ 12.) to ſearch for the veſtiges of the eroſion of water: by which we might underſtand a mechanical ſweeping or waſhing away of ſtrata, as well as a ſolution or melting as above.

EROSUM Folium, among *Botaniſts*. See Leaf.

EROTESIS, Ερωτησις, in *Rhetoric*, the ſame figure with *Interrogation*. Every interrogation or queſtion is not figurative; but it becomes figurative, when the ſame thing may be expreſſed in a direct manner; but the putting it by way of queſtion gives it much greater life and ſpirit. As when Cicero ſays, (in Catal. i. c. 1.) "Cataline, how long will you abuſe our patience? Do not you perceive your deſigns are diſcovered?" He might have ſaid, "You abuſe our patience a long while; you muſt be ſenſible your deſigns are diſcovered." But it is evident how much this latter mode of expreſſion falls ſhort of the force and vehemence of the former. Thus alſo, when Medea ſays, "I could ſave; and do you aſk, if I can deſtroy?" Had ſhe merely ſaid, "I could ſave, and I can deſtroy," the ſentence would have been flat, and very unfit to expreſs the rage and fury in which the poet there repreſents her. (Quint. Inſt. Orat. l. viii. c. 5.) This figure is ſuited to expreſs moſt paſſions and emotions of the mind, as anger, diſdain, fear, deſire, &c. It ſerves alſo to preſs and bear down an adverſary. This figure likewiſe diverſifies a diſcourſe, and gives it a beautiful variety, by altering the form of expreſſion, provided it be neither too frequent, nor continued too long. Beſides, the warm and eager manner in which it is expreſſed enlivens the hearers, and quickens their attention.

EROTEUM, in *Botany*, perhaps from ερωτιζω, *to queſtion*, in alluſion to its doubtful nature at firſt ſight, being very like *Thea* till the fruit is inveſtigated. Swartz. Prod. 5. The author, however, being himſelf, as it ſeems, diſſatisfied with this name, has, in his Fl. Ind. Occ. v. 1. 971, changed it to Freziera, which ſee.

EROTIA, Ερωτια, a feſtival among the Greeks, in honour of Cupid, being celebrated every fifth year with ſports and games.

EROTIANUS, in *Biography*, the author of a gloſſary, containing an explanation of all the words uſed in the writings of Hippocrates, lived in the firſt century of the Chriſtian era, in the reign of Nero, and dedicated his work to Andromachus of Crete, who was phyſician to that emperor. It was printed at Venice, in 1566, in 4to. with the notes of Barth. Euſtachius, under the title of "Vocum, quæ apud Hippocratem, collectio, et ejus operum in ſeptem ſectiones diſtributio." The gloſſary of Erotain was alſo annexed to the edition of Hippocrates, publiſhed by Foeſius at Geneva, in 1657. Haller. Bibl. Med. Eloy.

EROTIC, derived from ερως, *love*; whence ερωτικος, is applied to any thing which has a relation to the paſſion of love.

In *Medicine*, we particularly uſe the phraſe delirium eroticum, for a kind of melancholy contracted through exceſs of love.

Though, among the ſeveral ſpecies of pulſes, there be no amorous pulſe, that is, no pulſe peculiar to that paſſion; yet we can certainly diſcover where the diſorder is erotic, by the beating of the pulſe, which, in that caſe, is changeable, unequal, turbulent, and irregular. Speak to the patient of the perſon he loves, and his pulſe inſtantly changes, becoming higher and quicker; and the minute you change the converſation, the pulſe is loſt again, and is diſturbed anew.

EROTIDIA, ερωτιδια, the ſame with erotia.

EROTOMANIA, in *Medicine*, a term uſed by ſome writers to denote that modification of inſanity, of which the paſſion of love is the origin, and in which the love of a particular individual conſtitutes the predominant idea. Sauvages treats of this form of derangement under the name of *melancholia amatoria*; (ſee his Noſol. Meth. Claſs viii. Gen. xix. Spec. 2.) Sennertus under that of *amor* *inſanus*, &c. The word is derived from ἐρως, *love*, and μανια, *mania*, madneſs.

This diſeaſe is diſtinguiſhed from ſatyriaſis and nymphomania, if indeed ſuch maladies have any exiſtence, inaſmuch as the patient, ſo far from being urged by libidinous deſires, contemplates the object of his affection with reverence and diſtant admiration, as if ſhe were a divinity; he would ſpend his days in doing homage to her perfections, and deems food, ſleep, and the affairs of the world of little comparative moment. As a remedy for this ſpecies of inſanity, low and light diet has been recommended. Ovid has adviſed the performance of a long journey, during which a conſtant change of ſcene, and the abſence of all objects, with which the recollection of the individual beloved, might tend to reſtore the mind to its uſual condition: conſtant occupation of body or mind, "qui vis ſanari, res age, tutus eris;" and the admonitions of the wiſe in regard to the loſs of health, fortune, and character, which muſt attend ſuch hallucination, have alſo been ſuggeſted. The former part of the advice may be ſometimes beneficial, but thoſe who are moſt experienced in the treatment of the inſane, well know how little benefit is produced by reaſoning with madmen. See Melancholy.

EROTYLOS, in *Natural Hiſtory*, the name of a ſtone, of which we have no deſcription left us, but which the ancients are ſaid to have uſed in divination.

EROTYLUS, in *Entomology*, a genus of Coleoptera in the Fabrician ſyſtem, allied, and in ſome degree confounded, with the two Linnæan genera Chryſomela and Coccinella, and arranged by Gmelin under that of Cryptocephalus. The antennæ are filiform; feelers four and unequal, the anterior longer and hatchet-ſhaped; jaws horny and bifid; lip horny, ſhort, dilated at the lip, truncated, and ſomewhat emarginate; body ſuboval. The transformations of theſe inſects are unknown, in the perfect ſtate they are found generally on flowers. Three of the ſpecies are deſcribed by Linnæus, the remainder principally by Fabricius.

Species.

Giganteus. Oval, black; wing-caſes with numerous fulvous dots. Fabr. *Chryſomela gigantea*, Linn. *Coccinella gigantea*, Sulz. Native of India.

Cancellatus. Black; wing caſes yellow, reticulated with black. Fabr. Large and roundiſh; inhabits Brazil.

Histrio. Deep black; wing-caſes barred with black and yellow, a ſcarlet ſpot at the baſe and tip. Fabr.

A ſpecies of large ſize, an inhabitant of Cayenne.

Lugubris. Teſtaceous; antennæ and ſhanks black. Fabr. Native of America.

Gibbosus. Black; wing-caſes yellowiſh with black dots; band in the middle and at the end black. Fabr. *Chryſomela gibboſa*, Linn. *Coccinella*, Gronov.

An inſect of conſiderable magnitude, the wing-caſes of which are remarkably gibbous, and the thorax impreſſed on each ſide; it is a native of South America.

6-Fasciatus. Oval, black; wing-caſes with ſix waved fulvous bands, the anterior one interrupted. Fabr.

Inhabits Cayenne.

Notatus. Black; wing-caſes with a yellow band in the middle ſpotted with black, and marked with red at the baſe. Fabr. Native of South America.

Concatenus. Black; wing-caſes reticulated with yellow and black, and marked with two black bands. Fabr. Mant. Inſ. Country unknown; the body large.

5-Punctatus. Oval; wing-caſes black with five red dots. Fabr. Inhabits America.

Punctatissimus. Black; wing-caſes yellow with numerous black dots. Fabr.

Deſcribed from the Hunterian cabinet: an American ſpecies.

Varius. Black; wing-caſes punctured, ſpotted with fulvous in the middle. Fabr. Inhabits Surinam.

Gemmatus. Black; wing-caſes with numerous fulvous dots; thorax variolous. Fabr.

An inſect of moderate ſize, found in Cayenne.

Macrocheiros. Black; wing-caſes with alternate black and yellow bands; fore legs very long. Fabr.

Native of India.

Abdominalis. Black; wing-caſes yellow with four waved black bands and a diſtinct black dot. Fabr.

A Braſilian ſpecies, in ſize reſembling E. faſciatus, and having the abdomen yellow with two lines of black dots.

Fasciatus. Black; wing-caſes with three yellowiſh bands. Fabr.

From the Bankſian cabinet: the native place unknown: ſize moderate.

Zebra. Yellowiſh; head, baſe of the thorax, and three bands on the wing-caſes with the legs black. Fabr. Mant.

Alternans. Black; wing-caſes with two yellow bands, the anterior one dotted with black. Fabr.

Surinamensis. Black; wing-caſes red and immaculate. Fabr. Native of Surinam.

Limbatus. Oblong, black; margin of the thorax and border of the wing-caſes yellow. Fabr.

South American ſpecies; head yellowiſh with a black frontal ſpot; thorax ſmooth with a broad ſinnate lateral margin.

Nebulosus. Black; thorax, and wing-caſes varied with ferruginous. Fabr.

Inhabits the ſame country as the preceding.

Dilatatus. Oblong, black; thorax and wing-caſes ferruginous. Fabr.

Native of the Cape of Good Hope. The antennæ are brown, at the baſe ferruginous; wing-caſes ſmooth, and much broader than the body.

Morio. Oblong, black, and immaculate. Fabr.

This, and the four following ſpecies, are natives of New Holland. Theſe are deſcribed by Fabricius from the Bankſian cabinet, and are repreſented in the volume of "Donovan's General Illuſtration of Entomology, devoted to the Inſects of the Auſtralaſian regions."

Smaragdulus. Oblong, black; wing-caſes ſtriated and green.

Amethystinus. Oblong, black; thorax and wing-caſes blue; reſembles the laſt; front retuſe; wing-caſes with punctured ſtriæ.

Bicolor. Oblong, black; bronzed above.

Cupreus. Oblong, black; thorax and wing-caſes coppery.

Rufipes. Oblong, black; legs pitchy. Fabr. Mant. Inhabits Kiel.

Flavipes. Oblong, gloſſy green; antennæ and legs yellowiſh. Native of Jamaica, in the Bankſian cabinet.

EROWA, the name of a kind of nettle which grows in the mountains at Otaheite in the South Sea, with which the inhabitants make fiſhing lines, which ſerve to hold the ſtrongeſt and moſt active fiſh, and are much ſtronger than our ſilk lines of twice the thickneſs.

ERPACH, in *Geography*. See Erbach.

ERPENIUS, Thomas, in *Biography*, was born at Gorcum, in Holland, in the year 1584. His parents, natives of Bois-le-Duc, were, on account of their converſion to the Proteſtant religion, obliged to withdraw from that place, to one more favourable to the rights of private judgment. They provided their ſon with a good education in the rudiments of learning, and when they diſcovered in him a propenſity for literary purſuits they ſent him to Leyden, where he felt ſo diffident of ſucceeding in his ſtudies, that for ſome time he determined to relinquiſh them. Fortunately his deſire for knowledge overcame his modeſty, and he applied himſelf with ſo much diligence, that he obtained the higheſt praiſe of his different tutors, and excited their ſurprize at his extraordinary progreſs. He excelled in metaphyſics, but his fame with poſterity is built on the ſkill which he acquired in the oriental languages. After availing himſelf of all the advantages which the univerſity of Leyden afforded, he travelled for farther improvement in foreign countries. In England he became acquainted with Bedell, who was celebrated for his knowledge in Hebrew and rabbinical learning. In France he improved himſelf in his knowledge of the Arabic tongue; and in Italy he improved his acquaintance with the Hebrew language, by converſing with ſome learned Jews, and made himſelf maſter of the Perſian, Turkiſh, and Ethiopic tongues. After ſpending ſeveral years in foreign countries, Erpenius returned to Holland, where he was elected profeſſor of the oriental languages in the univerſity of Leyden. This was in the year 1612, and very ſhortly after his appointment he ſet up a preſs for the printing of works in the Eaſtern literature. In the year 1620 he was ſent by the States General on different journies into France, to engage Peter du Moulin, or Andrew Rivet, to undertake the theological profeſſorſhip at Leyden. After this he was appointed oriental interpreter to the States, and was employed to tranſlate the letters addreſſed to them from Aſia and Africa, and to write ſuch as were ſent by them to the ſovereigns in thoſe parts of the world. He was frequently invited into Spain by the ſovereign of that country, to explain certain inſcriptions in the Arabic language on the Mooriſh buildings and monuments in that country, and the emperor of Morocco is ſaid to have been highly pleaſed with the purity and beauty of his ſtyle, and to have exhibited his letters as objects of real curioſity. He died in the year 1624, when he was only 48 years of age. His works are numerous, and have given him a high reputation among the learned. They are enumerated by Moreri, and other biographical writers, and we are informed that he projected an edition of the Koran, with a Latin verſion and notes, likewiſe an Arabic grammar and lexicon, which his death prevented him from executing. Gerard-Jean Voſſius pronounced over him a funeral oration. Moreri.

ERPIS, or HERPIS, in *Ancient Geography*, a town of Africa, in Mauritania Tingitana. Ptolemy.

ERRA, in *Geography*, a town of Portugal, in the province of Eſtremadura, on a river of the ſame name; 22 miles S.E. of Santarem.—Alſo, a river, which runs into the Latas, 12 miles E. of Salvateira, in the province of Eſtremadura.

ERRABARI, a town of Egypt; 10 miles N.W. of Cairo.

ERRAINE, a town of Egypt; two miles E. of Tahta.

ERRANT, in *Law*, the ſame with itinerant; the term is attributed to judges who go the circuit; and to bailiffs at large.

ERRANTS, *knight*. See KNIGHT.

ERRATA, a liſt uſually placed at the beginning or end of a book, containing the faults that have eſcaped in the impreſſion, and, ſometimes, even in the compoſition of the work.

Lindenberg has an expreſs diſſertation on typographical errors, "De Erroribus Typographycis;" in which he obſerves, that there is no book exempt from them, not even the ſacred books. He ſets himſelf to enquire into all the cauſes thereof; and propoſes means to prevent them, but he advances nothing on that article but what is either common, or impracticable.

ERRATIC, in *Aſtronomy*, an epithet applied to the planets, which are called erratic, or wandering ſtars, in contradiſtinction to the fixed ſtars.

ERRATIC *fevers*, in *Medicine*, a term uſed to expreſs ſuch fevers as, according to the language of medical writers, obſerve no regular type, that is, are not determinate either in their attacks, or in their general period. They are thus called by way of diſtinction from the typic fevers, which are regular in both. See FEVER.

ERRATIC *winds*. See WIND.

ERRHINE, in the *Materia Medica*, from εν, *in*, and ῥιν, *the noſe*, is a term applied to thoſe ſubſtances which are introduced into the noſe, for the purpoſe of exciting a diſcharge from the paſſages. When they excite ſneezing, the medicines of this claſs have been called ptarmics, and ſternutatories; and, from the diſcharge which they occaſion, they have been termed apophlegmatica, and, in barbarous Latin, caput-purgia.

Errhines, by ſtimulating the exhalent veſſels and the mucous follicles of the Schneiderian membrane, which lines the internal ſurface of the noſe, and the cavities adjoining it, excite thoſe veſſels and follicles to pour out their fluids more copiouſly than uſual. The diſcharge is ſometimes of a mucous, and ſometimes of a thinner fluid; it is often attended with ſneezing, but ſometimes is procured without. This, however, implies no difference in the operation, except as to the ſtronger or weaker irritation of the medicine employed. For although when ſneezing is excited a larger evacuation is often produced, yet the effects of errhines are not altogether proportional to the ſenſible irritation which they occaſion. See Alſton, Mat. Med. vol. i ſect. 8.

The evacuation produced by theſe medicines conſiſts not merely in emptying the mucous follicles of the lining membrane of the noſe of their contents, but in augmenting the ſecretion: whence, agreeably to the laws of the circulation, a greater afflux of fluids to thoſe parts is neceſſarily occaſioned, and therefore a diminution of the fluids in the neighbouring veſſels. In this way Dr. Cullen explains the fact, that errhines often give relief to rheumatic pains in the neighbouring parts, eſpecially to the tooth-ach, as well as to ſome forms of head-ach, pains of the ear, and ophthalmia. "How far their effects may extend," he ſays, "cannot be exactly determined; but it is probable that they may operate more or leſs on the whole veſſels of the head, as even a branch of the carotid paſſes into the noſe: and independent of this, it is not improbable that our errhines may have been of uſe in preventing apoplexy and palſy; which at leaſt is to be attended to ſo far, that whenever any approach to theſe diſeaſes is ſuſpected, the drying up of the mucous diſcharge ſhould be attended to, and, if poſſible, reſtored." Cullen's Mat. Med. vol. ii. p. 436.

The nicotiana, or tobacco, as it is commonly prepared for perſons who amuſe themſelves by ſnuffing, may be conveniently employed, with people unaccuſtomed to it, as an errhine; but repetition ſoon diminiſhes its power, and renders it uſeleſs. It produces a different degree of diſcharge in different people, even of thoſe who uſe it habitually; and Dr. Cullen ſtates, from his own experience, "that whenever the diſcharge has been conſiderable, the laying aſide ſnuffing, and therefore ſuſpending that diſcharge, may have very bad effects."

The article moſt commonly employed as an errhine, is the *Aſarum aſarabacca*, ſnuffed up the noſe every evening, for a ſhort time, in the quantity of three grains. Quincy obſerves,

ſerves, that its pungency is not immediately felt upon taking, but after ſome time it makes the noſe run very much. In larger quantities it ſometimes brings blood, and even occaſions a ſwelling of the whole head. This laſt effect, however, has been oftener produced by the *Euphorbium*, a ſtill more acrid errhine. Dr. Cullen, ſpeaking of theſe ſevere effects, ſays, "I have ſeen ſome inſtances of megrims, ophthalmias, and particularly tooth-achs, cured by the violent operation of errhines; but I never thought it ſafe to imitate the practice." The *white hellebore*, in very ſmall quantity, is alſo an acrid errhine.

ERRIFF, in *Geography*, a province of Africa, in the country of Fez. See Rif.

ERRIPSIS, from ῥιπτω, *I precipitate*, in *Medicine*, is uſed in different ſenſes, ſometimes for a weakneſs of the whole body, ſometimes only of ſome one part. When applied to the whole body, it expreſſes that utter dejection and proſtration of ſtrength which makes a man fall down like a dead carcaſs; and, when applied to the eyes, it expreſſes ſuch a debility, as renders it impoſſible to keep them open.

ERROAD, in *Geography*, a town of India, in the country of Coimbatore; 39 miles E.S.E. of Damicotta, and 48 N.E. of Coimbatore.

ERROL, a ſmall uninhabited town of America on lake Umbagog, on the north-eaſternmoſt ſettled part of Grafton county, in New Hampſhire, incorporated in 1774.

ERROMANGO, an iſland in the Southern Pacific ocean, being one of thoſe called the "New Hebrides," 18 leagues from Sandwich iſland, and 24 or 25 leagues in circuit. The middle of it lies in S. lat. 18° 54′. E. long. 169° 19′, and it is of a good height. Captain Cook anchored in a bay of this iſland; and he found that although the behaviour of the inhabitants was at firſt friendly, their real intentions were very different. They were armed with clubs, ſpears, darts, bows and arrows, and ſeemed determined to employ them in a hoſtile manner. On this account it became neceſſary for the captain to give orders to his men to fire upon the aſſailants. At length they were ſo terrified as to withdraw and make no farther appearance. Thoſe iſlanders, it was obſerved, ſeemed to be of a different race from thoſe of Mallicollo, and they ſpoke a different language. They are of a middle ſize, with a good ſhape, and tolerable features. Their colour is very dark, and their aſpect is not improved by their cuſtom of painting their faces, ſome with a black, and others with a red pigment. Their hair is curly and criſp, and ſomewhat woolly. The few women, who were ſeen and who appeared to be ugly, wore a kind of petticoat, made either of palm leaves, or of a ſimilar plant; but the men, like thoſe of Mallicollo, were almoſt entirely naked. On account of the treacherous behaviour of the inhabitants of Erromango, captain Cook called a promontory, or peninſula, near which the ſkirmiſh happened, "Traitor's Head." This is in the N.E. point of the iſland, and is ſituated in S. lat. 18° 43′, and E. long. 169° 28′.

ERRONAN, or Footoona, the moſt eaſtern iſland of all the Hebrides, appeared to captain Cook to be about five leagues in circuit, of a conſiderable height, and flat at top. On the N.E. ſide is a little peak ſeemingly disjoined from the iſle; but which was thought to be connected by low land. It is diſtant in the direction of N. by E. ½ E. 11 leagues from Port Reſolution in the iſland of Tanna.

ERROR, a miſtake of the mind in giving aſſent to a thing, or propoſition, which is not true. See Fallacy.

Some philoſophers define error an act of the mind, whereby things that ſhould be joined are ſeparated; or, things that ſhould be ſeparated, are joined; or a wrong judgment, diſagreeing with the things whereon it is paſſed.

Error ſtands in oppoſition to truth, which conſiſts in an agreement between the propoſition and the thing whereof it is affirmed or denied.

However, a bare failure, or non-attainment of truth, does not conſtitute error; that being common both to ignorance and doubting.

Error only ſtands diſtinguiſhed from *falſhood*, in that the former is in the mind, and the latter only in the propoſition.

The great origin of all error, *i. e.* of believing that to be true which is falſe, is a liberty, or power, in the human mind, of giving its aſſent to ideas, to propoſitions, that are obſcure, as if they were perſpicuous and plain.

Particular cauſes of error are, inadvertency, ignorance, impatience, intereſt, authority, education, &c. See Faith, Probability, Opinion.

Againſt all which, there is this one general rule or caution laid down by F. Malebranche and others; *viz.* never to give our full aſſent to any propoſition, unleſs the evidence for it be ſo ſtrong, as that we can no longer withhold it, without incurring the ſecret reproaches of our own reaſon.

Mr. Locke reduces the cauſes of all our errors to theſe four; *viz.* 1. Want of proofs. 2. Want of ability to uſe them. 3. Want of will to uſe them. And, 4. Wrong meaſures of probability.

F. Malebranche conſiders five occaſional cauſes of error, or rather of five different kinds of errors, accommodated to the different manners we have of perceiving things. 1. Errors of ſenſe. 2. Of the imagination. 3. Of the underſtanding. 4. Of our inclinations. And, 5. Of the paſſions. See Sense, Imagination, Understanding, Inclination, and Passion.

Errors, *popular*. See Popular.

Error, in *Law*, generally denotes a fault, or overſight, either in pleading, or in proceſs; upon either of which is brought a writ, by way of remedy, called a *writ of error*; in Latin, *de errore corrigendo*.

A writ of error lies for ſome ſuppoſed miſtake in the proceedings of a court of record; for, to amend errors in a baſe court, not of record, a writ of "falſe judgment" lies. The writ of error only lies upon matter of law ariſing upon the face of the proceedings; ſo that no evidence is required to ſubſtantiate or ſupport it; there being no method of reverſing an error in the determination of *facts*, but by an attaint, or a new trial, to correct the miſtakes of the former verdict. A writ of error may be brought for notorious miſtakes in the judgment or other parts of the record; as where a man is found guilty of perjury, and receives the judgment of felony, or for other leſs palpable errors, ſuch as any irregularity, omiſſion, or want of form in the proceſs of outlawry, or proclamations; the want of a proper *addition* to the defendant's name, according to the ſtatute of additions; for not properly naming the ſheriff, or other officer of the court, or not duly deſcribing where his county or court was held; for laying an offence committed in the time of the late king, to be done againſt the peace of the preſent; and for many other ſimilar cauſes, which (though allowed out of tenderneſs to life and liberty) are not much to the credit or advancement of the national juſtice. Theſe writs of error to reverſe judgments in caſe of miſdemeanors are not to be allowed of courſe, but on ſufficient probable cauſe ſhewn to the attorney-general; and then they are underſtood to be grantable of common right, and "ex debito juſtitiæ." But writs of error to reverſe attainders in capital caſes are only allowed "ex gratia;" and not without expreſs warrant under the king's ſign manual, or at leaſt by the conſent of the attorney general. 1 Vern. 170. 175.

If a writ of error be brought to reverſe any judgment of an inferior court of record, where the damages are leſs than ten pounds; or, if it is brought to reverſe the judgment of any ſuperior court after verdict, he that brings the writ, or that is plaintiff in error, muſt (except in ſome peculiar caſes) find ſubſtantial pledges of proſecution, or bail (ſtat. 3 Jac. I. c. 8. 13 Car. II. c. 2. 16 and 17 Car. II. c. 8. 19 Geo. III. c. 70.): to prevent delays by frivolous pretences to appeal; and for ſecuring payment of coſts and damages, which are now payable by the vanquiſhed party in all, except a few particular inſtances, by virtue of the ſeveral ſtatutes here recited. 3 Hen. VII. c. 10. 13 Car. II. c. 2. 8 and 9 W. III. c. 11. 4 and 5 Ann. c. 16.

A writ of error lies from the inferior courts of record in England into the king's bench, and not into the common-pleas. (Finch. L. 480. Dyer 250.) Alſo from the king's bench in Ireland to the king's bench in England. It likewiſe may be brought from the common pleas at Weſtminſter to the king's bench; and then from the king's bench the cauſe is removable to the houſe of lords. From proceedings on the law ſide of the exchequer a writ of error lies into the court of exchequer chamber, before the lord chancellor, lord treaſurer, and the judges of the court of king's bench and common pleas; and from thence it lies to the houſe of peers. From proceedings in the king's bench in debt, detinue, covenant, account, caſe, ejectment, or treſpaſs, originally begun there by bill (except when the king is party) it lies to the exchequer chamber, before the juſtices of the common pleas, and barons of the exchequer; and from thence alſo to the houſe of lords (ſtat. 27 Eliz. c. 8.); but when the proceedings in the king's bench do not firſt commence therein by bill, but by original writ ſued out of chancery, this takes the caſe out of the general rule laid down by the ſtatute (1 Roll. Rep. 264. 1 Sid. 424. 1 Saund. 346. Carth. 180. Comb. 295.); ſo that the writ of error then lies, without any intermediate ſtage of appeal, directly to the houſe of lords, the dernier reſort for the ultimate deciſion of every civil action. Each court of appeal, in their reſpective ſtages, may, upon hearing the matter of law in which the error is aſſigned, reverſe or affirm the judgment of the inferior courts; but none of them are final, ſave only the houſe of peers, to whoſe judicial deciſions all other tribunals muſt therefore ſubmit, and conform their own. Blackſt. Com. book iii.

Error, *to aſſign.* See Assign.

Errors, *Clerk of the.* See Clerk.

Error *loci*, literally *error of place*, a doctrine of conſiderable importance in the theory of diſeaſes, taught by the celebrated Boerhaave. It was deemed the principal cauſe of thoſe obſtructions to the circulation of the blood, on which inflammation, in all its varieties, was ſuppoſed to depend. "The parts of a fluid," ſays Boerhaave, "become unable to paſs by error of place (per errorem loci), when a corpuſcle ruſhes into the dilated mouth at the baſis of a conical canal, and cannot paſs through the narrow end of it." (Aphoriſm 118.) This doctrine is founded upon theſe three circumſtances; the ſeries of particles, of which the blood is compoſed; the ſeries of progreſſively diminiſhing veſſels; and the conical form of theſe veſſels: and it is thus explained by the comment of Van Swieten.

The largeſt particles in the blood are the red globules, which are to be found naturally in the larger veſſels only. Now the extremities of the arteries carrying red blood, tranſmit the red globules ſingly, according to the obſervations made with microſcopes on the pellucid parts of living animals. The finer parts of the blood are conveyed into the ſmaller lateral veſſels, and the red vein receives the red blood only. The veſſel of the next magnitude receives all the fluids except the red globules, and retaining the larger particles only, (*viz.* the ſerous globules) tranſmits the remaining thinner liquids into the ſtill ſmaller veſſels, that ariſe from the ſerous artery. This law obtains, then, in all the decreaſing ſeries of veſſels. The red arteries can receive and tranſmit all the humours; the ſerous arteries exclude the red part of the blood, but tranſmit the ſerous globules, and every other thinner fluid, and ſo on. Now, ſhould the diameter of a lateral veſſel ariſing from a larger one be by any means increaſed, for example, the aperture of a ſerous artery, which ariſes from a red one, a red globule might be able to enter its orifice when thus dilated; but as a conical canal always grows narrower, it will ſhortly ſtick faſt, and be by no means able to paſs through its extremity, and conſequently will cauſe an obſtruction, as the bulk of the particle to be carried through exceeds the capacity of the tranſmitting veſſel.

This error loci of the fluids was conſidered as the proximate cauſe of inflammation by Boerhaave, and his commentator illuſtrates the dilatation and diſtention of the lymphatic and ſerous veſſels by the red blood in the caſe of inflammations of the eye; in which the veſſels of the ſurface of the eye, which are naturally tranſparent, become red, and viſible, ſometimes even giving a red colour to the whole of the ſurface. See Van Swieten, Comment. ad Aph. 118—378, &c.

ERRUCA, in *Ancient Geography*, a town of Italy, belonging to the Volſii, according to Diodorus Siculus.

ERSE, in *Geography*, a river of Germany, in the circle of Lower Saxony, which runs into the Fuhſe; 8 miles S. of Zelle.

ERSH, in *Agriculture*, is a term ſignifying land in the ſtate of ſtubble after the grain has been taken off. Hence we have pea, bean, and different ſorts of grain erſhes.

Ersh-*Crop*, is ſuch a crop as is grown after ſome of theſe ſorts of ſtubbles have been turned down by the plough.

ERSTEIN, in *Geography*, a ſmall town of France, in the department of the Lower Rhine, chief place of a canton in the diſtrict of Barr, with a population of 2344 individuals. The canton contains 14 communes and 8991 inhabitants, on a territorial extent of 137½ kiliometres.

ERTA, a town of Aſia, in Parthia.

ERTHOLM, a ſmall iſland, about three leagues from the coaſt of Schoonem, and half a league from Bornholm. It belongs to the Danes; and till of late was garriſoned only with 50 men: the force has been ſince augmented to 500. This iſland may be eaſily captured and retained by that power, which, during the interval of naval operations in the Baltic, has the ſuperior fleet.

ERTO del Ferro, a town of Italy, in the kingdom of Naples, and province of Calabria Citra; 10 miles W. of Umbriatico.

ERTZGEBIRGE, or rather Ertzgeburge, (arch-mountainous country,) is the fifth of the ſeven circles into which that part of the kingdom of Saxony, which is called Saxony Proper, or formerly Electoral Saxony, is divided. As late as the tenth century this whole extenſive tract of mountainous country was nothing but an impervious foreſt, called Miriquido, or Miriquidvi, few ſpots of which began to be cleared in 1004. It is bounded to the north by the circles of Miſnia, or Meiſſen and Leipzick, and by the principality of Altenburg, to the weſt by the ſame principality, the circles of Neuſtadt and Voigtland, and the dominions of the princes of Reuſs; to the ſouth and eaſt by the kingdom of Bohemia. Its principal rivers are the Zſchopau, the Flöhe, the Pöhl, the Preſaitz, and the Schwartzwaſſer.

The territorial extent of the Ertzgebirge is 121 German ſquare miles, and its population, in 1785, amounted to 405,600 individuals, which gives $3352\frac{1}{15}$ inhabitants to the German ſquare mile. It produces corn, potatoes, vegetables of all ſorts, and excellent flax, and has ſeveral manufactories, but chiefly thoſe which work upon minerals and metals.

The circle of the Ertzgebirge is remarkable for its numerous and valuable mines, which, in 1789, employed 12,867 miners, and, in 1788, yielded in ſilver only 50,618 marks. The aggregate of all the metals produced the ſum of 700,640 dollars. Amalgamation, or application of mercury to extract the ſilver from the ore, was firſt introduced in the Saxon mines in the year 1787.

Freyberg is the chief place of the Ertzgebirge, and the firſt town in Europe for the ſtudy of mineralogy. See Freyberg.

The whole circle of the Ertzgebirge contains 61 towns and 723 villages. It is ſubdivided into 13 diſtricts, *viz.* Freyberg, Auguſtuſburg, Chemnitz, Roſſen, Frauenſtein, Altenberg, Lauterſtein, Wolkenſtein, Annaberg, Grünhayn, Schwartzenberg, Weiſenburg, and Zwickau.

ERTZICA, a town of Aſia Minor, in Cappadocia, commonly called *Arzingham*.

ERUBRUS, a river of Gaul, thought by M. D'Anville to be the Rouver, which runs into the Moſelle, a little below Treves.

ERUCA, in *Zoology*. See Caterpillar.

Eruca *marina griſeo fuſca*. See Aphrodita.

ERUCAGO, in *Botany*, Tourn. Inſt. 232. t. 103, ſee Bunias, ſpec. 3.

ERUCTATION, Belching, the ſame as ructation.

ERUDITION, denotes learning or knowledge; and chiefly that of hiſtory and antiquity, of languages and of books, which is the reſult of hard ſtudy, and extenſive reading. The Scaligers were men of deep erudition: the writings of M. Launoy, a prieſt of the Oratory, are full of erudition.

Mr. Locke ſays, it is of more uſe to fill the head with reflections than with points of erudition. If the mind be not juſt and right, ignorance is better than erudition, which only produces confuſion and obſcurity. M. Balzac calls a heap of ill choſen erudition the luggage of antiquity.

ERVEDEIRA, in *Geography*, a town of Portugal, in the province of Eſtremadura; 12 miles N.N.W. of Leiria.

ERVILIA, in *Botany*, an ancient name for a kind of vetch or pea. See Pisum Ochrus, alſo Ervum.

ERUPA, in *Ancient Geography*, a town of Arabia Deſerta. Ptolemy.

ERUPTION, in general, a burſting forth, or excluſion of ſomething which was before covered, or concealed.

The eruption of volcanos, or burning mountains, is frequently the effect and iſſue of earthquakes. See Earthquake, Volcano, &c. For an account of the eruptions of mount Ætna and Veſuvius, ſee Ætna and Vesuvius.

Eruption, in *Medicine*, denotes the appearance of various ſpots and diſcolourations of the ſkin, whether puſtules, pimples, raſhes, &c.: thus, we ſpeak of an eruption of ſmall-pox, or of meaſles; and, by a figure of ſpeech, theſe puſtules, raſhes, &c. are often denominated eruptions, or cutaneous eruptions.

Eruption *in Infants*. See Infants.

ERUPTIVE Diseases, a term nearly ſynonymous with Cutaneous *Diſeaſes*, (which ſee). Eruptive fevers are thoſe febrile diſeaſes which are accompanied by an eruption of ſpots or tumours on the ſkin, by which they are principally characterized: ſuch as ſmall-pox, meaſles, chicken-pox, cow-pox, ſcarlet fever, eryſipelas, ſhingles, &c.

ERVUM, in *Botany*, an ancient Latin name of unknown derivation. Tare. Linn. Gen. 376. Schreb. 498. Willd. Sp. Pl. v. 3. 1112. Sm. Fl. Brit. 775. Juſſ. 360. Claſs and order, *Diadelphia Decandria*. Nat. Ord. *Papilionaceæ*, Linn. *Leguminoſæ*, Juſſ.

Gen. Ch. *Cal.* Perianth of one leaf, tubular, erect, cloven half-way down into five acute ſegments, all of equal breadth, but the lowermoſt is rather the longeſt. *Cor.* papilionaceous, twice as long as the calyx: ſtandard obovate, nearly entire, aſcending, with a broad claw, compreſſed and keeled at the back; wings two, oblong, obtuſe, half heart-ſhaped, ſhorter than the ſtandard, with narrow claws; keel as long as the wings, of two conjoined compreſſed petals, with ſeparate claws. *Stam.* Filaments in two ſets, one compoſed of nine, the other ſolitary; anthers roundiſh, two-lobed, erect. *Piſt.* Germen ſuperior, oblong, compreſſed, horizontal; ſtyle ſimple, aſcending, forming a right angle with the germen, and about half as long; ſtigma capitate, obtuſe, hairy all over. *Peric.* Legume oblong, obtuſe, compreſſed, rigid, knotty from the prominent ſeeds, of one cell, and two pointed, ſpirally-elaſtic valves. *Seeds* from two to four, occaſionally more, roundiſh, ſomewhat compreſſed.

Eſſ. Ch. Stigma capitate, hairy all over.

The genus *Ervum* in Linnæus is a heterogeneous aſſemblage, difficult to be accounted for. *E. Lens*, the ſpecies from which his generic character ſeems to have been principally taken, is moſt completely a *Cicer*, under which head it ſhould have been deſcribed in our eighth volume. *E. ſolonienſe* is not only a true *Vicia*, but the very ſame plant with *Vicia lathyroides*, Linn. Sp. Pl. 1040. See Engl. Bot. t. 30. *E. monanthos* and *Ervilia*, having the ſtyle hairy on the upper ſide, appear to us to belong to *Lathyrus*. Thus none of the Linnæan *Erva* remain, except our two Britiſh ſpecies, and theſe are not only very peculiar in habit, but according to the analogy of the tribe to which they belong, their ſtigma affords an excellent eſſential character, not to be found in any other *diadelphous* flower. All this was firſt explained in the Flora Britannica, by the author of the preſent article, and Willdenow has adopted it in every point, except that he retains the old erroneous character, "calyx deeply five-cleft," in addition to that derived from the ſtigma, and alſo makes *E. Ervilia* a *Vicia*. He moreover adopts a ſuppoſed new ſpecies from Desfontaines, making three in all.

1. E. *tetraſpermum*. Smooth-podded Tare. Linn. Sp. Pl. 1039. Curt. Lond. faſc. 1. t. 55. Engl. Bot. t. 1223. Stalks moſtly two-flowered. Pods ſmooth, many-ſeeded.—A troubleſome weed in cultivated land throughout Europe, flowering in June and July. *Root* annual, fibrous. *Stem* weak, climbing, branched, ſquare, hairy. *Leaflets* numerous, alternate, linear-oblong, obtuſe, hairy beneath, their common ſtalk ending in a branched tendril. *Flower-ſtalks* axillary, ſolitary, ſlender, as long as the leaves without their tendril, each bearing two (ſometimes ſolitary,) little drooping flowers of a pale blue veined with dark purple. *Calyx* hairy. *Pods* half an inch long, pendulous, oblong or obovate, ſmooth. *Seeds* four; occaſionally from five to ſeven in a variety found in Huntingdonſhire and at Algiers, which we have in vain tried to make a diſtinct ſpecies.

2. E. *vicioides*. Vetch-like Tare. Desfont. Atlant. v. 2. 168. t. 198. Willd. Sp. Pl. v. 3. 1112.—Stalks many-flowered. Pods ſilky, two-ſeeded. Leaflets obovate, entire. Gathered by Desfontaines in hedges at Algiers. It appears to be very nearly related to the following, from which it

chiefly differs in being rather larger, and in having more rounded and not emarginate *leaflets*. Nothing however is more variable than the termination of the leaflets in *Vicia* and its allies. The *pods* are called ſilky, which is perhaps equally applicable to *E. hirſutum*. All things conſidered, we much doubt of the permanency of this ſpecies, which we, like Willdenow, adopt entirely from the excellent work of Desfontaines. We tolerate, but cannot approve the mixture of Greek and Latin in the name *vicioides*, which if the ſpecies ſhould remain, ought to be made *viciæformis*.

3. E. *hirſutum*. Hairy-podded Tare. Linn. Sp. Pl. 1039. Curt. Lond. faſc. 1. t. 54. Engl. Bot. t. 970.—Stalks many-flowered. Pods hairy, two-ſeeded. Leaflets emarginate.—A pernicious weed in cornfields and paſtures throughout Europe. It much reſembles the firſt ſpecies, but the *ſtem* is uſually ſmoother, the ends of the *leaflets* more abrupt and notched, the *flowers* and *pods* more numerous on each ſtalk. The moſt eſſential difference conſiſts in the ſhorter, ſomewhat rhomboid, hairy *pods*, with only two ſeeds.—Mr. Curtis obſerves that he has "in wet ſeaſons ſeen whole fields of corn overpowered and totally deſtroyed by this plant, which is ſtronger and more prolific than *E. tetraſpermum*." He does not, however, ſuggeſt any remedy. Theſe weeds are too minute and inconſpicuous when young to be eradicated, and when they have fixed their tendrils upon the crop, they can no longer be ſeparated without "rooting up alſo the wheat with them." S.

Ervum *Orientale*. See Sophora.

ERVY, in *Geography*, a ſmall town of France, in the department of the Aube, chief place of a canton in the diſtrict of Troyes, with a population of 1975 individuals. It is 9 miles S. of St. Florentin, and has ſome manufactures of linen-cloth. The canton contains 14 communes and 11,199 inhabitants, on a territorial extent of 222½ kilometres.

ERWASH, a river of England, which riſes in the county of Nottingham, and almoſt in its whole courſe ſeparates that county from Derbyſhire, and falls into the Trent, 4 miles S. W. of Nottingham. See Erewash.

ERWITE, a town of Germany, in the circle of the Lower Rhine, and duchy of Weſtphalia; 5 miles S. of Lippſtadt.

ERXLEBEN, John Christian Polycarp, in *Biography*, was born in June, 1744, at Quedlingburg, where his father was dean of St. Nicholas's church. He ſtudied medicine at Gottingen, where he took the degree of maſter of arts in 1765, and ſhortly after gave lectures on natural hiſtory and the veterinary ſcience. Having publiſhed his introductory lectures, he undertook, at the expence of the Hanoverian government, a tour through France, Holland, Denmark, and a great part of Germany, in the courſe of which he acquired much practical knowledge in the veterinary art. On his return he lectured on the ſeveral ſciences connected with natural hiſtory, and natural and experimental philoſophy. In 1774, and the following years, he was elected a member of moſt of the learned ſocieties on the continent. He died in Auguſt, 1777, when he had but juſt attained his thirty-third year. Erxleben publiſhed many works which were highly eſteemed, among theſe are "Principles of Natural Hiſtory;" "Principles of Natural Philoſophy;" "An Introduction to the Veterinary Art." Gen. Biog.

ERYANNOS, in *Ancient Geography*, a river of Aſia Minor, in the Troade, which had its ſource in mount Ida.

ERYBIUM, a town of Greece, in the Doride, ſituated, according to Diodorus Siculus, at the foot of mount Parnaſſus.

ERYCEIRA, Francis de Meneses, *Count of*, in *Biography*, born at Liſbon in 1614, was brought up to the uſe of arms, and obtained ſome important offices under government; but in the midſt of his uſual occupations he cultivated literature, and publiſhed a number of works, particularly hiſtories of Tangier and Portugal; and the life of John I. king of Portugal.

Eryceira, Francis-Xavier de Meneses, was grandſon of the preceding, and, like him, united a literary with an active and military life. He was born at Liſbon in 1672, and roſe to eminence in the ſtate. He was choſen member of various learned ſocieties. From his anceſtor he inherited a well choſen and extenſive library, to which he made many great additions. He is ſaid to have been the author of more than a hundred different works, of theſe, however, but few ſeem entitled to notice. The beſt known are, "Memoirs on the Value of the Monies of Portugal," 4to. 1738; "Reflection on Academical Studies;" "Parallels on Illuſtrious Men and Women;" and "A Tranſlation of the Henriade." He died in the year 1743. Nouv. Dict. Hiſt.

ERYCINA, in *Mythology*, a ſurname given to Venus, from Erix, a mountain in Sicily, where ſhe had a temple. Venus Erycina had alſo a temple at Rome, which was deemed very ancient even in the time of Thucydides. See Erix.

ERYMANTHUS, in *Ancient Geography*, a mountain or foreſt of the Peloponneſus, in Arcadia, E. of a river of the ſame name, which had its ſource towards the north, on the confines of the Elide and of Arcadia, in mount Lampie. The wood of Erymanthus was full of boars, which made great deſolation in the country. Hercules was employed to give chaſe to them, which he did with ſuch ſucceſs, that he flew with his own hands the largeſt of them. See Hercules.—Alſo, a town of the Peloponneſus, in Arcadia, called *Phegia* and *Pſophis*, according to Pauſanias.

ERYMI, a people of Scythia, on this ſide of the Imaus. Ptolemy.

ERYMNÆ, a town of Aſia Minor, in Lycia. Steph. Byz.—Alſo, a town of Greece, in Theſſaly; placed by Pliny in Magneſia.

ERYNGIUM, in *Botany*, ἠρυγγιον of Dioſcorides, the derivation of which is unknown. Eryngo or Sea Holly. Linn. Gen. 127. Schreb. 177. Willd. Sp. Pl. v. 1. 1356. Mart. Mill. Dict. v. 2. Sm. Fl. Brit. 288. Juſſ. 226. Gærtn. t. 20. Claſs and order, *Pentandria Digynia*. Nat. Ord. *Umbelliferæ*.

Gen. Ch. *Common Receptacle* conical. *Flowers* all fertile, ſeſſile, with ſcales between them. *Involucrum* of the whole receptacle of many leaves, flat, ſpreading beyond the flowers. *Cal.* Perianth ſuperior, of five upright, acute leaves, ſeſſile on the germen, ſhorter than the corolla. *Cor.* in the aggregate uniform, roundiſh. Petals five, equal, oblong, with a linear longitudinal ſtricture, their points bent in, ſo as nearly to reach the baſe. *Stam.* Filaments five, capillary, ſtraight, projecting far above the corolla; anthers oblong, verſatile. *Piſt.* Germen inferior, briſtly; ſtyles two, thread-ſhaped, a little ſpreading, ſomewhat ſhorter than the filaments; ſtigmas ſimple. *Peric.* Fruit ovate, ſeparable perpendicularly into two parts. *Seeds* oblong, cylindrical; in ſome ſpecies remaining ſhut up in the cruſt of the pericarp, in others deciduous from it.

Eſſ. Ch. Involucrum of many leaves. Flowers in little denſe heads. Common receptacle conical, ſcaly. Seeds briſtly.

A moſt ſingular and very natural genus, having the habit and aſpect of a thiſtle, the herbage rigid, thorny, either more or leſs tinged with vivid blue, or pallid and whitiſh; while the fructification is exactly that of an umbelliferous plant, though the infloreſcence is capitate. Willdenow has eleven ſpecies, but they and their ſynonyms require a thorough inveſtigation. Two are natives of Britain, *viz. E. maritimum*, Engl. Bot. t. 718, (in which plate we are ſorry to remark that the petals are drawn reflexed inſtead of inflexed, an error that till now eſcaped us.)—This is frequent on ſandy ſea ſhores throughout Europe, flowering in July and Auguſt. The long creeping perennial *roots* are aromatic and ſomewhat acrid; they are eſteemed ſtimulant and reſtorative, and are ſometimes ſold candied. The herbage is glaucous variegated with a permanent blue. *Leaves* rounded, plaited, lobed, with ſpinous teeth. *Flowers* blue, in denſe terminal heads, encompaſſed with a large leafy involucrum. *Scales* of the receptacle three-cleft. The other Britiſh ſpecies is *E. campeſtre*, Engl. Bot. t. 57, found very rarely in England, though common on the continent. Its *leaves* are much more narrowly divided than the firſt, and pinnatifid. *Flowers* greeniſh-white, with narrow involucral leaves and undivided ſcales. This appears to be the true ηρυγγιον of Dioſcorides.

Among the exotic kinds *E. amethyſtinum*, Linn. Sp. Pl. 337, a native of Styria; *E. alpinum*, ibid. Curt. Mag. t. 922, from the Swiſs alps; and *E. planum*, Jacq. Auſtr. t. 391; are all hardy perennials, frequently cultivated for ornament. The *alpinum* is indeed peculiarly handſome, on account of its many-leaved, finely divided, blue involucrum.

The following five ſpecies are not in Willdenow.

E. *cyaneum*. Sm. Prod. Fl. Græc. Sibth. v. 1. 175. Fl. Græc. v. 3. t. 258. unpubliſhed. "Radical leaves in five deep pinnatifid ſegments. Stem much branched and divaricated. Involucrum of about five leaves."—Common in Greece and the iſlands of the Archipelago. The *root* is perennial *Stem* 12 or 18 inches high, of a fine blue, as well as the involucrums and foliage, many-flowered and divaricated. *Leaves* ſmall, in linear, narrow, pinnatifid ſegments. Heads of *flowers* ſmall, blue, with prominent, conſpicuous, white anthers. This moſt reſembles *E. triquetrum*, Vahl. Symb. v. 2. 46, in habit, but the flowers and involucrum are very different.

E. *multifidum*, ibid. Fl. Græc. v. 3. t. 259.—"Leaves doubly pinnatifid, ſomewhat lyrate; radiated at the extremity. Stem corymboſe. Involucrum pinnatifid."—Gathered by Dr. Sibthorp in the Morea. Taller than the laſt, with a bright blue *ſtem* and *flowers*. The finely pinnatifid *leaves* give it the aſpect of an *Echinops*. This is preſumed to be Eryngium creticum erectum, folio multifido, caule et ramis amethyſtinis; Tourn. Cor. 23.

E. *parviflorum*, ibid. (E. foliis laciniatis, capitulis florum exiguis et denſe congeſtis; Tourn. Cor. 23.) "Leaves bipinnatifid. Stem corymboſe. Involucrum three-cleft or ſimple, four times as long as the head." Of this no figure is extant, nor is it known where Dr. Sibthorp gathered the ſpecimens found in his herbarium. The *root* is perennial. *Herb* whitiſh. *Stem* denſely clothed with leaves, and bearing numerous flowers at the ſummit. *Leaves* twice or thrice pinnatifid, their ſegments narrow and divaricated. Heads of *flowers* very ſmall, with large involucra, generally of five leaves, which are either undivided or three-cleft.

E. *purpuratum*. Leaves all pinnatifid, their lower part fringed with capillary teeth. Stem nearly ſimple, with few flowers. Involucrum of about ſeven undivided leaves.—Gathered near Tangier by the late M. Brouſſonet and the Abbé Durand, who ſeverally ſent ſpecimens to Dr. Smith. *Root* perennial. *Stems* a ſpan high, round, furrowed, leafy, ſcarcely branched, but bearing about three dark-blue heads of *flowers*, with very ſpinous calyces. *Leaves* all nearly alike, pinnatifid, with decurrent, ſometimes lobed, ſegments; their lower part claſping the ſtem, pectinated, fringed with fine long capillary teeth. Great part of the ſtem, and the upper ſide of each leaf of the involucrum, are tinged with a rich deep blueiſh purple, hardly equalled in any other of the genus.

E. *carthamoides*. Leaves oblong, toothed, undivided, heart-ſhaped and claſping the ſtem at their baſe. Stem nearly ſimple, with few flowers. Involucrum of ſeveral ovate leaves. Gathered by M. Brouſſonet in the neighbourhood of Algiers, flowering in June. *Stem* a foot high, ſtrong, round, leafy, ſometimes purpliſh, ſimple, except at the ſummit, where it bears from three to five large heads of blueiſh *flowers*, whoſe involucrum conſiſts of ſeveral large, ovate, purpliſh, ſpinous-toothed leaves, much reſembling thoſe of a *Carthamus*. The radical and ſtem-*leaves* are all ſimple, oblong, wavy, with large ſpinous teeth, veiny and pale-green.

ERYNGO, in the *Materia Medica*. The root of eryngium is attenuant and deobſtruent, and is therefore eſteemed a good hepatic, uterine, and nephritic. Its whole virtue, it is to be obſerved, conſiſts in the external or cortical part. Their virtues, however, appear to be but weak; and they are now ſcarcely otherwiſe uſed than as made into a ſweetmeat.

The London college directs it to be candied in the following manner: boil the roots till the rind will eaſily peel off; when peeled, ſlice them through the middle, and the pith being taken out, waſh them three or four times in cold water; then for every pound of roots thus prepared, take two pounds of double-refined ſugar; diſſolve the ſugar in water, ſet it on a fire, and as ſoon as it begins to boil, put in the roots, and continue the boiling till they become ſoft.

Theſe candied roots are an ingredient in artificial aſſes milk, which is thus made: take of candied eryngo root one ounce, pearl barley half an ounce, liquorice root three drams; boil them in two pints of water to one pint, to which add a pint of new milk from the cow; boil them gently together, then ſtrain the liquor for uſe, of which half a pint ſhould be drunk three times a day.

ERYNNIS, *q. d.* ερις νȣ, *contentio mentis*, or becauſe, as Pauſanias remarks, ερινευειν ſignifies to fall into a fury, or *Furious*, a name given to Ceres by the Sicilians.

ERYSIBE, in *Botany*, ερυσιβη, *ruſt, or the mildew of corn*, from its ruſty panicle. Roxb. Pl. Coromand. v. 2. 31. Claſs and order, *Pentandria Monogynia*. Nat. Ord. *Sapotæ*, Juſſ.

Gen. Ch. *Cal.* Perianth in five deep, roundiſh, concave, permanent ſegments. *Cor.* of one petal, ſalver-ſhaped, the length of the calyx; tube cylindrical, pervious; limb the length of the tube, in 10 roundiſh ſegments, ſpreading. *Stam.* Filaments five, very ſhort, inſerted into the lower part of the tube; anthers erect, ovate, ſhorter than the tube. *Piſt.* Germen ſuperior, ovate; ſtyle none; ſtigma five-lobed. *Peric.* Berry oval, of one cell. *Seed* ſolitary, large.

Eſſ. Ch. Corolla ſalver-ſhaped; limb in ten equal ſegments. Style none. Stigma five-cleft. Berry ſuperior, with one ſeed.

E. *paniculata*. Roxb. Coromand. t. 159. The only known ſpecies, a native of the mountain foreſts of India, from whence Dr. Roxburgh ſent us ſpecimens in 1789. A very large climbing ſhrub. *Branches* alternate, leafy, round, clothed when young with copious ruſty down. *Leaves* alternate, three or four inches long, ſpreading and deflexed, elliptic-oblong, pointed, entire, veiny; ſmooth and ſhining above; paler and opaque beneath. *Footſtalks* half an inch long, angular, ruſty. *Stipulas* none. *Panicles* many-flowered, terminal, erect, much branched, about a ſpan long, their ſtalks, ſmall oblong ſcattered bracteas, and the calyx, all denſely clothed with ruſty down. Tube of the *corolla* greeniſh; limb yellow, about three lines in diameter. *Berry* the ſize of a ſmall cherry, black, pulpy, containing one large ſeed.

Of the uſes or qualities of this plant or its fruit we have no account. From its botanical affinity to *Chryſophyllum*, *Achras*, &c. it may certainly be eaten with ſafety. The flowers are not inelegant.

ERYSIMA, in *Ancient Geography*, a town of Aſia, in Cappadocia.

ERYSIMUM, in *Botany*, ερυσιμον of Theophraſtus and Dioſcorides, about the etymology of which there is much controverſy among the learned, but, as often happens in ſuch controverſies, nothing ſatisfactory. Hedge-muſtard. Linn. Gen. 339. Schreb. 442. Willd. Sp. Pl. v. 3. 509. Mart. Mill. Dict. v. 2. Sm. Fl. Brit. 706. Juſſ. 239. Tournef. t. 111. Gærtn. t. 143. Claſs and order, *Tetradynamia Siliquoſa*. Nat. Ord. *Siliquoſæ*, Linn. *Cruciferæ*, Juſſ.

Gen. Ch. *Cal.* Perianth of four ovate-oblong, coloured, parallel, cohering, deciduous leaves. *Cor.* cruciform, of four oblong, flat, very obtuſe petals, whoſe claws are the length of the calyx and erect. Nectary a gland betwixt each of the ſhorter filaments and the germen. *Stam.* Filaments ſix, the length of the calyx; of which two oppoſite ones are ſhorter than the reſt; anthers ſimple. *Piſt.* Germen ſuperior, linear, ſquare, the length of the ſtamens; ſtyle very ſhort; ſtigma ſmall, capitate, permanent. *Peric.* Pod long, linear, ſtraight, exactly ſquare, of two cells and two valves. *Seeds* numerous, ſmall, roundiſh.

Eſſ. Ch. Pod ſtraight, columnar, exactly ſquare. Calyx-leaves cohering. Stigma capitate.

Willdenow has 14 ſpecies, of which five are Britiſh.

1. E. *officinale.* Linn. Sp. Pl. 922. Curt. Lond. faſc. 5. t. 50. Engl. Bot. t. 735. "Pods cloſe-preſſed to the main ſtalk. Leaves runcinate." Common in waſte ground and about hedges. This is uſually taken for the ερυσιμον of Dioſcorides, whoſe deſcription, more full than uſual with that writer, is very applicable to it. Dr. Sibthorp, however, decidedly conſidered *Siſymbium polyceratium* as the plant Dioſcorides meant, and this, perhaps, will be found to accord ſtill better with his deſcription, which compares the horn-like pods to fænugreek. See its figure in Matthiolus, Ed. Valgr. fol. v. 1. 524. The ερυσιμον of Theophraſtus is ſuppoſed to be a ſtill different plant, as he reckons it among the various kinds of grain.

In this and ſimilar caſes, therefore, though the Linnæan generic name is adopted from ancient writers, it does not follow that their plant is of the ſame genus, which matter is frequently impoſſible to be aſcertained. It is ſufficient that ſuch names are eſtabliſhed by common conſent amongſt ſyſtematical botaniſts, from whom they acquire a new ſtamp of authority; nor ought they to be changed, whatever new light may be thrown upon them by future commentators. We ſtudy by the arrangements of Linnæus or Juſſieu, not by thoſe of Theophraſtus or Dioſcorides. It is only in caſe any ſpecies requires to be ſeparated from an eſtabliſhed genus, that we are glad to recur to its ancient appellation for a generic name; as in the caſes of *Cyamus*, Sm. Exot Bot. v. 1. 59. t. 31, 32 (ſee CYAMUS); and *Nuphar*, Prod. Fl. Græc. v. 1. 361.

2. E. *Barbarea.* Linn. Sp. Pl. 922. Engl. Bot. t. 443. "Lower leaves lyrate; their terminal lobe rounded: upper ones obovate, toothed."—Common in waſte ground, either dry or wet, flowering moſt in the ſpring. Its numerous *flowers* of a full yellow, often ſeen double in gardens, and its dark ſhining broad *leaves* eaſily diſtinguiſh it. The whole plant has a nauſeous, bitter, ſlimy flavour.

3. E. *præcox.* Sm. Fl. Brit. 707. Engl. Bot. t. 1129. "Lower leaves lyrate: upper ones pinnatifid, their ſegments linear, oblong, and entire."—Found in Devonſhire by the Rev. Dr. Beeke. The narrow lobes of the *ſtem-leaves*, ſmaller *flowers*, and much longer *pods*, diſtinguiſh this from the laſt, with which we believe Linnæus confounded it. The diſtinction is highly important, as we are convinced the preſent is the very ſame with the American Creſs, as it is called, or rather Winter Creſs, of the gardens, an agreeable and wholeſome pungent herb for ſallads, &c.

4. E. *Alliaria.* Linn. Sp. Pl. 922. Curt. Lond. faſc. 2. t. 48. Engl. Bot. t. 796. "Leaves heart-ſhaped."—Common under hedges in the ſpring, and known by its broad toothed *leaves*, white *flowers*, and ſtrong ſcent of garlick when bruiſed.

5. E. *cheiranthoides.* Linn. Sp. Pl. 923. Engl. Bot. t. 942. Jacq. Auſtr. t. 23.—"Leaves lanceolate, ſlightly toothed. Pods erect. Flower-ſtalks when in fruit ſpreading."—Not rare in Oſier-grounds, Turnip-fields, and other cultivated ground, where the ſoil is gravelly or ſandy, flowering in July. This reſembles the yellow ſtock or wall-flower in habit and *leaves*, but the ſmall *flowers* and ſquare *pods* at once diſtinguiſh it.

The exotic ſpecies are not quite ſo well aſcertained as ours. Ehrhart and Roth have taken pains to elucidate them, and the reſult is given by Willdenow. We know not that any of them is worthy of the attention of the cultivator except for botanical curioſity.—They are all either annual or biennial, perfectly hardy in our climate, and bear narrow lanceolate leaves, with ſmall yellow flowers. As weeds their copious ſeeds render them rather troubleſome.

ERYSIPELAS, from ερυω, *to draw*, and πελας, *near*, from the diſpoſition of the affection to draw the adjacent parts into the ſame ſtate; or from ερυθρος, *red*, and μελας, *black*, a dark red.) The generality of ſurgical authors have conſidered eryſipelas as a ſpecies of inflammation, and every reflection induces us to entertain the ſame opinion, notwithſtanding the oppoſite ſentiment of one of the lecturers on ſurgery in this metropolis. The immortal Celſus has obſerved: "notæ verò inflammationis ſunt quatuor; rubor, et tumor, cum calore et dolore," lib. 3. cap. 10. According to this definition, eryſipelas is certainly an inflammation, although the degree of ſwelling is not ſo great, nor the pain exactly of the ſame kind, as in caſes of phlegmon, or common inflammation.

With many diſtinguiſhed ſurgical authors, we regard eryſipelas as a particular kind of inflammation, moſt frequently affecting the ſmall veſſels on the ſurface of the body. It is, as Mr. Hunter deſcribes, more commonly a cutaneous inflammation, than one ſituated in deeper parts; although it is probable, that, in ſome conſtitutions, every inflammation, wherever it exiſts, will be of this kind. However, there can be no doubt of the fact laid down by this accurate obſerver, *viz.* that the ſkin appears to be the moſt ſuſceptible of eryſipelas, becauſe this affection will ſpread over a prodigious extent of the ſurface of the body, while (at leaſt, in common inſtances) the cellular membrane underneath remains free from diſorder. (See Hunter on Inflammation, p. 270.)

Mr. Hunter taught ſurgeons, that one of the uſes of the adheſions, which form in caſes of common inflammation, is to circumſcribe and bound the matter, in the event of ſuppuration taking place. Now, in eryſipelas, the extravaſation in the place affected is not ſo conſiderable as in phlegmon, nor is it of that kind, which produces adheſions among the inflamed parts. Indeed, ſince eryſipelas ſeldom ends in ſuppuration, ſuch adheſions, according to Mr. Hunter's view of the ſubject, would in general be unneceſſary. Perhaps, alſo, the circumſtance of there being no adheſions in eryſipelatous caſes, may account for the terrible diffuſion of miſchief, which always happens, when abſceſſes do occaſionally take place. Then, we know, that the matter makes its way extenſively through the cellular ſubſtance, in every direction under the ſkin, under faſciæ, and between the muſcles, producing, wherever it goes, what has been often named a gangrenous ſuppuration. When eryſipelas is of an unmixed kind, it has not the dark red colour which common inflammations have, but a lighter red, with a yellow tinge, which is particularly obſervable towards the termination of the diſorder. The ſwelling which occurs is unattended with any remarkable induration, and forms a very inconſiderable prominence. The ſkin of the inflamed part has a ſhining appearance, and, on being touched with the finger, turns white at the ſpot where the preſſure is made; but the bright red colour immediately afterwards returns. The pain is uſually of a burning, ſhooting deſcription, and the patient frequently complains of a ſort of itching, which is found to be particularly annoying. The ſwelling, which happens in caſes of eryſipelas, is not only not ſo hard and elevated as that which ariſes in examples of phlegmonous inflammation, it is at the ſame time not ſo clearly circumſcribed.

Another remarkable feature of eryſipelas, is the manner in which this inflammation often changes its ſituation, by getting well on one ſide, while it is ſpreading in ſome other direction. The great celerity with which the affection ſpreads, and the large ſurface which it in a very little while covers, may alſo be ſet down among its moſt ſtriking peculiarities.

When the affection is intimately dependent on the ſtate of the conſtitution, we very often ſee all the local ſymptoms recede in one place, and the diſeaſe make its attack in ſome other part of the body. Such inſtances are not unfrequently mentioned by writers as *metaſtaſes*, juſt as if it were a real fact, that, when the eryſipelatous ſymptoms get well on one leg, and the other leg becomes affected in a ſimilar way, theſe events happen, in conſequence of the firſt identical diſeaſe actually moving from one limb to the other. From this abſurd doctrine originates all the cant about the danger of uſing ſuch applications as are likely to repel the inflammation. The truth is, that the ſecond attack of the eryſipelas is not at all connected with the termination of the firſt; but ariſes from ſome different, and probably inexplicable cauſe, juſt as encyſted tumours will often form, one after another, in various parts of the body, as regularly as they are cut out. In this latter inſtance, no one is abſurd enough even to ſuſpect that the growth of one tumour is the effect of a previous one being cured.

In true eryſipelas, there is no throbbing of the part affected, as in caſes of phlegmon; and when eryſipelatous inflammation runs along the ſkin, the affection has a determinate edge, and does not loſe itſelf gradually and inſenſibly in the ſurrounding parts, as common inflammation does.

The alteration which the ſkin undergoes in eryſipelas conſiſts in its feeling at the part affected leſs pliable than in the natural ſtate, and a little thickened.

Such are the ordinary local ſymptoms of eryſipelas. They are ſubject, however, to ſome variety, depending on the mildneſs or violence of the attack, and on the circumſtance of the diſorder being either ſimple, or complicated with another affection; for inſtance, œdema, phlegmon, &c.

With reſpect to violence, eryſipelas may be very properly divided into three degrees. In the firſt, or mildeſt form of the complaint, the eryſipelas makes its appearance, without any preceding illneſs, or with only a ſlight indiſpoſition of ſhort duration, and conſiſting of laſſitude, diſturbed ſleep, loſs of appetite, &c. Theſe complaints very ſoon go off, when the eryſipelas comes out, which happens in about a couple of days. For two days more the local ſymptoms remain the ſame, and then the eryſipelas turns pale and yellow, gradually diſappearing altogether, with a detachment of the cuticle. During the whole courſe of the diſorder there is no fever of any conſequence; but a little while before the redneſs occurs the pulſe is ſometimes rather diſturbed.

In the ſecond, or more ſevere degree of the diſorder, the patient is troubled, about two days before the eryſipelas makes its appearance, with an unuſual proſtration of ſtrength, heavineſs in all his limbs, head-ach, loſs of appetite, nauſea, and even actual vomiting, complaints in the ſtomach, &c. Beſides theſe inconveniencies, the patient is affected with a fever, and all its uſual ſymptoms. After a couple of days, commonly on the third day from the commencement of all indiſpoſition, the eryſipelas comes out, attended with a gentle ſweat, and a moderate increaſe in the ſecretion of urine, after which circumſtances the fever, with all its attendant ſymptoms, goes off. The reſt of the progreſs of the caſe is ſimilar to what we have related, as happening in the firſt, or mildeſt attack of eryſipelas.

In the third, or moſt violent degree of the diſorder, particularly in thoſe caſes in which eryſipelas makes its attack on the face, the patient is affected with ſevere febrile ſymptoms, head-ach, loſs of ſleep, delirium, ſickneſs, &c. Theſe complaints do not diminiſh, as in the milder caſes of eryſipelas, when the local redneſs, heat, &c. take place on the third day; but continue with unabated vehemence, until the eryſipelas itſelf ſubſides. The laſt deſirable event commonly happens, according to Richter, on the eleventh day, accompanied with an increaſe in the ſecretions from the ſkin and kidnies.

The moſt dangerous caſes of eryſipelas are thoſe in which the face is affected. Of this form of the diſorder, the celebrated Cullen has left us a matchleſs deſcription, which we think is highly deſerving of inſertion in this Cyclopædia. The eryſipelas of the face, (ſays this intereſting author,) comes on with a cold ſhivering, and other ſymptoms of pyrexia. The hot ſtage of this is frequently attended with a confuſion of head and ſome degree of delirium; and almoſt always with drowſineſs, or perhaps coma. The pulſe is always frequent, and commonly full and hard.

When theſe ſymptoms have continued for one, two, or at moſt three days, there appears on ſome part of the face a redneſs, ſuch as that of erythema. This redneſs at firſt is of no great extent; but, gradually ſpreads from the part it firſt occupied, to other parts of the face, commonly till it has affected the whole; and frequently from the face it ſpreads over the hairy ſcalp, or deſcends on ſome part of the neck. As the redneſs ſpreads it commonly diſappears, or, at leaſt decreaſes in the parts it had before occupied. All the parts upon which the redneſs appears are at the ſame time affected with ſome ſwelling, which continues for ſome time after the redneſs has abated. The whole face becomes conſiderably turgid; and the eye-lids are often ſo much ſwelled, as entirely to ſhut up the eyes.

To continue Dr. Cullen's account: when the redneſs and ſwelling have proceeded for ſome time, there commonly ariſe, ſooner or later, bliſters of a larger or ſmaller ſize on ſeveral parts of the face; theſe contain a thin yellowiſh, or almoſt a colourleſs liquor, which ſooner or later runs out. The ſurface of the ſkin in the bliſtered places ſometimes becomes livid and blackiſh, but this livor ſeldom goes deeper than the ſurface, or diſcovers any degree of gangrene affecting the ſkin. On the parts of the face not affected with bliſters the cuticle ſuffers, towards the end of the diſeaſe, a conſiderable deſquamation.

Sometimes the tumours of the eye-lids end in a ſuppuration.

The inflammation coming upon the face does not produce any remiſſion of the fever which had before prevailed; and ſometimes the fever increaſes with the increaſing and ſpreading inflammation.

The inflammation uſually continues for eight or ten days; and, for the ſame time, the fever and ſymptoms attending it alſo continue.

In the progreſs of the inflammation, the delirium and coma attending it ſometimes go on increaſing, and the patient dies apoplectic, on the ſeventh, ninth, or eleventh day of the diſeaſe. In ſuch caſes, it has been commonly ſuppoſed that the diſeaſe is tranſlated from the external to the internal parts. But, Dr. Cullen obſerves, that he never met with any inſtance in which it did not appear to him, that the affection of the brain was merely a communication of the external affection, as this continued increaſing at the ſame time with the internal.

When the fatal event does not take place, the inflammation, after having affected a part, commonly the whole of the face, and, perhaps, the other external parts of the head, ceaſes. With the inflammation the fever alſo ceaſes; and, (ſays Cullen,) without any evident criſis, the patient returns to his ordinary ſtate of health.

The ſame diſtinguiſhed writer repreſents the diſeaſe as being not commonly contagious; but he conceived it poſſible that it might ſometimes be communicated from one perſon to another; and, he adds, that perſons who have once laboured under the diſorder are liable to returns of it.

According to Cullen, the event of the diſeaſe may be foreſeen from the ſtate of the ſymptoms which denote more or leſs affection of the brain. If neither delirium nor coma comes on, the diſeaſe is ſeldom attended with any danger; but when theſe ſymptoms appear early in the diſeaſe, and are in a conſiderable degree, the utmoſt danger is to be apprehended.

We have already remarked that, in caſes of eryſipelas, ſuppuration does not frequently happen; but that when it does, owing to the matter not being confined by the adheſive inflammation, very bad conſequences follow. Wherever the matter ſpreads, it occaſions under the ſkin an extenſive ſloughing of the faſciæ, tendons, and cellular ſubſtance, all which kind of miſchief may take place, while the ſkin itſelf, which is very vaſcular and highly organized, remains unimpaired in its texture. This combination of ſuppuration and mortification is more likely to happen when the eryſipelatous inflammation extends to a greater depth than common, ſo as to affect the cellular membrane. In this ſtate, as Mr. Hunter has well deſcribed, air, matter, and ſloughs, are all produced together under the ſkin, and, on handling the part, a ſtrange feel is communicated, neither like that of a fluctuation, or a crepitation. Mr. John Pearſon very whimſically, we will not ſay unaptly, compares the ſenſation with that excited by a quagmire or moraſs. Frequently, the practitioner may obſerve in ſome opening, made either by ulceration or the lancet, a ſmall black ſloughy point, and, on taking hold of it with a pair of forceps, and drawing it out, he finds, to his great ſurpriſe, that a whole mortified tendon, of conſiderable length, follows his inſtrument.

Eryſipelas is to be met with more frequently in ſummer than winter, and more commonly in hoſpitals than other places. Wounds of the head, oftener than any other kind of accident, give riſe to the diſorder.

Eryſipelas has ſometimes been obſerved on the ſkin of new-born infants. Several inſtances of this kind are mentioned in the Medical Communications, as having occurred in the Britiſh Lying-in-Hoſpital. In one of theſe examples, the child was born with its whole face ſwelled and inflamed, the left ſide being affected with a true eryſipelas. There was alſo an inflammation on the legs, feet, and left hand. On each tibia, there appeared an oblong ſlough, of a dark brown colour, almoſt livid; the one on the left leg was exceedingly large. The cure was attempted by employing embrocations, emollient poultices, and fomentations, and applying camphorated ſpirit of wine. This child appears to have ſwallowed the decoction of bark with great eaſe, as it took four ounces of it every day from the very time of birth. In three days the ſwelling of the face and other parts had conſiderably ſubſided; but, on the third day, a veſication began to form on the left cheek, and another juſt above the eye-brow, on the ſame ſide. Theſe veſications increaſed in number and ſize, eſpecially on the legs, where they extended over the whole limb. Some confectio cardiaca was added to the decoction of bark, and pledgets, dipped in oil of turpentine, were put on all the parts affected, previouſly to the application of the poultice. The veſications began to break on the ſixth day, and a ſanies to iſſue from them; yellow ſloughs alſo now made their appearance in different parts. The child ſeemed much debilitated, and, for the laſt three or four days, had taken eight ounces of the decoction of bark, with one dram of the confectio cardiaca every twenty-four hours. The pledgets, applied to the ſores, were dipped in a digeſtive ointment, with oil of turpentine, and ſome cataplaſm e cymino. Under this mode of treatment, the ſloughs were ſoon detached, and the child recovered. though not without the loſs of the little finger, two joints of the ring finger, and one of the middle one.

The diſtemper, which we have juſt been deſcribing, for ſome time proved extremely fatal, none of the infants recovering who were attacked. However, bark is ſtated to have acted quite as a ſpecific remedy for the diſeaſe, as ſoon as it was tried, and almoſt all the children are ſaid to have got well who took this medicine. Mortification always took place in ſuch ſubjects as died; and the danger was regularly obſerved to be the greateſt in the inſtances in which the genitals were the parts firſt attacked. The diſeaſe was alſo noticed to affect the children of weakly women, and of ſuch as were addicted to drinking ſpirits.

To return, however, to our account of the common forms of eryſipelas, we have to appriſe the reader, that the term "St. Anthony's fire," which is ſo frequently mentioned by all ſorts of perſons, is ſtrictly applied by medical writers and practitioners to that ſpecies of the affection in which veſicles ariſe upon the ſurface of the ſkin; while other inſtances, not accompanied with veſications, are named *ſimple* eryſipelas.

The diviſion of the ſubject, however, cannot be properly comprehended under theſe two varieties; and the generality of authors have found it neceſſary to obſerve other diſtinctions.

Mr. Pearſon, in his Principles of Surgery, has noticed the following ſpecies of the complaint:

1. The acute eryſipelas.
2. The œdematoſe eryſipelas.
3. The malignant, or gangrenous eryſipelas.

Each of theſe ſpecies may be an idiopathic, or ſymptomatic diſeaſe.

Mr. Pearſon remarks, that the acute eryſipelas is moſt commonly ſeen in thoſe of a ſanguine and choleric temperament; it is generally ſudden in its attack, and uſually affects the face. Febrile ſymptoms are often preſent immediately after the acceſſion of the diſeaſe; but they gradually diminiſh as the eryſipelas becomes more diſtinctly formed. Conſiderable heat, and great uneaſineſs, take place in the part affected; the ſkin is alſo of a brighter ſcarlet colour than in the other ſpecies. If puſtules appear, they are diſtinct; but ſometimes there are no veſications on the ſurface.

Suppuration very rarely occurs in this kind of eryſipelas, and the violence of the diſeaſe commonly ſubſides in three or four days; the part then grows yellowiſh, and throws off furfuraceous ſcales. The diſeaſe terminates about the tenth day. A tenderneſs of the hairy ſcalp will often continue for a conſiderable time after the diſeaſe has diſappeared.

The acute eryſipelas, as we have already obſerved, is ſometimes an idiopathic affection; frequently it is ſymptomatic, or, in other words, the conſequence of a wound, eſpecially one of the head. Perſons who have once been attacked with the acute eryſipelas, in a ſpontaneous manner, are particularly liable to ſuffer again from future attacks of the ſame diſorder.

Mr. Pearſon ſtates, that the œdematoſe eryſipelas is not, in general, ſo ſudden in its attack, nor ſo ſevere on its acceſſion, as the acute eryſipelas. The diſeaſe increaſes gradually, is more diffuſed, and is attended with leſs burning pain. If febrile ſymptoms ſhould ariſe, they never run high, nor are they of long duration; moſt commonly the ſtrength is depreſſed, attended with a ſoft, frequent, perhaps, irregular pulſe. In this ſpecies of eryſipelas no conſtitutional relief is derived from the appearance of the local affection: on the contrary, the danger increaſes with the progreſs of the external diſeaſe.

When the face is the ſeat of the œdematoſe eryſipelas the whole countenance has a bloated appearance. The red colour of the ſkin is mingled with yellow or brown, and the complaint is attended with ſhiverings, vomiting, and more or leſs diſturbance of the functions of the brain. Mr. Pearſon further remarks, that the veſications are often ſmall and numerous, and, that when they have been expoſed for a few days to the air, the countenance becomes covered with a dark-coloured cruſt, very much reſembling the appearance which ariſes in the confluent ſmall-pox. Though the face is very much ſwelled, it is not firm to the touch, and eaſily yields to preſſure.

The œdematoſe eryſipelas is deemed highly dangerous. Patients often die, in a delirious or comatoſe ſtate, about the ſeventh day, ſometimes a little later.

It is common to ſee many people afflicted with this ſpecies of eryſipelas about the ſame time. Mr. Pearſon informs us, that, in hoſpitals, he has ſeen ſeveral perſons ſucceſſively attacked with the complaint in the ſame ward. Some conjectures have been entertained of the diſorder being contagious.

All ages and conſtitutions may be affected with the œdematoſe eryſipelas. However, ſubjects weakened by age, or intemperance, are moſt frequently attacked. Dropſical patients, children, and new-born infants, are alſo ſeen affected with the complaint.

According to Mr. Pearſon, the œdematoſe eryſipelas, when ſymptomatic, is much leſs dangerous than when idiopathic; but, ſays this author, whenever the face is conſiderably affected, the diſeaſe is always to be regarded as a ſerious one, whatever be the remote cauſe. On the limbs it is ſeldom dangerous, or very afflicting, unleſs treated in an improper way. Mr. Pearſon mentions his having ſeen the œdematoſe eryſipelas make its firſt appearance upon the face, and, by a gradual and regular progreſſion, proceed downward to the extremities, ſucceſſively appearing upon an inferior portion of the body, as it diſappeared from a ſuperior part. Each renewed acceſſion of the complaint was leſs and leſs ſevere, as it receded to a greater diſtance from the part that was primarily affected.

The malignant, or gangrenous eryſipelas, makes its firſt appearance ſomewhat like the œdematoſe form of the diſorder. Its progreſs, however, is much quicker. Phlyctenæ, with a livid baſe, ſoon occur on the ſkin, together with gangrenous ſymptoms. The diſeaſe, at a very early period, becomes attended with a ſtate of the conſtitution, reſembling that which exiſts in putrid fevers.

The gangrenous eryſipelas moſtly occurs on the face, neck, breaſt, and ſhoulders: the danger of the diſeaſe depends very much on the ſtate of the conſtitution.

When an eryſipelatous inflammation, particularly one of the legs has been cured, a degree of œdema will frequently continue about the lower part of the limb for ſome time afterwards.

Eryſipelatous inflammation differs from phlegmon in the following reſpects. The ſwelling is leſs prominent; and is never diſtinctly circumſcribed. The ſkin often has the appearance of being ſcorched, or burnt. The redneſs is quite circumſcribed, has a very determinate edge, is frequently tinged with yellow, and, on being touched with the end of the finger, a white ſpot is produced for a ſhort time in the place where the preſſure was made. The pain is not of the lancinating, throbbing kind, which attends phlegmonous inflammation; but is ſuch as cauſes a ſenſation of a great heat and burning in the part, together with a violent degree of itching. The part affected does not preſent the feel of, what ſurgeons underſtand by, tenſion; but only ſeems to the touch as if the ſkin were a little thickened. Except in the acute eryſipelas, there is no hardneſs of the pulſe, as in caſes of phlegmon, and inſtead of being attended, as the latter affection, with rather an increaſe of ſtrength, eryſipelas is almoſt always accompanied with more or leſs debility.

With reſpect to the cauſes of eryſipelas our knowledge is very imperfect, and every obſervation on this ſubject muſt be received with doubt. We do not mean to ſtate, that the remote cauſes are not very often ſufficiently obvious. We frequently have occaſion to remark, in the practice of ſurgery, that certain punctured wounds, and injuries of the external parts of the head give riſe to eryſipelas. Indeed, we may ſtate, as a general remark, that the ſame claſs of irritations, termed *remote* cauſes, which in one conſtitution would occaſion phlegmonous inflammation, in another would excite eryſipelas. What is far more difficult of inveſtigation, is the cauſe why eryſipelas ſhould take place rather than common inflammation; in other words, the exact particularity, to which the origin of eryſipelatous inflammation is to be aſcribed, is involved in much more obſcurity. Sometimes even the remote cauſe cannot be diſcovered, the affection having the appearance of originating in a ſpontaneous manner.

It was one of the ancient doctrines, eſtabliſhed by Galen, and maintained down to the preſent time, that what is underſtood by a bilous habit is particularly ſubject to eryſipelatous inflammation. Many parts of the writings of the celebrated Pott, the experienced Richter, and other noted modern writers, evince their belief in this opinion.

Weak and irritable conſtitutions appear to us to be moſt ſubject to eryſipelas; while ſtrong, plethoric perſons moſt frequently undergo common phlegmonous inflammation. We think, that there is every reaſon to believe, that, in general, eryſipelas is intimately dependant on the ſtate of the conſtitution, or on ſome peculiarity of temperament. This opinion is ſomewhat confirmed by the fact, that while perſons, who lead drunken, intemperate lives, are particularly often afflicted with eryſipelatous inflammation, in conſequence of local injuries, other people, who lead more regular lives, generally have phlegmonous inflammation after ſimilar injuries.

It muſt be admitted, however, that eryſipelas occaſionally makes its appearance in conſtitutions with which we can find no evident fault. Indeed, Hunter ſeems to have conſiderable reaſon for his inference, that the affection may, in ſome inſtances, be altogether independent of conſtitutional cauſes, ſince it is the common courſe of the diſeaſe to be actually getting well on one ſide as faſt as it is ſpreading on another.

If we can ſometimes aſſign particular circumſtances, which operate as cauſes conducive to eryſipelas, it is all that we can hope to do. To trace the proximate cauſe in every example which preſents itſelf, is far beyond our pretenſions; neither do we believe that it is to be done by the powers of human reſearch. We might adopt the language of Cullen, and talk of eryſipelas depending "on a matter generated within the body, and thrown out, in conſequence of fever, upon the ſurface of the body." We might alſo join Mr. Pearſon in repreſenting eryſipelas as being ſometimes the "critical termination of another diſeaſe, ſuch as obſtructed menſtruation, quartan ague, ſuppreſſed ſuppuration, ſpaſmodic and convulſive diſeaſes." However, we ſhould ſhew juſt as much devotion for truth, were we to offer any other wild, vague ſuppoſitions, unſupported by rational evidence.

Leſs aſpiring in our attempts, we ſhall only aim at pointing out circumſtances which ſeem to act as cauſes, conducive to the diſorder, in ſome inſtances. If many women of temperate lives, and young children, are occaſionally affected with eryſipelas, as they undoubtedly are, the fact only proves, that there are other cauſes beſides intemperance which may be concerned in giving riſe to the complaint. The ſources of the diſeaſe muſt, we believe, on ſome occaſions, be regarded as among the myſterious and inacceſſible ſecrets of nature. When drunkenneſs and other kinds of intemperance are aſſigned as cauſes conducive to eryſipelas, it is not meant that they are excluſively ſo. There are, probably, hundreds of other cauſes in exiſtence, though we may not be able to detect them.

With regard to women of temperate regular lives, and to children being occaſionally affected with eryſipelatous inflammation, the fact cannot be called in queſtion. But, ſtill, no experienced man will contend that ſuch ſubjects are attacked with eryſipelas, on meeting with local injuries, half ſo frequently as perſons with conſtitutions impaired by any kind of intemperance, habits, or modes of life.

Richter and ſome other writers, have deſcribed eryſipelas as depending very much on a ſuppreſſed ſtate of the perſpiration; but we are inclined to think that they have aſcribed the importance of a cauſe to a mere effect of the fever, with which eryſipelas is connected.

Treatment of the acute, or phlegmonous eryſipelas.—This ſpecies of the diſeaſe being commonly attended with a full, and frequently a hard pulſe; the blood drawn ſhewing upon its ſurface the buffy coat to be ſeen in all inflammatory complaints; and laſtly, the ſwelling of the eyelids, frequently ending in ſuppuration; there can be no doubt, that the affection ſhould be treated very much in the ſame manner as phlegmonous inflammation. Blood-letting, cooling purgatives, and every part of the antiphlogiſtic regimen, are adviſed by Cullen, who affirms, that his experience had confirmed the fitneſs of this method of cure.

The evacuations of blood-letting and purging are to be employed, more or leſs, according to the urgency of the ſymptoms, particularly the febrile ones, and thoſe which mark an affection of the brain.

Although Mr. Pearſon mentions general and topical bleeding as being indicated in the treatment of the acute eryſipelas, yet he obſerves, that caſes very rarely occur in large towns where bleeding is at all admiſſible, and a repetition of the operation can very ſeldom be proper.

Profeſſor Richter ſtrongly praiſes the good effect of emetics on eryſipelas; but ſome other writers, probably in a ſtrain of ignorance, or prejudice, repreſent ſuch medicines as having ſometimes occaſioned fatal conſequences.

Another indication is to promote a gentle degree of perſpiration. For this purpoſe, we may exhibit ſmall doſes of the antimonium tartariſatum, or the pulvis ipecacuanhæ comp., æther vitriolicum; ſaline draughts with volatile alkali, &c.

Opium and camphor are alſo proper remedies for allaying irritation.

Whoever has been in the habit of conſulting the writings of ſeveral celebrated medical authors, will perceive that they place great reliance in bark, as a medicine tending very powerfully to check and cure eryſipelatous inflammations. When we mention Mr. John Hunter among ſuch authors, our readers will be inclined, perhaps, to ſuſpect that there muſt be ſome foundation for the repute into which this medicine has riſen for the complaints under conſideration. However, we muſt confeſs our own belief, that bark gained credit for its good effects on eryſipelas entirely in conſequence of the general enthuſiaſm which once depicted it as a cure for almoſt every diſeaſe of the human frame. The ſentiment is corroborated, if not confirmed, by the fact, that the beſt modern practitioners ſeem now to conſider bark no longer of eminent ſervice in caſes of acute eryſipelas.

With reſpect to local applications, in theſe inſtances, ſeveral kinds have been uſed by different practitioners. Cold aſtringent lotions, oily ſubſtances, rubefacients, farinaceous, or earthy powders, and emollient poultices, have all been tried. As far as our experience extends, the lotio aquæ lithargyri acetati is as good an application as can be made to a part affected with the acute ſpecies of eryſipelas. However, it becomes us to appriſe the reader, that the majority of medical writers beſtow the greateſt praiſe on the employment of dry mealy powders, ſuch as flour, ſtarch, &c. for topical remedies, with which the inflamed part is to be covered.

Mr. Pearſon, ſtrangely enough, ſpeaks in favour of rubefacients, as if the ſkin were not already reddened enough by the diſeaſe; but reſerves his higheſt recommendations for mild warm poultices. Let the ſurgeon, however, conſider the ill conſequences and terrible miſchief which always occur when ſuppuration ſupervenes, and let him beware of the injudicious plan of promoting the latter event.

Treatment of the œdematoſe eryſipelas.—In this caſe topical bleeding may be practiſed; but veneſection is hardly ever allowable. The bowels ſhould be kept open with ſaline purgatives of the mildeſt deſcription, and a gentle perſpiration ought to be excited, by means of ſmall doſes of tartariſed antimony, the pulvis ipecacuanha comp., &c. For the purpoſe of appeaſing pain and irritation, the practitioner may preſcribe camphor, opium, æther, &c.

When the patient's conſtitution is in a debilitated condition, tonics are indicated, together with the moſt nouriſhing food. Bark, wine, porter, brandy, the confectio aromatica, may now be found of the utmoſt ſervice.

Treatment of the malignant or gangrenous eryſipelas.—Little need be ſaid here on this ſubject, as the mode of treatment is the ſame as that of mortification in general. See Gangrene.

The grand objects are; to ſupport the patient's ſtrength; to cover the parts affected with emollient poultices; to foment them two or three times a day with a decoction of poppy-heads; to make depending openings for the eſcape of the matter and ſloughs; and remove the dead parts, as ſoon as it can be done without occaſioning the leaſt irritation and pain.

We have frequently ſeen the gangrenous miſchief ſo extenſive in theſe caſes, that amputation of the limb was the only means of ſaving the patient from deſtruction. See Richter's Anfangſgründe der Wundarzneykunſt. Band i. Von der Roſe. Pearſon's Principles of Surgery. Cullen's Firſt Lines of the Practice of Phyſic. Cooper's Firſt Lines of the Practice of Surgery.

ERYSIPHE, in *Agriculture*, a term applied by ſome to that vegetable diſeaſe generally known by the name of mildew. See Mildew.

ERYSTHIA, in *Ancient Geography*, a town of the iſland of Cyprus. Steph. Byz.

ERYTHEIA, an iſland of Iberia, in the ocean. According to Strabo, it was ſeparated from the continent by a large ſtrait of a ſtadium, or, according to Pliny, of 100 paces. It was near Gades. Its name was derived from the Phœnicians, who, having inhabited the banks of the Erythrean ſea, came to ſettle here. It was alſo called *Aprodiſias*, or the iſle of Venus, and the iſle of Juno. See Gades.

ERYTHE'MA, in *Surgery*, (from ερυθος, *red.*) The celebrated Cullen diſtinguiſhed two claſſes of eryſipelatous inflammations. When the diſeaſe was an affection of the ſkin alone, and very little of the whole ſyſtem, or when the affection of the ſyſtem was only ſymptomatical of the external inflammation, he called the diſeaſe *erythema;* but when the external inflammation was an exanthema, and ſymptomatical of an affection of the whole ſyſtem, he named the diſeaſe *eryſipelas*, which ſee.

"An Erythema, Roſe, or St. Anthony's Fire, (ſays Dr. Cullen) is an inflammatory affection of the ſkin, with hardly any evident ſwelling; of a mixed, and not very bright red colour, readily diſappearing upon preſſure, but quickly returning again; the redneſs of no regular circumſcription, but ſpreading unequally, and continuing almoſt conſtantly to ſpread upon the neighbouring part; with a pain like to that from burning; producing bliſters, ſometimes of a ſmall, ſometimes of a larger ſize, and always ending in a deſquamation of the ſcarf-ſkin, ſometimes in gangrene."

We need not enlarge on the ſubject of erythema, in the ſenſe of an eryſipelas not originating from a conſtitutional affection, as every uſeful information, concerning eryſipelatous inflammations in general, is to be found in the article Eryſipelas.

The chief object which we have in view in the preſent part of this work is to deſcribe a particular affection of the ſkin, named, in conſequence of its being occaſioned by the uſe of mercury, the *mercurial erythema*, or *eczema*.

It was perhaps, for the firſt time, diſtinctly noticed and deſcribed by Mr. Benjamin Bell in his Treatiſe on the Venereal Diſeaſe. "It is not an uncommon effect of mercury (ſays this author) to excite an eruption upon the ſurface of the body. In ſome, this appears as a miliary raſh, ſomewhat reſembling meaſles; while in others it is conſiderably elevated, and ſeems to be produced by a ſerous effuſion between the cutis and ſcarf-ſkin. In ſome the eruption is partial, being confined to particular ſpots; while in others it prevails generally over the whole body.

"This eruption, or efflorеſcence, is not attended with pain; but the heat and itchineſs which accompany it are, in ſome inſtances, ſo diſtreſsful, that it keeps the patient at all times very uneaſy, and deprives him entirely of reſt.

"The remedies, (obſerves Mr. B. Bell) which I have found to anſwer the beſt, are the internal uſe of opiates, conjoined with the application of flour or ſtarch-powder to the parts affected. The ſkin is kept ſufficiently cool and eaſy by one or the other of theſe powders being from time to time freely applied to the eruption; and, by a proper exhibition of opiates we ſecure reſt during the night. In ſome inſtances, however, we are obliged to avoid the uſe of opiates; for although they may anſwer the purpoſe of procuring ſleep, they tend evidently to increaſe the heat and itchineſs of the eruption. We find, indeed, that, in ſome conſtitutions, opium excites an uneaſy itchy ſenſation over the whole body, even where an eruption has previouſly taken place: and it is, perhaps, with ſuch patients only, that it cannot be employed in the treatment of this eruption.

"The eruption to which I allude, (adds Mr. Bell,) appears to ariſe entirely from the effect of mercury upon the ſyſtem; but it does not ſeem to depend upon any particular preparation of the remedy. It takes place indiſcrimately from all of them; and not more readily from unction than from thoſe preparations that are uſed internally." See a Treatiſe on Gonorrhæa Virulenta and Lues Venerea; by B. Bell, vol. ii. p. 228.

Since this gentleman publiſhed the foregoing work, the mercurial erythema has excited conſiderable attention, and ſeveral writers, *viz.* Drs. Moriarty, M'Mullin, and Spens, and Meſſrs. Alley and Pearſon, have endeavoured to render our knowledge of the ſubject more extenſive.

Dr. M'Mullin judiciouſly obſerves, that eruptions of various kinds are very common ſymptoms of ſyphilis, but a very unuſual effect of mercury. Hence, until the real nature of the mercurial erythema was aſcertained, whenever the affection occurred in patients undergoing a mercurial courſe for ſyphilitic complaints, it was naturally enough conſidered as an anomalous form of lues venerea. The mercury was conſequently puſhed to a greater extent, in proportion to the violence of the ſymptoms, and from the cauſe of the diſeaſe being thus unconſciouſly applied for its removal, it could not fail to be aggravated, and hurried on to a fatal termination. At length, the obſervation of this fact, and of another truth, that a ſimilar eruption did ſometimes appear in patients who were uſing mercury for other complaints, and in whom no ſuſpicion of ſyphilis could be entertained, led to the important diſcovery that the eruption was entirely an effect of mercury, and not at all connected with the original diſeaſe.

Dr. M'Mullin imputes the firſt explanation of the nature of the mercurial erythema to Drs. Moriarty and Spens, and Mr. George Alley, all which writers publiſhed in the courſe of the ſame year, *viz.* 1804. However, the paſſage which we have quoted above, from Mr. B. Bell's work on the venereal diſeaſe, clearly evinces that though the above gentlemen have undoubtedly great merit in having increaſed our information concerning the diſeaſe, yet the latter writer had noticed the affection before them. Indeed, Dr. Spens has had the liberality to make this acknowledgment himſelf.

According to Dr. M‘Mullin, the different appearances which this diſeaſe aſſumes, from its ſeverity and duration, may be beſt underſtood by deſcribing it as conſiſting of three diſtinct ſtages. The firſt ſtage, ſays this gentleman, commences with languor, laſſitude, and cold ſhiverings. Theſe ſymptoms are ſucceeded by increaſed temperature of the body, quick pulſe, nauſea, head-ach, and thirſt. The patient is troubled with a dry cough, and complains of difficult reſpiration, anxiety, and ſenſe of ſtricture about the præcordia. The tongue is uſually moiſt, and covered with a white glutinous ſlime. It ſometimes appears clean and of a bright red colour in the centre, while the margins remain foul. The ſkin feels unuſually hot and itchy, with a ſenſe of prickling, not unlike the ſenſation experienced from the application of nettles. The belly is generally coſtive; but a diarrhœa is often produced by very ſlight cauſes.

To continue Dr. M‘Mullin's deſcription: on the firſt, or ſecond day, an eruption moſt commonly appears, the colour of which is either dark or bright red. The papulæ are at firſt diſtinct and elevated, very much like thoſe which occur in rubeola. Sometimes, but not often, the eruption appears like urticaria, and in ſuch inſtances the diſeaſe is obſerved to be very mild. The papulæ very ſpeedily run together in ſuch a manner as to form a ſuffuſed redneſs, which diſappears on preſſure. In moſt caſes, it firſt begins on the ſcrotum, inſide of the thighs, fore-arm, or where mercurial frictions have been made, and the ſkin of the parts affected becomes conſiderably ſwollen. Inſtances have alſo been ſeen in which an eruption of a purpliſh colour, and accompanied by papulæ, has ſuddenly diffuſed itſelf over the whole body. (See Moriarty on Lepra Mercurialis.) Dr. M‘Mullin remarks, however, that the latter form of the affection may be conſidered as uncommon. In every inſtance which Dr. M‘Mullin has ſeen the eruption was at firſt confined to a few places, and thence gradually extended, until the different portions of the eruption had united. The papulæ were alſo rough to the feel. But, in ſuch caſes as reſemble urticaria, many minute veſicles, interſperſed among the papulæ, and containing a ſerous fluid, make their appearance from the very firſt. Contrary to what happens in moſt diſeaſes, accompanied with cutaneous affections, the febrile ſymptoms are much aggravated, and continue to increaſe, after the eruption is complete. The pulſe in general beats from 120 to 130 in a minute, the thirſt continues urgent, and the patient, who is extremely reſtleſs, ſeldom enjoys quiet ſleep. Dr. M‘Mullin further informs us, that when the eruption has continued in this manner, for a certain period, the cuticle begins to peel off in thin, whitiſh, ſcurfy exfoliations, not unlike thoſe obſerved in rubeola. This deſquamation firſt begins where the eruption made its earlieſt appearance, and in this order ſpreads to other parts. About this period the fauces become ſore, the tongue ſwells, and the eyes appear ſomewhat inflamed.

The duration of this ſtage is very various; ſometimes it continues from ten to fourteen days, and in other caſes it terminates in half that time. When the diſeaſe has appeared in its mildeſt form, the patient recovers immediately after this deſquamation, a new cuticle having formed underneath. When the diſeaſe is ſevere, however, he has only experienced the ſmalleſt part of his ſufferings, and the ſkin now aſſumes a new appearance, which Dr. M‘Mullin has conſidered as the ſecond ſtage.

This author repreſents the ſkin as appearing at this period as if ſtudded with innumerable minute veſicles, which are filled with a pellucid fluid. Theſe veſicles (he obſerves) may be expected, if the patient, at the cloſe of the firſt ſtage, ſhould complain of increaſed itching, and a ſenſe of a burning heat in the parts, from which the cuticular exfoliations have fallen. The veſicles ſometimes remain for a day or two; but in general they are burſt immediately after their formation, by the patient rubbing the parts, in order to relieve the troubleſome itching which he ſuffers. A ſerous acrimonious fluid is diſcharged, which poſſeſſes ſo diſagreeable an odour, that it induces nauſea in the patient himſelf, and thoſe who approach his bed-ſide. The ſmell is ſaid to be ſo peculiar, that it can be eaſily recogniſed by any perſon who has once perceived it. Dr. M‘Mullin ſtates, that this fluid is poured out moſt copiouſly from the ſcrotum, groin, inſide of the thighs, or wherever the ſkin forms folds, and ſebaceous glands are moſt numerous. The ſerous diſcharge from the veſicles forms, with the cuticle, incruſtations, which Dr. M‘Mullin regards as the criterion of the third or laſt ſtage.

The ſame writer obſerves, that the cruſts are generally very large, and when detached retain the figure of the parts from which they have fallen. Their colour is in general reddiſh, but it ſometimes appears dark and dirty. Dr. M‘Mullin conceives, that this period of the diſeaſe might be termed, with much propriety, the ſtage of *decruſtation*, in order to diſtinguiſh it more fully from the *deſquamation*, which has been already noticed. When the ſtage of decruſtation appears, the fauces become more affected, the eyes intolerant of light, and the tarſi tender, inflamed, and ſometimes turned inward. The cruſts formed on the face, as in other parts of the body, before falling off, break ſo as to leave cracks and fiſſures, which horridly deform the countenance; and in conſequence of the great ſwelling of the face the eye-lids are alſo completely cloſed. The back and hairy ſcalp are ſaid to be the parts moſt backward in becoming affected, and, according to Dr. M‘Mullin's account, they even ſometimes eſcape entirely in very ſevere caſes.

In this ſtage of the mercurial erythema the patient is under the neceſſity of avoiding every kind of motion, on account of the pain which it occaſions, and which he compares with ſuch a ſenſation as one may fancy would be produced by a cracking of the fleſh. The cruſts alſo fall off in ſuch abundance, that the bed ſeems as if ſtrewed with the cones of hops.

While the eruption is only making its appearance in one place, it may have attained its moſt advanced form in another part, ſo that all the different ſtages of the diſeaſe may be preſent at one time, in the ſame individual.

Typhus prevails throughout the whole courſe of the complaint; but, what is curious, the appetite continues in moſt caſes unimpaired, and ſometimes is even voracious.

Dr. M‘Mullin alſo remarks, that when the catarrhal ſymptoms have continued during the progreſs of the complaint, they are particularly aggravated in the advanced ſtage of the caſe. The anxiety and pain in the breaſt are likewiſe ſtated to be very ſevere, attended with cough and bloody expectoration, the patient invariably feeling languid and dejected. The pulſe becomes frequent, feeble, and irregular; the tongue black and parched; and, at length, diarrhœa, delirium, convulſions, gangrene of the ſurface of the body, and death, enſue.

The mild form of the diſeaſe only goes through the firſt ſtage, and ends, as we have already deſcribed, in a ſlight deſquamation, after a few days. When the affection is ſevere, however, it is often protracted more than two months, every ſtage of the eruption continuing proportionably longer; and when, in this manner, it has run its courſe, it repeatedly breaks out on the new ſurface, and paſſes through the ſame ſtages.

For the preceding hiſtory of the ſymptoms of the mercurial erythema, we feel ourſelves highly indebted to Dr. M'Mullin. See Edinburgh Medical and Surgical Journal, vol. ii. p. 25, &c.

With the exception of one caſe, which Dr. Rutter has inſerted in the eighteenth number of the journal juſt now mentioned, we have no inſtance recorded, in which the preſent diſorder originated, without the patient being under the influence of mercury. Whether Dr. Rutter's example is to be conſidered as the ſame identical diſeaſe as the one which we have been deſcribing, we ſhall not undertake to inveſtigate. We ſhall only obſerve, that ſince it is very poſſible to miſtake other complaints for the real mercurial erythema, we do not conſider one ſolitary fact, reſting on the judgment of an individual, who might differ in opinion concerning the nature of the diſeaſe, with the next medical practitioner conſulted, a ſufficient ground for implicitly believing, that ſuch a diſeaſe as the mercurial erythema can be produced quite independently of the uſe of mercury.

In certain habits, every preparation of mercury, and every form of employing this medicine, ſeem capable of bringing on the diſeaſe. As the complaint was firſt taken notice of in patients who were afflicted with ſyphilis, it was ſuppoſed to be an anomalous form of the venereal diſeaſe. But, at laſt, the repeated appearance of the eruption in perſons exempt from all ſuſpicion of having any ſyphilitic ſymptoms, made ſurgeons convinced, that what is now commonly named the mercurial erythema had nothing venereal in its nature. However, ſince few out of the great number of patients, continually employing mercury, are afflicted with this erythema, medical writers have attempted a further explanation of the difficult ſubject of cauſes, by ſtating, that the mercurial erythema only takes place in ſuch patients as have a certain undeſcribable peculiarity of conſtitution. The contemplative reader will at once perceive, that this is a vague and an unphiloſophical mode of accounting for the production of the diſeaſe, as the ſame ſorry kind of explanation may be generally adopted in regard to every diſorder, the immediate cauſe of which is totally unknown. Is it not a greater mark of prudence and good ſenſe to confeſs our ignorance, under theſe circumſtances, than to offer ſtatements, wiſhing them to be conſidered as explanatory, while they do not convey any information whatever on the ſubject?

It has been ſuppoſed by ſome, among whom is Dr. Gregory of Edinburgh, that the application of cold to the body, while under the influence of mercury, is abſolutely eſſential to the production of the diſorder under conſideration.

Notwithſtanding there can be no reaſonable doubt that the mercurial erythema is commonly excited by the uſe of mercury in ſome form or another, yet it appears from what Mr. Pearſon has ſtated, that the diſeaſe is not always exaſperated by a perſeverance in the employment of the medicine. On ſome particular occaſions, when this gentleman judged it to be of great moment to continue the mercurial frictions, the eruption neither ſpread univerſally, nor was it materially increaſed. The patients, however, did not get rid of the raſh till the mercury was diſcontinued.

We have already noticed the opinion of Dr. Gregory and ſome other practitioners, that expoſure of the body to cold, at a time when the ſyſtem is under the influence of mercury, is abſolutely neceſſary for the production of the mercurial erythema. Mr. Pearſon ſeems to entertain a very different ſentiment; for, he obſerves, that he is not aware of any other cauſe, than the action of mercury on a particular kind of conſtitution being concerned. He acquaints us, that he has ſeen this cutaneous diſeaſe occur in private practice as well as the Lock hoſpital, where the ſtricteſt attention has been paid to the temperature of the apartment, to regimen, and to perſonal cleanlineſs. He has had no reaſon to believe that any one ſeaſon of the year is more conducive to the diſeaſe than another; and he ſtates that free expoſure to the air, either in winter or ſummer, has not the leaſt perceptible effect in exciting the eruption.

Mr. Pearſon, as a general rule, recommends the employment of mercury to be immediately left off on the firſt appearance of the eruption; and though he ſeems to admit that the affection may be relieved by remedies, yet he is doubtful whether any plan of treatment has the power of interrupting its regular courſe, or abridging its duration. Mr. Pearſon would by no means wiſh to inſinuate, however, that the patient may not derive conſiderable benefit from medical aſſiſtance; his ſufferings (he owns) may be greatly mitigated; many inconveniences may be remedied; his ſtrength may be ſupported; and, in ſhort, (ſays Mr. Pearſon,) he may be ſo conducted through the diſeaſe, that his general ſtate of health ſhall not ſuffer any material or permanent injury.

It is not enough to diſcontinue the employment of mercury. In large hoſpitals, and particularly ſuch as are appropriated to venereal caſes, the patient ſhould be immediately removed from thoſe wards which may have their atmoſphere vitiated by the breathing of perſons charged in general with mercury.

In the early ſtage of the mercurial erythema, Mr. Pearſon recommends ſmall doſes, of antimonial powder, with ſaline draughts, or elſe the ammonia acetata. A gentle purgative ſhould be given every three or four days, and opium is proper for appeaſing the pain and irritation, and procuring ſleep. Sometimes, ſays Mr. Pearſon, opium mixed with camphor, or Hoffman's anodyne liquor, will have a better effect than when adminiſtered alone. When the diſcharge is no longer ichorous, and the tumefaction is ſubſiding, the ſame ſurgeon preſcribes the liberal exhibition of ſarſaparilla and bark. He has alſo thought, that the general ſenſe of uneaſineſs has been leſſened by the vitriolic acid, which proves at the ſame time grateful and refreſhing.

The diet ſhould be of a light and nouriſhing quality; but no fermenting liquors can be prudently allowed till the deſquamation of the cuticle is ſomewhat advanced.

In order to diminiſh the pain ariſing from the irritation of the ſkin, the warm bath may be uſed as often as the patient's ſtrength will permit. His linen and ſheets, which are ſoon rendered hard and ſtiff by the diſcharge, ſhould be very frequently changed. Mr. Pearſon is alſo in the habit of covering every part, where excoriations occur, with a ſoft mild cerate, made of litharge plaſter, yellow wax, and olive oil. This application is to be thickly ſpread on rollers, by which means it may be conveniently put wherever it is needed. The dreſſing ſhould be changed twice a day.

Dr. M'Mullin has noticed, that, though in the early ſtage of the mercurial erythema, diaphoretics are indicated, yet the bowels are ſo irritable, that ſuch medicines can ſcarcely be employed. For the ſame reaſon, he recommends us to be very cautious in giving mineral acids, ripe fruits, &c. This gentleman approves of the patient being kept in rather a warm temperature, and in a place where he can derive the advantage of a quick circulation of air. The bowels being weak, Dr. M'Mullin adviſes us only to employ the mildeſt purgatives, when medicines of this claſs are required.

With regard to the topical treatment, the latter gentleman ſays, that ſolutions of ſulphate of zinc, and acetite of lead, ſulphur ointment, and the decoction of oak-bark, have all been tried, but without any particular good, and he ſeems to prefer ſprinkling the parts with powdered ſtarch. To allay the cough and ſoreneſs of the fauces, he adviſes mucilaginous mixtures, containing a ſmall proportion of opium.

When the incruſtations become general, the fever always aſſumes more of the typhoid type. In this ſtage bark has been uſually preſcribed, with a view of ſupporting the ſtrength; but Dr. M'Mullin remarks, that this medicine can never be given in ſufficient quantity, owing to its affecting the ſtomach, or occaſioning diarrhœa. In ſome inſtances, he obſerves, the cold infuſion, conjoined with aromatics, has been beſt retained, and a little opium may be added to the doſes. Opium, which this gentleman deſcribes as improper in the firſt ſtage, may now be taken without any riſk of unpleaſant conſequences. He ſtates, that wine is the beſt remedy in this ſtage of the diſeaſe. Porter and diluted ſpirit are alſo proper, and the thirſt muſt be aſſuaged with whey, light broths, and nouriſhing drinks of every kind. Owing to there being now a large extent of the ſkin in an excoriated ſtate, the patient cannot at this time generally bear warm bathing, which often brings on a ſtate of ſyncope, and all that can be done is to waſh the parts, in the moſt tender manner, with tepid water.

For the ophthalmia tarſi, the unguentum zinci vitriolati is recommended, and the linimentum aquæ calcis is ſaid to relieve moſt effectually the pain which makes the patient feel as if his fleſh were cracking.

We ſhall conclude this article with adviſing the reader, who wiſhes to be perfectly acquainted with the ſubject of mercurial erythema, to conſult B. Bell's Treatiſe on Gonorrhœa Virulenta and Lues Venerea, vol. ii. p. 228. Pearſon on the Effects of various Articles in the Cure of Lues Venerea. Edit. 2. p. 165. An Eſſay on a Peculiar Eruptive Diſeaſe ariſing from the Exhibition of Mercury, by G. Alley, Dublin, 1804. A Deſcription of the Mercurial Lepra, by Dr. Moriarty, Dublin, 1804. Hiſtory of Three Caſes of Erythema Mercuriale, by Dr. Spens, in Edinb. Med. and Surgical Journal, vol. i. p. 7. Eſſay on Erythema Mercuriale, by Dr. M'Mullin, in Edinb. Med. and Surgical Journal, vol. ii. p. 25. Caſe of Erythema not occaſioned by Mercury, by John Rutter, M. D. in Edinb. Med. and Surgical Journal. vol. v. p. 143.

ERYTHRÆ, in *Ancient Geography*, a town of Greece, in Bœotia. Pliny. It was ſituated near mount Citheron, according to Euripides. Some authors place it in the territory of Platæa, to the eaſt of this town.—Alſo, a town of Greece, in Theſſaly, ſituated upon the river Erypæus, according to Strabo.—Alſo, a town of Greece, in Œtolia, near Eupalium.—Alſo, a town in the iſle of Cyprus, called Paphos.—Alſo, one of the twelve towns of Aſia Minor, in Ionia, according to Pliny Strabo ſays, that it gave name to the Erythræan Sibyl. He ſays alſo, that it had a port, called Cyſſus, in which were four iſles called Hippi. This town was built by Nilæus, the ſon of Codrus. In the town was a temple of Hercules, one of the moſt ſtately edifices in all Aſia. Erythræ took part, on all occaſions, with the Romans, who rewarded its fidelity with ample privileges, and conſiderably enlarged its territory. It is now a village, named Erethri.—Alſo, a town of Africa, in Libya.

ERYTHRÆA, in *Botany*, ερυθραια, *red*, a name given by Renealm to the *Chironia Centaurium*, (Gentiana *Centaurium* of Linnæus), on account of its red colour, unuſual in the Gentian tribe. This writer controverts the univerſally received opinion of its being the κενταυριον μικρον of Dioſcorides, becauſe the latter is ſaid to prefer watery ſituations. But neither this, nor indeed any other of his arguments, is of much weight; for the *Chironia Centaurium* often occurs in low and wet places, and according to Dr. Sibthorp is very frequent throughout Greece. *Chironia ſpicata*, which Dioſcorides would hardly diſtinguiſh from it always grows in marſhy ſpots, and is found on the coaſts of Greece, as may alſo *Chironia pulchella*, though ſcarcely diſtinguiſhed by any body from the common kind when Dr. Sibthorp viſited that country, and therefore not noted by him.

ERYTHRÆAN Sea, in *Ancient Geography*, is the ancient name of the *Red Sea*. Indeed, the ancients gave this name to the whole expanſe of water that extends from the coaſt of Ethiopia to the iſland of Taprobana. This appellation was probably derived from Edom or Eſau, whoſe deſcendants were called Idumæans, and inhabited the northern part of Arabia. The Idumæans navigated upon the Red ſea and the Perſian gulf, and alſo upon the Indian ſea, and the oriental name Idumæan ſignified red. Whence the ſea of the Idumæans was called the Red ſea, and the Erythræan ſea.

ERYTHRÆAN *Sibyl*. See SIBYL.

ERYTHREAN, an appellation given to Hercules, from a temple which he had at Erythres, in Arcadia.

ERYTHRINA, in *Botany*, from ερυθρος, *red*, on account of the ſcarlet flowers, whence alſo it is called Coral-tree. Linn. Gen. 365. Schreb. 486. Willd. Sp. Pl. v. 3. 912. Mart. Mill. Dict. v. 2. Juſſ. 356. (Corallodendron; Tournef. t. 446.) Claſs and order, *Diadelphia Decandria*. Nat. Ord. *Papilionaceæ*, Linn. *Leguminoſæ*, Juſſ.

Gen. Ch. *Cal.* Perianth of one leaf, entire, tubular; its margin more or leſs two-lobed; its baſe on the lower ſide furniſhed with a honey-bearing pore. *Cor.* papilionaceous, generally of five petals; ſtandard much the longeſt, lanceolate, aſcending, its ſides bent downwards; wings minute, ſomewhat ovate, ſcarcely longer than the calyx, and hardly reaching beyond the claw of the ſtandard; keel ſtraightiſh, uſually about the length of the wings, ſometimes longer, of two petals either ſeparate or united, notched at the end. *Stam.* Filaments ten, unequal, united below into a tube, ſlit at the upper edge, a little incurved, half as long as the ſtandard, one of them occaſionally ſeparate; anthers ten, oblong. *Piſt.* Germen ſuperior, ſtalked, awl-ſhaped, tapering into an awl-ſhaped ſtyle, as long as the ſtamens; ſtigma terminal, ſimple. *Peric.* Legume very long, protuberant from the ſeeds, pointed, of one cell. *Seeds* ſeveral, kidney-ſhaped.

Eſſ. Ch. Calyx two-lobed, ſtandard much longer than the keel. Wings minute. Legume cylindrical, with many convex ſeeds.

Obſ. *E. herbacea* has the tenth ſtamen ſeparate; which is alſo the caſe with *E. Criſta-galli*, whoſe keel moreover has its petals united into one, and is much longer than in the generality of the ſpecies.

The ſpecies of this ſplendid genus are, for the moſt part, natives of very hot climates in the Eaſt or Weſt Indies, and amount in Willdenow, who has paid particular attention to them, and deſcribed two new ones, to twelve.

E. *herbacea*, Linn. Sp. Pl. 992. Trew. Ehret. t. 58. found in Carolina, will ſupport our winters in a green-houſe, nor does its ſtem always die down to the root. The *flowers* form long and very handſome ſpikes, being of a moſt vivid though deep ſcarlet, with purpliſh ſtalks and calyx. *Seeds* ſcarlet with a black eye.

E. *Corallodendrum*, Linn. Sp. Pl. 992, brought from the Weſt Indies, requires a ſtove. It has an arboreſcent prickly *ſtem*, with *flowers* much like the former.

E. *mitis*, Jacq. Hort. Schoenbr. v. 2. 47. t. 216, is another ſimilar ſpecies in its *flowers*, but deſtitute of prickles. It was ſent to the Imperial garden from the Caraccas.

E. *Criſta-galli*, Linn. Mant. 99. Sm. Exot. Bot. v. 2. 69. t. 95, is perhaps one of the moſt ſtately of the whole. This is ſaid to be a native of Braſil, but was raiſed in the Liverpool garden from ſeeds brought from the Eaſt Indies, probably from the garden at Calcutta. It was in 1805 but a ſlender prickly ſhrub about ſix feet high, with ternate prickly-ribbed *leaves*. *Flowers* in large terminal cluſters, of a rich unpoliſhed deep ſcarlet, their ſtandards much broader, and keels much longer, than is uſual in this genus; the wings very ſmall and three-lobed, of a greeniſh white. Tenth *filament* ſeparate to the very baſe.

E. *ſpecioſa*, Andr. Repoſ. t. 443, a plant we have never ſeen, flowered in the garden of A. B. Lambert, eſq., and though ſuppoſed to be a native of South America, is ſaid to be perfectly hardy, and to ſtrike very freely from cuttings. Whether it be comprehended under any of Willdenow's ſpecies, we are not at all certain. The *ſtem* is prickly, thick and ſtrong. *Leaflets* very broad, with prickly ribs. *Flowers* ſcarlet, in very denſe ſpikes. *Wings* half as long as the ſtandard, which is narrow like the firſt ſpecies; keel not half ſo long as the wings. If theſe circumſtances are conſtant, the generic character will require correction.

ERYTHRINUS, in *Ichthyology*, a ſpecies of SPARUS and alſo of SALMO, which ſee reſpectively.

ERYTHROCEANEUS, in *Ornithology*, the red and blue maccaw, with a wedge-like tail, and the ſides of the head naked and rough. See PSITTACUS.

ERYTHRODANUM, in the *Materia Medica*, a name by which ſome authors have called the rubia tinctorum, or madder.

ERYTHROIDES, in *Anatomy*, from ερυθρος, *red*, and ειδος, *form*, a name given by ſome anatomiſts to the firſt proper covering of the teſticles. It is not now admitted that theſe bodies are covered by any thing except the fibres of the cremaſter and cellular ſubſtance of the ſcrotum, to which, perhaps, the above-mentioned name may have been applied.

ERYTHRONIUM, in *Botany*, from ερυθρος, *red*, in alluſion either to the colour of the flower, or to the more unuſual blood-like ſtain in the leaves. Dog's-tooth Violet. Linn. Gen. 165. Schreb. 220. Willd. Sp. Pl. v. 2. 96. Mart. Mill. Dict. v. 2. Juſſ. 48. (Dens canis; Tournef. t. 202.) Claſs and order, *Hexandria Monogynia*. Nat. Ord. *Sarmentaceæ*, Linn. *Liliа*, Juſſ.

Gen. Ch. *Cal.* none. *Cor.* Petals ſix, regular, lanceolate, pointed, lying over one another alternately towards the baſe, ſpreading gradually, reflexed from about the middle; three of them external, three internal. Nectary two ſcars, or little ſcales, at the baſe of each of the inner petals. *Stam.* Filaments ſix, uniform, awl-ſhaped, ſhort; anthers oblong, erect, as long as the filaments. *Piſt.* Germen ſuperior, roundiſh or oblong, with three angles; ſtyle ſimple, ſhorter than the corolla, taper at the baſe, and a little bent at that part, otherwiſe ſtraight; ſtigmas three, ſpreading, ſomewhat cylindrical, furrowed, or notched. *Peric.* Capſule nearly globular, contracted at the baſe, of three cells and three valves. *Seeds* numerous, ovate, pointed.

Eſſ. Ch. Corolla bell-ſhaped, of ſix reflexed petals. Nectary two ſcars at the baſe of the three inner ones. Capſule globoſe, contracted at the bottom. Seeds ovate.

1. E. *Dens canis*. Linn. Sp. 437. Jacq. Auſtr. v. 5. 31. append. t. 9. Curt. Mag. t 5. Leaves with a blunt flat point. Style cylindrical. Germen globoſe, obtuſe. Native of mountainous places in Italy, Switzerland, Carniola, Styria, Carinthia and Tartary, flowering in the ſpring. In our gardens it is a hardy perennial, diſtinguiſhed by its elliptical radical *leaves*, very various in breadth, elegantly ſtained with purple, and its ſolitary drooping crimſon or whitiſh *flower*, with pendulous dark purple anthers. No remains of the herbage are to be ſeen after the end of June. Lobel and ſeveral botaniſts of his time preſumed this to be the real ςατυριον of Dioſcorides, nor does it ill accord with the deſcription, though Dr. Sibthorp ſeems not to have met with the plant in Greece. It cannot, however, be made to agree with the ςατυριον ερυθρονιον of the ſame author, though the latter appellation ſeems to have given riſe to its preſent generic name. The old authors made two ſpecies on account of the various dimenſions of the leaves, which Linnæus reduced to one, but he very improperly made a third variety of the following ſpecies.

2. E. *flavum*. (E. americanum; Curt. Mag. t. 1113. E. Dens canis γ; Linn. Sp. Pl. 437.) Leaves involute at the point. Style club-ſhaped. Native of the colder parts of North America. It flowered in April 1808, in the gardens of Mr. Loddiges at Hackney, and Mr. Saliſbury at Brompton, and was firſt well determined by Mr. Gawler in Curtis's Mag. The leaves reſemble the former, except in having a hooded termination, from the involute edges of the point. *Flower* deep yellow ſpotted with red. *Anthers* and pollen yellow. *Style* very thick in the upper half. *Germen* obovate.

3. E. *revolutum*. Leaves flat-pointed? Style cylindrical. Germen elliptic-oblong, acute.—Gathered by Mr. A. Menzies on the weſt coaſt of North America. The *leaves* are broadly elliptical, and in our ſpecimens appear pale, and ſcarcely ſpotted. *Petals* purpliſh, very much rolled back, as in the Martagon Lily. *Stamens* with unuſually long taper-pointed filaments, and pale or yellowiſh, not dark purple, anthers. *Germen* elliptic-lanceolate, pointed. *Style* contracted at the baſe, but otherwiſe pretty exactly cylindrical, with much longer ſtigmas than either of the foregoing.—The whole plant alſo is larger, and appears to us unqueſtionably diſtinct. The diſcovery of this ſpecies in America renders the original name of the laſt ſo exceptionable, that we hope we may be pardoned for changing it before it is adopted in any regular ſynoptical work, otherwiſe it would be too late. S.

ERYTHROPHTHALMUS, in *Ichthyology*. See CYPRINUS.

ERYTHRORHIZA, in *Botany*, ερυθρα ῥιζα, *a red root*; Michaux Fl. Boreali-Amer. v. 2. 36. t. 36, is *Galax aphylla*, which ſee.

ERYTHROXYLUM, ερυθρον ξυλον, *red wood*. Brown. Jam. 278. Linn. Gen. 228. Schreb. 307. Willd. Sp. Pl. v. 2. 746. Mart. Mill. Dict. v. 2. Juſſ. 253. Claſs and order, *Decandria Trigynia*. Nat. Ord. *Tribilatæ*, Linn. *Malpighiæ*, Juſſ.

Gen Ch. *Cal.* Perianth of one leaf, turbinate, very ſmall, withering, in five ovate acute ſegments. *Cor.* Petals five, ovate, concave, ſpreading. Nectary an upright, coloured, notched ſcale, attached to the baſe of each petal. *Stam.* Filaments 10, the length of the corolla, connected at the baſe by an abrupt membrane; anthers heart-ſhaped. *Piſt.* Germen ovate, ſuperior; ſtyles three, thread-ſhaped, diſtant, the length of the ſtamens; ſtigmas thickiſh and obtuſe. *Peric.* Drupa ovate, of one cell. *Seed.* Nut oblong, with four obtuſe angles.

Eſſ. Ch. Calyx turbinate. Petals five, each with a notched nectariferous ſcale at its baſe. Stamens connected at their baſe. Drupa of one cell.

This genus, founded by Browne, conſiſts of two ſpecies only in his work. 1. *E. areolatum*, Linn. Sp. Pl. 612. Brown. Jam. t. 38. f. 2. and t. 14. f. 3. (E. carthaginenſe; Jacq. Amer. 134. t. 87. f. 1.) This is called, in Jamaica, Red Wood, or Iron Wood, and is ſaid to be excellent for the ſize of the tree, which is not above five or ſix inches in diameter. The *leaves* are obovate, two inches long, marked with two lines at the back, which circumſcribe the part that was expoſed before each leaf expanded. *Flowers* ſtarry, white, fragrant, on ſimple, cluſtered, lateral ſtalks.

2. The ſecond ſpecies of Browne has been neglected by following authors, probably as a variety of the firſt. He deſcribes it as different in its manner of growth, with ſmaller rounder *leaves*.

Cavanilles and Lamarck have much increaſed the number of ſpecies, ſo that they now amount in Willdenow's work to 12, all except the above unknown to Linnæus. They are natives either of South America, Madagaſcar, or the iſlands of Mauritius and Bourbon, and were chiefly gathered by Commerſon. The French call many of them Bois d'huile. The wood is, in ſome inſtances, ſaid to have a very ſtrong and diſagreeable ſmell while burning.

ERYX, in *Ancient Geography*. See Erix.

Eryx, in *Zoology*, a ſpecies of Anguis, being the *Anguis dorſo trilineato* of Boddaert, above cinereous, with three black lines, and light blueiſh beneath. It is found in England, and in America.

ERZ, or Erzi, in the *Botanical Writings of the Ancients*, a word uſed originally by the Hebrews, and by them made the name of the cedar.

ERZEN, in *Geography*, a town of Germany, in the circle of Lower Saxony, and principality of Calenberg, ſeated on the Humme; 7 miles S.W. of Hameln.

ERZERUM, or Arzerum, a city of Aſiatic Turkey, and capital of a pachalic to which it gives name, and is a part of Armenia, ſituated near the head of the Euphrates, at the foot of a chain of mountains which are uſually covered with ſnow till the latter end of ſpring. The town is ſurrounded with a double wall, and defended with ſome ſquare towers; the houſes are mean, and none of them large. The ſuburbs are inhabited by Chriſtians. Of the inhabitants, they count 18,000 Turks, of whom two-thirds are Janizaries; 6000 Armenians, who have an archbiſhop, and two churches; and 400 Greeks, who have a biſhop, and one mean church. The Greeks are moſtly employed in the manufacture of copper, brought from ſome mines three days journey from the city; this, and the manufacture of the ſkin of a ſpecies of martin, are the only articles of their commerce. Erzerum is the ſtaple of the merchandize of India, eſpecially when the Arabians infeſt the environs of Aleppo and Bagdad. This merchandize conſiſts of ſilk from Perſia, cotton, painted linens, ſpices, rhubarb from Bucharia, madder from Perſia, zedoary, &c. This town was one of the laſt which was taken from the Greek emperors by the Arabians; 250 miles N.N.E. of Aleppo, and 510 E. of Conſtantinople.

ERZGEBIRG. See Ertzgebirge.

ESAPHE, from εσαφαω, *I feel with the fingers*, a word uſed by Hippocrates, to expreſs the touching of the mouth of the uterus, in order to diſcover its ſtate of diſeaſe.

ESAU, in *Biography*, the ſon of Iſaac and Rebecca, and the twin-brother of Jacob, whom he ſucceeded at his birth, was born in the year 1836 B.C. At his birth he was covered with hair, indicating great bodily ſtrength, by which he was fitted for the kind of life to which he afterwards devoted himſelf. As he was fond of hunting, he ſupplied his father with a variety of delicious food, and became his favourite. Jacob, however, was the favourite of his mother, and by means of a circumſtance mentioned in his hiſtory, ſupplanted Eſau of his birth-right, which he conſented to barter for a meſs of red pottage, that had been prepared for their father, during his abſence. Hence he and his poſterity derived the appellation of Edom, ſignifying red. At the age of 40 years Eſau diſtreſſed his parents by marrying two wives out of idolatrous Canaanitiſh families, with which the poſterity of Abraham were prohibited from forming any connection. In proceſs of time, he regained his father's favour, and as death approached, Iſaac determined to confer his laſt prophetic benediction on Eſau, as his firſt-born ſon and heir. The artifice of his mother, however, counteracted his purpoſe; and ſhe contrived to impoſe upon Iſaac, and to obtain the father's parental bleſſing for her ſon Jacob. Eſau was indignant on account of the treatment of his brother; and determined to kill him as ſoon as their father ſhould die.

Rebecca again interpoſed, and ſent Jacob away to her brother Laban, with whom he might be ſecure from the threatened vengeance of his brother. During the period of ſeparation, which laſted ſeveral years, Eſau married a wife of the family of Iſhmael, and removing to mount Seir, acquired great power and wealth. When Jacob returned, after long abſence, to his father's country, with a numerous family, and large flocks and herds, he dreaded his brother's diſpleaſure; and though they had an amicable and affectionate interview, he entertained ſuſpicion of remaining reſentment, and inſtead of complying with the wiſhes of his brother, who was deſirous that he would ſettle in his neighbourhood, he dwelt in Shechem. After their father's death they lived in peace and amity; but as their poſſeſſions enlarged, and there was not ſufficient room for them in the land in which they were ſtrangers, Eſau returned to mount Seir, where his poſterity multiplied under the denomination of Edomites. (See Edom.) The time of his death is not mentioned, but biſhop Cumberland thinks it probable that he died about the ſame time with his brother Jacob, at the age of about 147 years. Geneſis, ch. xxv—xxxvi.

Esau, in *Geography*, a mountain of Arabia, in the country of Yemen, 4 miles N. of Udden.

ESAULOVO, a town of Ruſſian Siberia, in the government of Kolivan; 36 miles E.S.E. of Kraſanoiarſk.

ESBONITÆ, in *Ancient Geography*, a people of Arabia Petræa, who took their name from the capital, which was ſeated in the mountains over-againſt Jericho.

ESBUS. See Heshbon.

ESCACENA, in *Geography*, a town of Spain, in the country of Seville; 20 miles W. of Seville.

ESCAILLON, a river of France, which runs into the Scheldt, about two miles above Valenciennes.

ESCALA, La, a town of Spain, in the province of Catalonia, on the coaſt of the Mediterranean; 22 miles E. of Gerona.

ESCALADE, or Scalade, in the *Military Art*, a furious attack of a wall or a rampart; carried on with ladders, to paſs the ditch, or mount the rampart; without proceeding in form, breaking ground, or carrying on regular works to ſecure the men.

When the troops are prepared to paſs the ditch, either with the aſſiſtance of boards, hurdles, and faſcines, when it is muddy, or with ſmall boats of tin, or baſkets covered with ſkins, or oil-cloth when it is deep, and filled with water, a party muſt be placed on the counterſcarp, oppoſite to the landing-place, ready to fire at the garriſon if they are alarmed, and oppoſe the mounting on the rampart. If the ditch is dry, the ladders are fixed in ſome place fartheſt diſtant from the centry; and as ſoon as they get upon the rampart, they put themſelves in order to receive the enemy; if the centry ſhould be ſurpriſed, and ſilently overcome, the detachment haſtens to break open the gate, and to let in the reſt of the party. If the ditch is wet, the rampart high, and provided with a revetement, it will be difficult to ſurpriſe the town in this way; but if there is no revetement, the troops may hide themſelves along the outſide of the rampart till all are over. Since the invention and uſe of gun-powder, and the walls of cities have been flanked, they are ſeldom taken by eſcalade.

ESCALANA, in *Geography*, a town of Spain, in Old Caſtile; 14 miles N.N.E. of Segovia.

ESCALANTE, a town of Spain, in the province of Biſcay; 15 miles E. of Santander.

ESCALAON, a town of Portugal, in the province of Beira; 16 miles N. of Almeida.

ESCALLION, in *Botany*. See SCALLION.

ESCALLONIA, ſo called by the younger Linnæus, at the recommendation of Mutis, in honour of a learned Spaniard named Eſcallon, the pupil of Mutis in botany, mathematics and philoſophy, and his inſeparable companion during his abode in New Spain. This gentleman diſcovered the ſhrub in queſtion, as well as a vaſt number of new or rare plants beſides, in his various journeys through New Granada, moſt of which were, by Mutis or himſelf, communicated to Linnæus or his ſon. A very fine plant was originally choſen by Mutis for the above purpoſe, of which a ſpecimen and drawing were ſent to Linnæus; but it proved, on a careful examination, to be a *Loranthus*, and remains undeſcribed in the Linnæan herbarium. —Linn. Suppl. 21. Schreb. 152. Willd. Sp. Pl. v. 1. 1149. Mart. Mill. Dict. v. 2. Juſſ. 321. Claſs and order, *Pentandria Monogynia*. Nat. Ord. *Onagræ*, Juſſ.

Gen. Ch. *Cal.* Perianth of one leaf, inferior, hemiſpherical, with five large, ſpreading, ovate, acute, permanent teeth. *Cor.* Petals five, equal, inſerted into the calyx, tongue-ſhaped or obovate, obtuſe, a little diſtant from each other, longer than the calyx-teeth. *Stam.* Filaments five, equal, erect, awl-ſhaped, inſerted into the calyx between the petals, oppoſite to its teeth and about the ſame length; anthers incumbent. *Piſt.* Germen half inveſted with the calyx, globular; ſtyle cylindrical, ſtraight, the length of the ſtamens; ſtigma capitate, umbilicate. *Peric.* Berry roundiſh, of two cells, crowned with the calyx-teeth. *Seeds* very numerous, minute.

Eſſ. Ch. Berry of two cells, with many ſeeds. Calyx encompaſſing the fruit. Stigma capitate. Petals five, inſerted into the calyx.

1. E. *myrtilloides*. Linn. Suppl. 156. Sm. Pl. Ic. t. 30. —Leaves finely ſerrated, minutely pointed, veiny beneath. Flowers ſolitary.—Gathered in New Granada by Eſcallon. —*Stem* ſhrubby, branched, ſlightly angular, with a ſmooth deciduous bark. *Young branches* numerous, alternate, ſhort, ſimple, leafy, each terminated by a ſolitary, ſtalked, terminal *flower*. *Leaves* alternate, ſpreading, about three-quarters of an inch long, obovate, obtuſe with a minute point, minutely ſerrated, eſpecially towards the end, ſmooth, deciduous; with no perceptible veins on the upper ſide; paler and veiny beneath; the baſe tapering down into a ſhort, often fringed, *footſtalk*, each of whoſe edges unites at their baſe with a glandular toothed angle or rib in the branch. *Stipulas* none. *Flower-ſtalks* angular and glandular. *Petals* about thrice as long as the calyx-teeth, apparently white, erect, their extremities reflexed. *Berry* black? the ſize of a large pea, or bigger, crowned with the calyx and baſe of the ſtyle.

2. E. *ſerrata*. Sm. Pl. Ic. t. 31.—Leaves ſerrated, ſomewhat abrupt, ſmooth and without veins at the back. Flowers ſolitary.—Gathered about the ſtraits of Magellan, by Commerſon; in Staten land, (not Terra del Fuego,) by Mr. Archibald Menzies.—A humble branched ſmooth *ſhrub*, with ſomething of the aſpect of a *Vaccinium*. *Branches* alternate, ſomewhat zig-zag, angular, with a pale ſmooth bark; thoſe of the preſent ſeaſon green, leafy, ſtraighter, each bearing a ſolitary, terminal, ſtalked flower. *Leaves* deciduous, alternate, obovate, obtuſe, often abrupt or retuſe, with a minute central point or tooth, equally ſerrated or ſomewhat crenate, very ſmooth; ſlightly veiny above; pale and deſtitute of lateral veins beneath, though furniſhed like the former with a ſtrong central rib. *Footſtalks* ſmooth and entire, as are the angles of the branches. *Stipulas* none. *Flower-ſtalk* ſmooth. *Petals* white, ſpreading, not recurved. Top of the *germen* violet. All the parts of fructification, except the petals, are but one-third the ſize of the former. The little *berries*, crowned with the permanent ſtyle, appear to remain through the winter, and their upper part, above the calyx-teeth, eaſily ſeparates like a lid as they ripen, expoſing the pulp full of ſmall ſeeds, with its tranſverſe partition.

3. E. *glanduloſa*. Leaves double ſerrated, acute, glandular at the back like the branches. Flowers ſomewhat corymboſe.—Gathered in Chili by Mr. A. Menzies.—*Branches* wand-like, roundiſh, leafy, when young clothed with abundance of prominent glandular tubercles. *Leaves* alternate, when full grown near an inch and half long, obovate, pointed, ſtrongly and doubly ſerrated; ſmooth or ſlightly downy above; veiny, and rough with innumerable prominent reſinous glands, beneath; tapering at the baſe into a ſhortiſh glandular *footſtalk*. Each leaf is accompanied by an axillary tuft of ſmaller ones, the rudiments of future branches. *Stipulas* none. *Flower-ſtalks* ſeveral about the tops of the branches, axillary and terminal, ſimple or ſubdivided, each about an inch long, angular, glandular like the branches, as is alſo the baſe of the calyx. *Bracteas* few, at the baſe or ſubdiviſion of each ſtalk, linear, glandular. *Calyx* about the ſize of the laſt. *Petals* more like the former, and ſomewhat longer, with rounded, reflexed extremities. *Style* furrowed, ſurrounded at its baſe with an annular lobed gland or nectary, of which we can find no traces in the other ſpecies. *Germen* of two cells. The *fruit* we have not ſeen. S.

ESCALONA, in *Geography*, a ſmall, tolerably built, walled town of Spain, in the province of New Caſtile, with ſeveral ſuburbs, ſeated on an eminence defended by a caſtle, in a fruitful ſpot watered by the Alberche, 20 miles N.W. of Toledo, and 32 S.W. of Madrid. It has four churches, and two convents.

ESCALOP *Foſſil Shells*, in *Conchology*, are deſcribed by Da Coſta (Conchol. p. 247.) as found in the lime-ſtone quarries at Thame in Oxfordſhire; Mr. Walcot, in his "Petrifactions found near Bath," has alſo deſcribed a ſimilar kind of ſhell, as found in the clay on the ſide of the road between Claverton-Down and village, and in the free-ſtone at the quarries near King's Down; and another kind found in a ſlaty loam at the limeſtone quarry near the Creſcent in Bath.

ESCAMBIA, one of the moſt conſiderable rivers that fall into the bay of Penſacola, in Weſt Florida, diſcharges itſelf near the head of the north branch, about 12 or 15 miles from Penſacola, through ſeveral marſhes and channels which have a number of iſlands between them, that are overflowed when the water is high. The courſe of this river from an unknown ſource is very winding. The lands on each ſide are, in general, rich, low, or ſwampy, or well adapted for the culture of rice or corn. The numerous rivulets that fall into this river from the high country about it may be led over every part of the rice lands, at any ſeaſon of the year. The iſlands at the mouth of the river, of which ſome are conſiderable in extent, are not inferior for rice to any in America.

ESCAMBIO, from the Spaniſh *cambier*, to change, was anciently a licence granted any one for making a remittance, or giving a bill of exchange to another, beyond ſea.

For, by ſtat. 5 Rich. II. no perſon might exchange, or return money beyond ſea, without the king's licence

ESCAMUS, in *Ancient Geography*, a river of Mœſia, which has its ſource in mount Hæmus.

ESCAPE, FIRE. See FIRE-ESCAPE.

ESCAPE, in *Law*, an evaſion out of ſome lawful reſtraint, either by violence or ſtealth.

Eſcapes are either *voluntary*, or *negligent*.

Voluntary, are ſuch as are, by the expreſs conſent of the keeper to whoſe cuſtody, in civil actions, the debtor has been committed; after which, he can never retake his priſoner again, (3 Rep. 52. 1 Sid. 330.) though the plaintiff may retake him at any time, (ſtat. 8 or 9 W. III. c. 27.); but the ſheriff muſt anſwer for the debt.

Negligent eſcapes are where the priſoner eſcapes without his keeper's knowledge or conſent; and then upon freſh purſuit the defendant may be retaken, and the ſheriff ſhall be excuſed, if he has him again before any action brought againſt himſelf for the eſcape. (F. N. B. 130.) A reſcue of a priſoner in *execution*, (which ſee,) either going to gaol or in gaol, or a breach of priſon will not excuſe the ſheriff from being guilty of and anſwering for the eſcape; for he ought to have ſufficient force to keep him, ſince he may command the power of the county (Cro. Jac. 419.)

An eſcape of a perſon arreſted upon criminal proceſs, by eluding the vigilance of his keepers before he is put in hold, is an offence againſt public juſtice; and the party himſelf is puniſhable by fine or impriſonment. (2 Hawk. P. C. c. 122.) But the officer permitting ſuch eſcape, either by negligence or connivance, is much more culpable than the priſoner. Officers, therefore, who, after arreſt, *negligently* permit a felon to eſcape, are puniſhable by fine (1 Hal. P. C. 600.); but *voluntary* eſcapes, by conſent and connivance of the officer, are a much more ſerious offence; for it is generally agreed that ſuch eſcapes amount to the ſame kind of offence, and are puniſhable in the ſame degree, as the offence of which the priſoner is guilty, and for which he is in cuſtody, whether treaſon, felony, or treſpaſs; and this, whether he was actually committed to gaol, or only under a bare arreſt. (1 Hal. P. C. 590. 2 Hawk. P. C. 124.) But the officer cannot be thus puniſhed, till the original delinquent hath actually received judgment or been attainted, upon verdict, confeſſion, or outlawry, of the crime for which he was ſo committed or arreſted; otherwiſe it might happen, that the officer might be puniſhed for treaſon or felony, and the perſon arreſted, and eſcaping, might turn out to be an innocent man. But before the conviction of the principal party, the officer thus neglecting his duty may be fined and impriſoned for a miſdemeanor. (1 Hal. P. C. 588, 9. 2 Hawk. P. C. 134, 5.). See RESCUE.

ESCAPE *warrant*. If any perſon committed or charged in cuſtody in the king's bench, or Fleet priſon, in execution, or on meſne proceſs, &c. go at large; on oath thereof before a judge of the court where the action was brought, an eſcape warrant ſhall be granted, directed to all ſheriffs, &c. throughout England, to retake the priſoner, and commit him to gaol when taken, there to remain until the debt is ſatisfied; and a perſon may be taken on a Sunday upon an eſcape warrant. Stat. 1 Anne, cap. 6.

ESCAPEMENT, in *Horology*, is an ingenious mechanical contrivance for tranſmitting, in a modified way, and at equidiſtant intervals of time, the maintaining power of a clock or watch to the regulator, whether balance or pendulum, in order to reſtore that loſs of motion in every vibration or oſcillation, which neceſſarily ariſes from the friction of the acting parts, and the reſiſtance of the air in every machine. It has been ſaid, under the article CLOCK, that the maintaining power, whether conſiſting of a weight or ſpring, when ſuffered to expend itſelf unreſtrained, would make the wheel-work run on with an increaſing velocity, until the obſtacles to motion, ſuch as the friction in the teeth and at the pivots, the reſiſtance of the air, &c. fixed the maximum of velocity with which it could expend itſelf; at which period the friction and reſiſtance would jointly operate as a regulator, whilſt they and the maintaining power remained unaltered, and the machine ſo circumſtanced would greatly reſemble a common kitchen-jack; and if an index were inſerted on the arbor of the firſt or ſlowly moving wheel, it would indicate ſuch portions of time as the ratio between the maintaining power and the regulating friction and reſiſtance of the air taken together would produce; but it is obvious, that every alteration produced in the friction by wear, foulneſs, &c. or in the denſity of the air by the ſtate of the atmoſphere, would affect the indication ſo much, as to render it extremely irregular; hence the balance and the pendulum were ſucceſſively invented and applied to regulate the indication of time by their iſochronous vibrations; but then as both theſe regulators have alternate motions backwards and forwards, they could neither of them be applied *immediately* to check a wheel that moves continually in one direction, without the intervention of ſome contrivance, connected both with the wheel and regulator, which ſhould convert a direct circular motion into a motion changing its direction by perpetual alternations. To deviſe and execute a piece of mechaniſm that ſhould perform ſuch an office ſteadily and accurately, required much ſcience as well as mechanical ſkill, and the invention once executed was denominated an *eſcapement*, or by contraction among the workmen *'ſcapement*, becauſe it ſuffers a tooth of the wheel, with which it acts, to *eſcape*, or paſs on, at ſuch intervals of time as are meaſured by the regulator, which wheel is therefore alſo called the *eſcapement wheel*.

From this ſhort account of the origin and office of an eſcapement, the reader will perceive, that the accuracy of its conſtruction conſtitutes one of the moſt eſſential conſiderations in an horometrical machine, it being an indiſpenſable condition, that the ſucceſſive impulſes taken from the maintaining power through the medium of the wheel-work, and given to the regulator, ſhould be ſo modified, as to diſturb as little as poſſible the natural iſochroniſm of the regulator, or, if it do diſturb it, that it ſhould ſomehow compenſate that diſturbance. Hence it becomes neceſſary, that the workman, or mechanician, ſhould be fully acquainted with the theory of the natural iſochroniſm of his propoſed regulator, when he undertakes to deſign and execute his eſcapement; he muſt not only know how much of the maintaining power will be ſufficient to balance the loſs ſuſtained in the natural length of a vibration, by reaſon of friction and the reſiſtance of a ſtandard medium, but he muſt conſider and indeed aſcertain, by theory or experiment, or both, at what part of the arc of vibration the power muſt be applied; likewiſe how long the impulſion ſhall continue to act, and whether that action ought to be uniform, increaſing, or decreaſing in its intenſity. Theſe and ſimilar conſiderations have produced, as might be expected, a great variety of conſtructions of an eſcapement, both with regard to their external ſhape and *modus operandi.* As a good eſcapement is of the utmoſt importance in the uſeful art of clock-making, and as we have no author in the Engliſh language who has given us the different conſtructions in hiſtorical order, together with ſuch remarks as may enable the reader to judge of their reſpective excellence, we will devote ſome time to the detail of both the theory and practical conſtruction of ſuch different eſcapements as ſeem to merit a general notice.

But before we enter upon our deſcription and examination of different eſcapements of clocks and watches, as the reader has not yet had an opportunity of peruſing the article Pendulum, and as all eſcapements derive their ſhape and manner of action from the relation they bear either to the laws of its motion, or to thoſe of a moving balance, it will contribute greatly to his better underſtanding the ſubject, if we premiſe firſt ſome of the chief circumſtances which relate to the theory of a free pendulum, and to the influence that any external impulſe will have on it when applied to become the regulator of a clock; and ſecondly, if we explain the theory of a balance's motion, which we have purpoſely reſerved for this place by reaſon of its intimate connection with the eſcapement.

1. In *fig.* 1. of *Plate* XXXI. of *Horology*, let C D repreſent a *free pendulum*, or pendulum that has no weight but what is collected at the centre of oſcillation or point D, and let the arc D B repreſent a ſemi-vibration round the point C, taken as the centre of motion or point of ſuſpenſion, at which we will ſuppoſe there is no friction, then if the reſiſtance of the air and rigidity of the ſtring or rod were not to interfere, when the pendulum was once removed from its natural or perpendicular ſituation C D to B, and ſuffered to deſcend again by the ſole force of gravity, it would acquire ſuch a velocity at its loweſt point D, by means of the accelerating force of gravity, as would, under theſe circumſtances, carry it up an equal ſemi-vibration or arc D G, the increments of accelerated motion being equal in the arc B D to the decrements of retarded motion in the equal arc D G, the ſame reaſoning would apply in the returning vibration from G to B; the velocity acquired at D by the deſcent from G to D would carry the pendulum again up to B, and the conſequence would be, under ſuch *unnatural* circumſtances, if they could be effected, that there would be a perpetual alternation of vibrations of the ſame length, which would conſequently be iſochronal with reſpect to each other, ſo long as the pendulum remained of the ſame length; and ſuch a pendulum would of itſelf be a perfect time-meaſurer, and would only want a regiſter to indicate the number of its vibrations, to make it a complete regulator or chronometer: but the fact is, the friction and rigidity at the point of ſuſpenſion cannot by human art be entirely annihilated, though ingenuity can greatly diminiſh it; nor can the obſtacle to free motion ariſing from the reſiſtance of the air be removed, or even rendered uniform; hence it is found that when a pendulum is drawn aſide from its point of reſt, every ſucceeding vibration, after motion has commenced, is ſomewhat ſhorter than the preceding one, until after ſome hours have been ſpent in alternate vibrations continually ſhortening, the pendulum finds its original point of reſt; the time expended in doing this is longer in proportion to the diminution of friction, the air and other circumſtances remaining unchanged. Ferdinand Berthoud, the famous French clock-maker, made ſome experiments to aſcertain this fact, and conſtructed the knife-edge ſuſpenſion of a ſecond's pendulum, with a heavy lenticular ball, ſo free from friction, that an arc of vibration of 10° was not reduced to 15′ till $29^{h}\,46^{m}$ had elapſed; but notwithſtanding every attempt to reduce the friction, the pendulum came to reſt at laſt. From this ſhort view of the tendency of a pendulum to come to reſt after it has had a motion communicated to it, we clearly perceive the neceſſity of making ſome auxiliary additions to the natural force of gravity, in order that the pendulum may keep up the length of its original vibration in every ſucceeding one, notwithſtanding the obſtructions which continually oppoſe the operation of gravity; theſe auxiliary additions to the motion, produced by gravity only, conſtitute the operation of the maintaining power, modified by the wheel-work and eſcapement, in every pendulum clock; and hence ariſes a *diſturbance* in the *theory* of the free pendulum, which makes ſuch a theory no farther of uſe in clock-work, than as it affords certain laws and a ſcale of forces, ſuch as the mechanician may labour to imitate, by modifying the joint agency of his *auxiliary additions* and of the operation of gravity, ſo that they ſhall act in concert; which imitation is to be effected principally, as to its *mode*, by the eſcapement, the maintaining power being concerned only as to the *quantity* of any additional power to be applied in aid of gravity.—Now, if we ſuppoſe the pendulum at the ſituation B, or extremity of its arc, and draw A B perpendicular to the vertical line C D, and B E = C B perpendicular to the line A B, or, which is the ſame thing, parallel to the line C D; alſo, if we draw B F a tangent to the arc at the point B, and from the point E demit the line E F upon it, to form a right angle at F, in which caſe the line F E will be parallel to the line C B, B E will repreſent the force of gravity, which, by the reſolution of forces, is equivalent to B F and F E; but F E is perpendicular to the tangent, or is in the direction C B of the radius, and therefore can neither accelerate nor retard the motion, whilſt B F, being in the direction of the tangent, or perpendicular to the radius, is wholly employed in accelerating or retarding the pendulum's motion: hence, the line B E : B F : : the force of gravity : the accelerating force; but from the ſimilar triangles B E F, C B A, B E is = C B, and B F = B A, therefore, by ſubſtitution, C B : B A : : force of gravity : accelerating force, and conſequently the accelerating force $= \frac{\text{gravity} \times BA,}{CB}$ in which expreſſion gravity and the radius C B are invariable, therefore the accelerating force varies as the ſine B A of the arc of vibration. From this law of variation of the accelerating force of a body moving in a circular arc, it follows, that the longer arcs require longer times than the ſhorter arcs in the proportion of 34 : 29, as Huygens has demonſtrated; for the ſine does not increaſe ſo faſt as the arc, which it ought to do, to make the vibrations of the ſame pendulum in different arcs iſochronal: if, however, the body could be made to move along the chord or ſtraight line B D, inſtead of the arc B D, then the vibrations of different lengths would be iſochronal, becauſe two ſimilar bodies will run down each a ſeparate chord of different lengths to the loweſt point of the ſame circle in the ſame time, namely, in the time that each would take in falling

through the whole diameter of the circle, and the acquired velocity of each, at the loweſt point, would be in proportion to the length of its chord. But the mechanician has not attempted to make his pendulum vibrate in chord lines, which probably is impracticable, but has invented another curve, called the cycloid, generated by a point in a circle revolving on a ſtraight line, which curve poſſeſſes this peculiar property, that the accelerating forces, which a body acquires by moving along it, are exactly proportionable to the *arcs*, (ſee Cycloid,) ſo that a pendulum vibrating in this kind of curve, will perform its long and ſhort vibrations in the ſame time. This property of the cycloid was firſt diſcovered by the celebrated Huygens, who owed much of his celebrity to it, and adopted a contrivance for making a pendulum move in ſuch a curve, which will be deſcribed under our article Pendulum, and alſo the reaſons will be given why it was laid aſide in the practice of clock-making. It may be proper, however, to remark here, that with a pendulum vibrating in the arc of a cycloid, with all its weight collected in the ball, and its length rendered invariable, if ſuch a pendulum could be made, it would, notwithſtanding, be of conſequence what the nature of the eſcapement were, becauſe though the variations in the *arcs*, ariſing from varied gravity alone, would not affect the *times* of the ſucceſſive vibrations, yet, when *additional force* is applied in aid of gravity, by means of the maintaining power and eſcapement, the uniform law of acceleration juſt deſcribed would be partially diſturbed by ſuch addition, though the diſturbance would be leſs perceptible than in circular arcs of conſiderable extent.

When, however, a pendulum vibrates in a ſmall arc, it is demonſtrable that ſuch an arc differs very little from a cycloidal arc near its loweſt point, nay almoſt coincides with it; it is alſo found from experience, that a heavy ball is leſs diſturbed by the requiſite additional force, communicated by the maintaining power, than a light one, as might be inferred from theory; on which two accounts the prevailing practice among clock-makers is, to make ſuch eſcapements for a pendulum as require but ſhort vibrations, and, in order to gain momentum, to append a heavy ball; and it has been diſcovered, and is now indeed an acknowledged fact, that a regulator with an exact compenſation for the effects of variable temperature in its pendulum, and that vibrates by means of a good eſcapement in ſmall arcs, with a heavy lenticular ball, goes with a degree of accuracy beyond what Huygens durſt even hope for from his cycloidal contrivance; in effecting which, theory and practice were found to be greatly at variance.

But the cycloidal theory, which, conſidered as a theory, is not only ingenious, but illuſtrative of the principal circumſtances which relate to the motion of a pendulum, will furniſh us with a conciſe and clear notion how the natural arc and time of a vibration will be altered by an acceſſion of external force to the force of gravity, without ſome knowledge of which alteration no mechanician can proceed on ſcientific principles in the conſtruction of an eſcapement.

Suppoſing now the pendulum in *fig.* 2, ſimilar to that in the preceding figure, and the arc to be ſo ſmall as nearly to coincide with the cycloidal curve, let the arc G B be unbent into the ſtraight line *h* H, and with the ſemi-arc D H, as a radius, deſcribe the ſemi-circle H L *h*; ſet the line A B from H to M, and from *h* to *m* perpendicular to the line *h* H, and join *m* M, which line will paſs through the centre D; from any other points I and K in the ſemi-arc or radius, draw the lines I N and K O parallel to H M, and alſo the correſponding ones *i n* and *k o* parallel to *h m*, and we ſhall obtain the following relations of the properties of the pendulum's motion, *viz.*

1ſt. The forces of gravity urging the pendulum towards D from B, at the points I and K of the ſemi-vibration, will be repreſented by, and proportional to, the ordinates I N and K O of the ſtraight line M D *m*; and the correſponding ordinates *i n* and *k o* will repreſent, and be proportional to, the retarding forces of the ſame gravity, at the points *i* and *k* of the other ſemi-vibration, and *vice verſâ* in each half of the returning vibration.

2dly. The velocities acquired by the uniform action of gravity at the points I K and *i k*, will be reſpectively proportional to the ordinates I P, K Q, and *i p*, *k q*, of the ſemicircle H L *h*; hence the velocity of the pendulum at the loweſt point D, is to its velocity at any other point of the arc I, as D L (= D H, or whole ſemi-arc) is to I P.

3dly. The times of the pendulums vibrating through the portions H I, I K, K D, &c. of its arc, will be repreſented by, and proportional to their correſponding arcs H P, P Q, Q L, &c. reſpectively in the ſemi-circle H L *h*; which proportions will be equally applicable in the aſcending portions of the arc D *k*, *k i*, and *i h*, which will alſo be moved through in times proportional to the arcs L *q*, *q p*, and *p h*, reſpectively; if the pendulum is projected from the loweſt point D with the initial velocity D L, this velocity will be reduced at the point *k* to *k q*, at *i* to *i p*, and at *h* to nothing, whence the pendulum will return, and the operation of gravity will begin to be reverſed.

4thly. If one pendulum deſcribe the arc repreſented by H D *h*, and another deſcribe the arc K D *k*, (ſtill ſuppoſing them to be cycloidal or very nearly ſo,) they will deſcribe them in equal times, but their velocities at D, or greateſt velocities, will be reſpectively proportional to H D and K D, or length of their ſemi-arcs; that is, while a pendulum, projected with the initial velocity D L, from the loweſt point, aſcends to the point *h*, or extremity of its ſemi-vibration, another ſimilar pendulum, projected with the initial velocity R D, will aſcend to the point *k*, or extremity of its arc, D R being = D *k*, and the ſame will be true in the deſcent, where the increments of motion exactly balance the aſcending decrements.

5thly. The areas M H I N, M H K O, &c. are proportional to the ſquares of the velocities acquired in moving down the arcs H I, H K, &c. or to the diminution of the ſquares of the velocities effected by the retardation of gravity in the returning or aſcending ſemi-vibration.

From a due examination of the relations exhibited in the preceding illuſtration of the principles of a pendulum's motion, the reader will readily perceive that there is a certain length of the arc of every vibration, whether performed in a circle or cycloidal curve, which correſponds to its maximum of velocity, or velocity at the loweſt point; which length, in large circular arcs, is determined by the greateſt chord line, but in cycloidal curves, or *ſmall* circular arcs, is the whole arc itſelf: he will alſo underſtand how, when the weight of a pendulum is given, its accelerating action in any given point of the arc may be appreciated; from which and ſimilar conſiderations he will be able to form ſomething like an eſtimate of the effect that will be produced in the above natural relations by the application of an external force of an aſcertained quantity, acting in a given manner: for inſtance, let us ſuppoſe that a maintaining power is applied to keep up the vibrations of a pendulum, as in our laſt figure; that the quantum of power to be added to gravity be to its accelerating force at H or *h*, as *h m* is to *m r*, which we will ſuppoſe to be a number of grains to ſome number of ounces; and that this additional power is applied through the agency of an eſcapement, which ſo modifies it, that its action is exerted but a ſhort time, and at the extremity of the arc: the rough conjecture which the reader would be apt to form would be, that as the two forces began to act in concert, a pendulum actuated by them would obey a compound ſcale of forces, differing in quantity but not in quality from the ſimple ſcale of gravity, and that therefore little or no alteration would take place in the time of its vibration; let us ſee what would be the reſult according to our theory; from the point *m* of the line *h m*, of the greateſt acceleration or retardation, as the caſe may be, ſet off *m r* equal to its repreſentative, for ſo many grains of augmenting or retarding force, and then *h r* will be the whole force urging the pendulum towards D: do the ſame for every point of *h* D, and we get a new ſcale of forces repreſented by the dotted line *r s t* D, and the ſpace *m* D *r*, contained between the two ſcales D *m* and D *r*, will repreſent the addition made to the ſquare of the velocity in moving over *h* D by the joint action of gravity and of the maintaining power. Then if we make the area D *u v* equal to the area D *h m*, by leaving out as much ſpace parallel to the perpendicular *h m*, as we take in beyond the hypothenuſe *m* D, the point *u* will limit the excurſion or extent of the returning, as well as of every ſucceeding vibration, becauſe the area of the triangle D *u v* is proportional to the ſquare of the velocity, and *u* is therefore the point where the initial velocity D L will be extinguiſhed. Laſtly, if the arc *h w* of the ſemi-circle be biſected, its half will very nearly repreſent the contraction effected in the time of the outward ſemi-vibration, agreeably both to theory and practice; and in a ſimilar manner might be eſtimated the effect to be produced on a natural vibration, or vibration from ſimple gravity, by any acceſſion of external force differently applied: in the inſtance we have given, a temporary impulſion would evidently make a greater derangement when given at the extremity of the arc, than if it had been given at I, and greater at I than at K, and conſequently the leaſt derangement would have ariſen if the impulſion had been given at the loweſt point D, which is worthy of recollection; though the fact is, that moſt of the eſcapements, that are not of the detached kind, continue to act for a ſenſible time, and, after all, the thing principally aimed at in modern practice is, to conſtruct all the parts of an horological machine ſo, that the arc of vibration may vary as little as poſſible under the different influences that affect the pendulum's motion; for then, whatever the length of the arc be, whilſt there is no variation in it, the vibrations will be iſochronal, whatever be the nature of the curve; but completely to effect ſo deſirable a purpoſe can hardly be expected under all the combinations of variable reſiſtances ariſing from friction, oil, air, &c., however detached the eſcapements may be, *i.e.* however ſmall the continuance of each of their impulſions. Hence, certain ingenious artiſts have attempted ſuch a compound ſcale of forces, conſiſting of gravity and maintaining power conjointly, as ſhall render even circular vibrations of different lengths iſochronal among themſelves, when they ſhall happen to vary in length, which plan would certainly make the beſt compenſation for the effects of variable reſiſtances, if ſuch plan could be completely executed at pleaſure; and the compound ſcale of forces to do this, muſt be to the ſcale of gravity alone, as the *arc* of ſemi-vibration is to the *ſine* of the ſame in every point of the excurſions. For in *fig.* 1, if B F be ſuppoſed equal to the ſemi-arc B D, then B E, the whole compound force at the point B, will be greater than C B or force of gravity alone, and will be to it, by ſimilar triangles, as B F (= B D) is to the ſine A B, as has been demonſtrated; therefore the whole compound force at any point B of either ſemi-vibration ſhould be to the force of gravity alone in that point, as the arc D B is to the ſine A B, which compound ſcale conſequently will demand a certain limited variation, or ſcale, in the auxiliary force derived from the maintaining power through the modifying medium of the eſcapement.

2. When a balance was firſt applied as a regulating power, it poſſeſſed no natural property, like the pendulum, of perpetuating its own oſcillations, but had its motion produced by an artificial force acting alternately on its oppoſite pallets, and derived entirely from the maintaining power at certain intervals; ſo that to perform all the oſcillations in equal times, the action of the force applied was required to be the ſame in mode, quantity, and duration, in each oſcillation, which conditions could not be fulfilled by reaſon of the conſtant changes that took place in the friction of the works, and in the denſity and conſequent reſiſtance of the air; a ſimple balance therefore was no otherwiſe better than a continued fly, except that its alternate oſcillations prevented the acceleration of motion that would enſue, if there were no ſuch frequent checks as the balance experiences at each alternate impulſe of the pallets. Dr. Hooke's invention of a regulating ſpring, to be to the natural balance what gravity is to a pendulum, was an important one, to which all the excellence of an ordinary watch may have its origin imputed, and without which the compenſations for different temperatures in the beſt chronometers would not be of any utility. The diſcovery of a *ſpring's force* being *as its tenſion*, or diſtance moved from the point of reſt, *(ut tenſio ſic vis,)* was the firſt ſtep towards a theory of motion by which the balance and its regulating ſpring, taken conjointly, may have their effect eſtimated, and by which ſuch a balance with the beſt compenſation and eſcapement now vies in accuracy even with the pendulum itſelf.—George Atwood, eſq. of Cambridge, has publiſhed an excellent memoir in the Philoſophical Tranſactions of London, vol. 84, part i. 1794, intitled "Inveſtigations founded on the Theory of motion, for determining the times of Vibration of Watch Balances," from which we beg leave to extract ſo much as falls within our purpoſe in this place.

"Let P M N S, *fig.* 3. of our laſt plate, repreſent the circumference of a watch balance, which vibrates by the action of a ſpiral (or helical) ſpring, on an axis paſſing through the centre C. Let O D B E be the circumference of a concentric circle, conſidered as fixed, to which the motion of the balance may be referred. In the circumference of this circle let any point O be aſſumed, and when the balance is in its quieſcent poſition, ſuppoſe a line to be drawn through C and O, interſecting the circumference of the balance in the point A; the radius C A will be an index, by which the poſition of the balance, and its motion through any different arcs of vibration, will be truly defined. In the ſequel, the motion of the balance, and the motion of the index C A, will be uſed indifferently, as terms conveying the ſame meaning. Since the balance is in its quieſcent poſition when the index C A is directed to the fixed point O, on this account O is called the point of quieſcence of the balance, or balance ſpring, indicating the poſition when the balance is not impelled by the ſpring's elaſtic force either in one direction or the other. If the balance ſhould be turned through any angle O C B, the ſpiral ſpring being wound through the ſame angle, endeavours by its elaſtic force to reſtore itſelf, and when at liberty, impels the balance through the arc B O with an accelerated velocity, till it arrives at the poſition O, where the force of acceleration ceaſes; with the velocity,

city acquired at O, the balance proceeds in its vibration, deſcribing the arc O E with a retarded motion. The elaſtic forces of the ſpring at equal diſtances, on the oppoſite ſides of the point O, are aſſumed to be equal; it is alſo aſſumed that the effects of friction, and other irregular reſiſtances, which retard the motion of the balance, are compenſated by the maintaining power, ſo that the time of deſcribing the firſt arc of vibration B O, by an accelerated motion, ſhall be equal to the time of deſcribing the latter arc O E, by a retarded motion, and that the entire arc of vibration B O E is biſected by the point O.

To render the conſtruction of *fig.* 3. more diſtinct, the fixed circle O D B E is repreſented to be at a ſmall diſtance from the circumference of the balance, but is to be conſidered as coincident with it, ſo that the arc B O, ſubtending the angle B C O, may be of the ſame length with an arc of the circumference of the balance, which ſubtends the ſame angle B C O: on this principle C O or C A may be taken indifferently as the radius of the balance.

The determination of the time in which the balance vibrates, from the theory of motion, requires the following particulars to be known, *viz.*

Firſt. The ſpring's elaſtic force, which impels the circumference of the balance, when it is at a given angular diſtance O D, (*fig.* 3.) from the quieſcent point O:

Secondly. The law or ratio obſerved in the variation of the ſpring's force, while the balance is impelled from the extremity of the ſemi-arc B, to the point of quieſcence O, where all acceleration ceaſes.

Thirdly. The weight of the balance, including the parts which vibrate with it.

Fourthly. The radius of the balance C O, and the diſtance of the centre of gyration from the axis of motion C G.

Fifthly. The length of the ſemi-arc B O.

Suppoſe the plane of the balance to be placed vertically, and let a weight P, (*fig.* 4.) be applied by means of a line ſuſpended freely from the circumference at T, to counterpoiſe the elaſtic force of the ſpring when the balance is wound through an angle from quieſcence O C D. This weight P (the weight of the line being allowed for,) will be the force of the ſpiral (or other) ſpring, which impels the circumference of the balance, either at reſt or in motion, when at the angular diſtance O D from the quieſcent poſition. It appears from many experiments (of Berthoud) that the weights neceſſary to counterpoiſe a ſmall ſpring's elaſtic force, when the balance is wound to the ſeveral diſtances from the quieſcent point, repreſented by the arcs O G, O H, O I, &c. *fig.* 4, are nearly in the ratio of thoſe ſeveral arcs. It alſo appears, that the ſhape, the length, and number of turns of the ſpiral, may be ſo adjuſted to each other, that the forces of elaſticity ſhall be counterpoiſed by weights, which are in the preciſe ratio of the angular diſtances from the quieſcent poſition, or, as it is ſometimes expreſſed, in the ratio of the ſpring's tenſions; at leaſt as nearly as can be aſcertained by experiment: this law of elaſtic force is aſſumed in the ſubſequent inveſtigation.

The poſition of the centre of gyration may be always determined when the figure of the vibrating body is regular, by calculating the ſum of the products, which ariſe from multiplying each particle into the ſquare of its diſtance from the axis of motion, and dividing the ſum by the weight of the vibrating body; the ſquare root of the reſult will be the diſtance of the centre of gyration from the axis of motion. When the figure of a vibrating body is irregular, recourſe muſt be had to experimental methods, in order to determine the poſition of the centre of gyration. See Atwood's treatiſe "On the Rectilinear Motion and Rotation of Bodies."

Let the radius of the balance C A or C O = r, *fig.* 3, the ſemi-arc B O = b; let the ſpring's elaſtic force, acting on the circumference of the balance, when wound to any given angle O C D, from the quieſcent poſition, be P, and let the arc O D = a; the weight of the balance and the parts which vibrate with it = W; the diſtance of the centre of gyration from the axis of motion C G = g. Theſe notations being premiſed, the reſiſtance of inertia, by which the maſs contained in the balance oppoſes the communication of motion to the circumference, is $\frac{Wg^2}{r^2}$, and conſequently the force which accelerates the circumference at the angular diſtance O C D from the quieſcent poſition is $\frac{Pr^2}{Wg^2}$. This quantity remaining invariably the ſame, while the balance deſcribes the arc of vibration B O E, may be denoted by the letter F, ſo that $F = \frac{Pr^2}{Wg^2}$; ſuppoſe the radius C A commencing a vibration from the point B to have deſcribed the arc B H, and let O H = x, ſince the force which accelerates the circumference at the angular diſtance from quieſcence O D = F, and the forces of acceleration are ſuppoſed to vary in the proportion of the angular diſtances from the quieſcent point O, the force which accelerates the circumference of the balance at the point H will be = $\frac{Fx}{a}$; let u be the ſpace through which a body falls freely from reſt by the acceleration of gravity, to acquire the velocity of the circumference at the point H; the principles of acceleration give this equation $\dot{u} = \frac{-Fx\dot{x}}{a}$; (Newtonii Princip. vol. i. prop. xxxix.) and taking the fluents while x decreaſes from b to x, $u = \frac{F \times \overline{b^2 - x^2}}{2a}$: if therefore l is made = 193 inches, being the ſpace which bodies falling freely from reſt by the force of gravity near the earth's ſurface deſcribe in one ſecond of time, the velocity of the circumference, when the extremity A of the index C A has arrived at the point H, will be = $\sqrt{\frac{2lF}{a}} \times \sqrt{b^2 - x^2}$. Let t repreſent the time in which the circumference deſcribes the arc B H; then will $\dot{t} = \sqrt{\frac{a}{2lF}} \times \frac{-\dot{x}}{\sqrt{b^2 - x^2}}$; and $t = \sqrt{\frac{a}{2lF}} \times$ a circular arc, of which the coſine $= \frac{x}{b}$ to radius = 1, which is the time of deſcribing the arc B H expreſſed in parts of a ſecond; when $x = o$, that is, when the circumference has deſcribed the entire ſemi-arc B O, the circular arc of which the coſine $= \frac{x}{b}$ is a quadrant of a circle to radius = 1. Let $p = 3.14159$, &c. the time t of deſcribing the ſemi-arc $BO = \sqrt{\frac{a}{2lF}} \times \frac{p}{2} = \sqrt{\frac{p^2 a}{8lF}}$.

In this expreſſion for the time of a ſemi-vibration, the letter a denotes the length of the arc O D (*fig.* 3.); if this arc ſhould be expreſſed by a number of degrees $c°$, a will then $= \frac{prc°}{180°}$; and this quantity being ſubſtituted for *a*, the time of a ſemi-vibration will be $t = \sqrt{\frac{p^2 r c^\circ}{8 l F \times 180^\circ}}$; if inſtead of F, its value $\frac{P r^2}{W g^2}$ is ſubſtituted in the equation $t = \sqrt{\frac{p^2 r c}{8 l F \times 180^\circ}}$, the time of a ſemi-vibration will be $t = \sqrt{\frac{W p^2 g^2 c}{8 P r l \times 180^\circ}}$.

Let the given arc c° be $= 90$; in this caſe $t = \sqrt{\frac{W p^2 g^2}{16 P r l}}$. Theſe are expreſſions for the time of a ſemi-vibration, whatever may be the figure of the balance, the other conditions remaining the ſame as they have been above ſtated. If the balance ſhould be a cylindrical plate, it is known that the diſtance of the centre of gyration from the axis is to the radius as 1 to $\sqrt{2}$; wherefore in this caſe $g^2 = \frac{r^2}{2}$; and the time of a ſemi-vibration, or $t = \sqrt{\frac{W p^2 r}{32 P l}}$."

Agreeably to this expreſſion, Mr. Atwood wiſhed to try the practical reſults of a chronometer made by Kendal, to prove how far his theory agrees with practice, and aſſuming the centre of gyration to be the ſame as if the balance were a cylindrical plate, he obtained from Mr. Earnſhaw the following data, *viz.*

W, the weight of the balance and vibrating parts = 42 grains.

P, the force at the circumference of the balance, which counterpoiſes the force of the ſpring when wound to the diſtance of 90° = 24 grains.

r, the radius of the balance = 1.125 inches.

l, the ſpace deſcribed in one ſecond of time by bodies which deſcend freely from reſt by the acceleration of gravity = 193 inches.

p, the circumference of a circle to radius 1 = 3.14159, &c.

The balance, when adjuſted to mean time, made juſt five vibrations in a ſecond; the actual time of a ſemi-vibration is therefore 0.1000.

Then *t*, the time of a ſemi-vibration by the theory, will be $= \sqrt{\frac{42 \times 3.14159^2 \times 1.125}{32 \times 24 \times 193}} = 0.0994$ parts of a ſecond; hence $0.1000 - 0.0994 = 0.0006$ is the difference between the actual time and the time by calculation from the theory; and the near coincidence of the two reſults proves that the ſuppoſition of the centre of gyration being nearly as in a cylindrical plate, is near the truth.

"It is obſervable," ſays our author, "that the ſemi-arc of vibration B O = *b*, does not enter into theſe expreſſions for the time of a ſemi-vibration; if, therefore, inſtead of the ſemi-arc B O, an arc of any other length L O, terminating in the point of quieſcence, (*fig.* 3.) ſhould be ſubſtituted in the preceding inveſtigation, the time of deſcribing L O would be ſtill $= \sqrt{\frac{a p^2}{8 l F}}$, or, $\sqrt{\frac{p^2 r c^\circ}{8 l F \times 180^\circ}}$, equal to the time of deſcribing the other ſemi-arc B O; conſequently, whether the balance vibrates in the largeſt or ſmalleſt arcs, the times of vibration will be the ſame. From the preceding inveſtigations it appears, continues our author, that when the force by which the circumference of the balance is accelerated at the given angular diſtance c° from the quieſcent poſition is = F, the time of a ſemi-vibration $t = \sqrt{\frac{p^2 r c^\circ}{8 l F \times 180^\circ}}$; and converſely, when the time of a ſemi-vibration is = *t*, the force which accelerates the circumference at the given angular diſtance c° from the quieſcent poſition, that is, $F = \sqrt{\frac{p^2 r c^\circ}{8 l t^2 \times 180^\circ}}$.

"Since time-keepers are uſually adjuſted to mean time when the balance makes five vibrations in a ſecond, the time of a ſemi-vibration will, in this caſe, be $= \frac{1}{10}$th part of a ſecond; the ſubſtitution of $\frac{1}{10}$th for *t* being made in the preceding equation, the force which accelerates the circumference of the balance, when at any given angular diſtance c° from the quieſcent poſition, will be determined for all time-keepers adjuſted to mean time, in which the balances make five vibrations in a ſecond. Suppoſe the given angle $c^\circ = 90^\circ$, then making $c^\circ = 90^\circ$, $p = 3.14159$, &c. $l = 193$, $t = \frac{1}{10}$, the accelerative force at the angular diſtance from quieſcence 90° or $F = \frac{p^2 r \, 90^\circ}{8 l t^2 \times 180^\circ} = r \times 1.00408926$. We have therefore arrived at the following concluſion; if the radius of the balance is equal to one inch, and the time-keeper is adjuſted to mean time when the balance makes juſt five vibrations in a ſecond, the force which accelerates the circumference of the balance at the diſtance of 90° from the quieſcent poſition is = 1.00408926, the accelerative force of gravity being = 1. And if the radius of the balance is greater or leſs than one inch, the force by which the circumference is accelerated at the diſtance of 90° from quieſcence will be greater or leſs than 1.00408926 in proportion to the radii.

"According to the principles aſſumed in the preceding ſolution, the ſpring's elaſtic force is ſuppoſed to vary in the proportion of the angular diſtances from the quieſcent poſition, and on this condition the vibrations are ſhewn to be iſochronous, whether they are performed in longer or ſhorter arcs; but if the ſpring's elaſtic force at different diſtances from quieſcence ſhould not be preciſely in the ratio here aſſumed, the longer and ſhorter arcs may be deſcribed in times differing in any proportions of inequality. If, for inſtance, the ſpring's force, inſtead of varying in the ratio of the aforeſaid diſtances, ſhould vary in the $\frac{999}{1000}$dth power or $\frac{1001}{1000}$dth power of the diſtances, it does not appear from the preceding ſolution what alteration in the daily rate would be cauſed by this change in the law of the force's variation, when the ſemi-arc of vibration is increaſed or diminiſhed by a given arc. To aſcertain this point fully, other reſearches will be neceſſary, by which it may be known, what alteration of the daily rate of a time-keeper is occaſioned by a given increaſe or diminution of the arc of vibration, when the ſpring's elaſtic force varies in a ratio of the diſtances from the quieſcent poſition, the general index or exponent of which is any number or fraction *n*.

"The force which accelerates the balance being aſſumed in that power of the diſtances, the exponent of which is *n*, let B O = *b*, (*fig.* 5.) be the ſemi-arc of vibration when the time-keeper is adjuſted to mean time; let D O = *a*; the accelerating force on the circumference at the diſtance from quieſcence O D = F; ſuppoſe the circumference to have deſcribed the arc B H from the extremity of the arc B; and let H O = *x*: then the force by which the circumference is accelerated when at the angular diſtance from the quieſcent poſition O H $= \frac{F x^n}{a^n}$; let *u* be the ſpace through which a body falls freely from reſt by the acceleration of gravity, to acquire the velocity of the circumference when it has deſcribed the arc B H: the principles of acceleration gave this equation $u = \frac{-F x^n \dot{x}}{a^n}$: taking the fluents while x decreaſes from b to x, $u = \frac{Fl^{n+1} - Fx^{n+1}}{\overline{n+1} \times a^n}$, and l being 193 inches, the velocity acquired by the circumference, after deſcribing B H, will be $= \sqrt{\frac{4lF}{\overline{n+1} \times a^n}} \times \sqrt{b^{n+1} - x^{n+1}}$; let T be the time of deſcribing the arc B H; wherefore $\dot{T} = \sqrt{\frac{\overline{n+1} \times a^n}{4lF}} \times \frac{-\dot{x}}{\sqrt{b^{n+1} - x^{n+1}}}$. The time of deſcribing the arc B H will be the fluent of this fluxion, while x decreaſes from b to x, and the time of deſcribing the ſemi-arc B O will be the entire fluent of $\sqrt{\frac{\overline{n+1} \times a^n}{4lF}} \times \frac{-\dot{x}}{\sqrt{b^{n+1} - x^{n+1}}}$, while x decreaſes from b to o. Now let the balance commence its vibration from any other point I, (*fig.* 5.) and let I O $= c$; ſuppoſe the circumference to have deſcribed the arc I K, and make O K $= y$; let t be the time of deſcribing the arc I K; then by proceeding in the ſame manner as in the former caſe, it is found that $\dot{t} = \sqrt{\frac{\overline{n+1} \times a^n}{4lF}} \times \frac{-\dot{y}}{\sqrt{c^{n+1} - y^{n+1}}}$; and the time of deſcribing the ſemi arc I O will be the entire fluent of this fluxion, while y decreaſes from c to o. Although the fluents of the fluxions $\frac{-\dot{x}}{\sqrt{b^{n+1} - x^{n+1}}}$, and $\frac{-\dot{y}}{\sqrt{c^{n+1} - y^{n+1}}}$, cannot be expreſſed in general terms, yet the exact proportion of the ſaid fluents may be aſſigned, which will be the proportion of the times in which the balance vibrates in the two ſemi-arcs B O, I O; the multiplying quantity $\frac{\sqrt{\overline{n+1} \times a^n}}{4lF}$ being common to both fluxions; and ſince the entire fluent of $\frac{-\dot{x}}{\sqrt{b^{n+1} - x^{n+1}}}$ is to the entire fluent of $\frac{-\dot{y}}{\sqrt{c^{n+1} - y^{n+1}}}$ as $b^{\frac{1-n}{2}}$ is to $c^{\frac{1-n}{2}}$, it follows that the time of a ſemi-vibration in the arc B O is to the time of a ſemi-vibration in the arc I O as $b^{\frac{1-n}{2}}$ to $c^{\frac{1-n}{2}}$, or as 1 to $\left.\frac{IO}{BO}\right|^{\frac{1-n}{2}}$.

Suppoſe a watch to be adjuſted to mean time when the ſemi-arc of the balance's vibration is $=$ B O, (*fig.* 5.) and let this ſemi-arc be afterwards diminiſhed to I O; the time ſhewn by the watch in any given portion of mean time t, when the ſemi-arc of vibration is I O, will be $= t \times \left.\frac{BO}{IO}\right|^{\frac{1-n}{2}}$; and if t is put $= 24^h$, the alteration of the daily rate, in conſequence of the diminution of the ſemi-arc of vibration from B O to I O, will be $24^h \times \left.\frac{BO}{IO}\right|^{\frac{1-n}{2}} - 1$. To apply this propoſition, let a caſe be aſſumed; ſuppoſe a watch to be regulated to mean time, when the ſemi-arc of vibration is 135°, and let this ſemi-arc be diminiſhed 8°, ſo as to become 127°; let the ratio of the ſpring's elaſtic force deviate from that of the diſtances from the quieſcent poſition by a ſmall difference of $\frac{1}{1000}$dth power of the diſtances, inſtead of in the entire ratio of the ſaid diſtances from the quieſcent poſition. The alteration in the daily rate of the watch will be obtained from the preceding theorem, by making the following ſubſtitutions; B O $= 135°$, I O $= 127°$, $n = \frac{999}{1000}$, the alteration of the daily rate $= 24^h \times \left.\frac{135}{127}\right|^{\frac{1}{2000}} - 1 = +\, 2''.62$."

From this theory of the balance and balance ſpring it is evident, that when there is a very minute alteration in the law of the force's variation, amounting to no more than $\frac{1}{1000}$dth part of the entire ratio of the diſtances, an acceleration is cauſed in the daily rate of more than 2½″, when the diminution of the ſemi-arc is only 8°, and as this alteration in the force is leſs, probably, than can be detected by actual meaſurement of the force by mechanical means, it is very probable that a much greater acceleration or retardation of the rate, than in the example before us, may occur from the ſame cauſe, which can only be corrected by a correſponding alteration either in the length or ſtrength of the balance ſpring, or both, as the caſe may require, and the beſt way of detecting the law of force by which the ſpring acts at different diſtances from the quieſcent poſition, is by increaſing or diminiſhing the maintaining power, ſo as to render the arc of vibration unequal in ſucceſſive trials for a limited time. The neceſſary concluſion, from ſuch trials with different maintaining powers, will be, that when an acceleration of the daily rate accompanies a diminution of the arc of vibration, the elaſtic force of the ſpring uſed varies in a leſs ratio than that of the diſtances from the quieſcent poſition; but on the contrary, when a retardation takes place under the ſame circumſtances, the ſaid elaſtic force varies in a higher ratio than that of the diſtances from the point of quieſcence. We here ſuppoſe the ſame eſcapement to be uſed in all the trials, and that the impulſe given to the balance is no more than ſufficient to overcome the inertia of the balance and the reſiſtance it meets with from friction and the denſity of the air; but as there is generally an overplus of power communicated to the balance to guard againſt ſtopping by the acceſſion of dirt or thickening of the oil, this ſuperfluous power has ſuch an influence on the balance and its ſpring when in motion, as to produce a compound law of varying forces, ſomewhat different from the ſimple law derived ſolely from the elaſticity of the ſpring, and the more this compound law varies from the ſimple law derived from the ſpring's elaſticity, the greater will be the diſcrepancy between the theory and performance of a watch balance. The buſineſs of a good eſcapement of a watch or balance clock is to keep the balance in continual motion with as little interference as poſſible with the ſimple law of its natural varying forces, which it has been ſhewn are in proportion to the diſtances from the point of quieſcence.

After theſe remarks on the laws by which a pendulum and a balance together with its ſpring become the regulators of an horological machine, the reader will be able to form an opinion, founded on ſcientific principles, on the merits or demerits of the different eſcapements that are ſucceſſively deſcribed, not only in this article, but in the articles CHRONOMETER and CLOCK, which have been already publiſhed.

Henry Sully, who was an ingenious clock and watch maker about the beginning of the 18th century, wrote a hiſtory of the eſcapements of his time down to the year 1727, which Julien le Roy added to Sully's "Regle Artificielle du Temps," in the ſecond edition, publiſhed at Paris, 1737, from which Berthoud has extracted his account of ſeveral eſcapements in his "Hiſtoire de la Meſure du Temps," and which we mean to avail ourſelves of in a certain degree in our ſubjoined deſcriptions.

The different eſcapements of clocks and watches may be divided into four claſſes; *viz;*

1. Thoſe with a *recoil*, or which produce a backward motion of the eſcapement wheel and ſecond's hand in ſome parts of the vibration; (echappement a recul.)

2dly. Thoſe that have the *dead-beat*, or that allow the eſcapement wheel and hand to reſt while the whole vibration is made; (echappement a repos.)

3dly. *Detached*, or *free* eſcapements, which act on the balance or pendulum an almoſt inſenſible time, and ſuffer the vibration to be performed almoſt without connection with the pallets; (echappement a vibrations libres.)

4thly. *Detached*, or *free* eſcapements with a *remontoir*, or auxiliary ſpring frequently wound up by the maintaining power, to equaliſe the arcs of vibration; (echappement a vibrations libres et a remontoir d'égalité d'arcs.)

The moſt ancient eſcapement in uſe at this time, and probably the firſt that was ever contrived, is the *crown-wheel eſcapement* at preſent employed in our table-clocks and common watches; we know not who was the original inventor, but find mention made of it by Leonard de Vinci, who died in the year 1513; and Venturi thinks that the horological machines of Wallingford and Dondi, early in the fourteenth century, had the ſame, as we have ſeen, under our article Clock, that Henry de Wyck's clock had in the year 1364. The idea of converting a rotatory into a vibratory motion, and the means adapted to effect this purpoſe mechanically are equally ingenious; as an effort of genius this thought is much to be admired. We have already given a general deſcription of the connection that the eſcapement-wheel has with a train of wheel-work on one ſide of it, and with the balance on the other, under our article juſt referred to, but as the balance had no rim, and was without the *regulating*, or, as it is ſometimes called, the *pendulum ſpring*, we think it right to give a ſeparate drawing and deſcription of this eſcapement, as made at preſent, together with ſome remarks on its properties.

1. *Crown-wheel eſcapement.*—In *Plate* XXXI. of *Horology*, *fig.* 6. repreſents the crown-wheel and balance in connection, which may be in either a horizontal or vertical poſition, and is in fact ſometimes in one poſition and ſometimes in the other in a common watch agreeably to the different poſitions of the body of the wearer; and it is eaſy to conceive that a ſhort pendulum might be ſubſtituted for the balance when the crown-wheel moves horizontally in a fixed poſition, and the axis of the balance is placed horizontally, which is the caſe in moſt of the portable clocks. The name of crown-wheel is taken, no doubt, from the reſemblance it has to an old faſhioned *royal diadem*; but when applied to a watch it is frequently called ſimply the *balance-wheel*, from its connection with the *balance*: this wheel and the balance, including the pallets and regulating ſpring, may be conſidered as conſtituting the *eſcapement*, the action of all which may be underſtood from the following ſhort account.

Suppoſe the pinion *a*, on the arbor *a b* of the balance-wheel or crown wheel *c d*, to be actuated by the main-ſpring, or weight which forms the maintaining power, by means of the rain, in the direction *c f d e*, while the pallets *e* and *f*, attached to the axis of the balance *g h*, and ſtanding at right ngles to each other, or very nearly ſo, are long enough to all in the way of the ends of the ſloped teeth of the wheel, hen turned round an angle of 45°, ſo as to point in oppo-ite directions, as in the figure; then a tooth of the wheel elow, for inſtance, meets with the pallet *f*, ſuppoſed to e at reſt, and drives it before it a certain ſpace, till the end of the tooth *eſcapes*; in the mean time the balance attached to the axis of the pallets moves in the direction *h k g*, and winds up the ſmall ſpiral ſpring *i*, one end of which is faſt to the axis and the other to a ſtud on the plate of the frame, in this operation the ſpring oppoſes the momentum given to the balance by this puſh of the pallet *f*, and prevents the balance from going quite round before the pallet *e* meets with another tooth at the oppoſite end of the wheel's diameter; here this pallet receives a puſh which carries the balance back again, having as yet but ſmall momentum, in the direction *h l g*, and aids the ſpring, which now unbends itſelf till it comes to its quieſcent poſition, but beyond that point is unwound, partly by the puſh from the maintaining power on the pallet *e*, and partly by the acquired momentum of the moving balance, particularly when this pallet has eſcaped; at length pallet *f* again meets with the ſucceeding tooth, and is carried *backward* by it, in the direction the balance is now moving in, till the maintaining power and force of the unwound ſpring together overcome the momentum of the balance; during which time the *recoil* of the ſecond's hand is apparent, when put on the pivot of the arbor *a b*; at length the wheel brings the pallet *f* back again till it eſcapes, and the ſame proceſs takes place with pallet *e* that has been deſcribed with reſpect to pallet *f*, and thus two contrary excurſions, or oſcillations of the balance, take place before one tooth has completely eſcaped, which is the reaſon why there muſt be always an odd number of teeth in this wheel, that a ſpace at one ſide of the wheel may always be oppoſite to a tooth at the other, in order that one pallet may be out of action while the other is in action. The ſame account will apply to the vibrations of a ſhort pendulum ſubſtituted for the balance, when this eſcapement is uſed. This eſcapement, which is of the firſt claſs, is evidently calculated to derange the natural law of the ſpring's varying force, which, we have ſeen, is in theory in proportion to the diſtances from the quieſcent poſition; for as the action of the maintaining power continues to preſs on the pallets, either with or againſt the balance's motion, during a large portion of each vibration, this extraneous force acting along with the elaſtic force of the ſpring makes a new law compounded of the two forces, which may or may not be a regular law, as modified by circumſtances, that are to be taken into conſideration; for inſtance, the relative forces of the maintaining power and of the regulating ſpring, the uniformity of each force ſeparately conſidered, the ratio between the radius of the pallet-wheel and length of the pallets, the weight and diameter of the balance, the angle of action in the eſcapement relatively to the whole arc of vibration, the adjuſtment of the length and ſtrength of the ſpring for iſochroniſm, and of its quieſcent place to the poſition of the pallets, together with the friction and inertia of the acting parts, as well as reſiſtance of the air to the moving balance muſt all enter into the account, which complex data render all calculations founded in theory very inadequate to their purpoſe of determining the practical reſults independently of experimental trials, which are neceſſarily adopted by the workmen in finiſhing the adjuſtments. The bad effect of an almoſt conſtant force on the balance, as derived from the maintaining power, is evident by the application of the key to the fuſee-arbor of a watch, and by urging it in a direction contrary to that of winding up, for the additional force thus given to the maintaining power, will very ſenſibly accelerate the beats of the watch, and leſſen the arc of vibration; hence any inequality occaſioned in the maintaining power, by the acceſſion of dirt, or by want of perfect compenſation in the fuſee of the varying force of the main-ſpring, &c. will alter the daily rate very materially, though the mechanical adjuſtments at the balance may, in the firſt inſtance, have produced jointly a law of varying forces in the regulating mechaniſm that ſhall approximate near enough to the iſochronous law of the balance ſpring, while the arcs of vibration remain unaltered. It is of the utmoſt importance, therefore, when a crown-wheel eſcapement is uſed in any watch, that, whenever a new main-ſpring is put in, the fuſee ſhould alſo be altered, ſo as to become as perfect a compenſator as poſſible for that *identical ſpring*, which, we believe, is ſeldom, if ever, attended to in practice. This eſcapement uſually has a pin in the rim of the balance that may catch a notch on each ſide of the cock beyond the extremities of the longeſt vibrations, called the *banking*, to prevent the derangement of the balance and of its regulating ſpring by any ſhake or accident.

2. *Eſcapement a pirouette by Huygens.*—About the year 1675, when Huygens was contriving the beſt conſtruction he could deviſe of a marine time-piece, he naturally dwelt upon the portability of the balance, as affording the likelieſt plan of accompliſhing his purpoſe, but he was aware that the balance vibrating in ſhort arcs was not comparable in point of ſteadineſs to a pendulum, as a regulating principle, ſeeing it is too much under the controul of the maintaining power, when uſed with the crown-wheel eſcapement, the only one at that time known. The balance under ſuch ſtrong influence, and that a variable influence, had the property of putting itſelf into motion when in a ſtate of reſt: Huygens, therefore, made ſuch additions to the balance and eſcapement then in uſe, as produced much longer vibrations than had been before witneſſed, and introduced an additional wheel and pinion between the pallet-wheel and the balance to effect this object; thus, in *fig.* 7. of our laſt plate, is a ſide view of a ſmall frame containing the mechaniſm of Huygens' eſcapement, conſiſting of two wheels, one pinion, a pair of pallets, and a balance with the ſpiral ſpring, together with the requiſite cocks to bear the pivots of the arbors; *a b* is the crown-wheel or pallet-wheel of the uſual ſhape and number of teeth, placed in a vertical poſition, like the contrate wheel of a common watch or table clock; *c d* is a contrate wheel placed horizontally, like the pallet-wheel of a common watch, having two pallets *e*, *f*, as uſual on its arbor, at right angles to each other, and acting exactly as we have explained above; the contrate wheel *c d* drives a pinion *g* on the axis of the balance *h*, under which, as uſual, is the ſpiral ſpring *i*; the action of this eſcapement differs from that of its predeceſſor only, inaſmuch as the contrate wheel impels the pinion ſeveral times round at each impulſe of one of the pallets, thereby occaſioning ſeveral revolutions of the balance itſelf at each oſcillation; and Sully ſays, that when the ſpring is not uſed he has ſeen the oſcillations performed in the ſpace of two ſeconds, and with a ſpring in one, in imitation of a ſeconds' pendulum clock, to which this eſcapement is not applicable. The influence, however, of the maintaining power muſt have been exerted on the balance in this conſtruction alſo, during at leaſt one of its revolutions, and the extraneous force interfering with the law of the ſpring's varying forces would produce a compound ſcale of forces, in which, as in the former inſtance, one would be nearly conſtant while it acted, and the other varying; beſides, the friction in the teeth of the wheel and pinion, however well executed of the reſpective ſizes and ſhapes, would produce checks that would be unfavourable to the ſteady oſcillations of the balance, we therefore are not ſurpriſed to find that this eſcapement, which was of the firſt claſs, was ſoon diſcontinued.

3. *Eſcapement with two balances by Dr. Hooke, and by Du Tertre.*—Dr. Hooke, ſays Sully, produced a balance in the year 1675, which he had invented in 1658, with two balances engaging each other by means of teeth cut in their edges, and one of them having a ſpiral ſpring on its verge or axis; but Berthoud attributes the invention of this eſcapement with two balances, without the ſpring, to a German artiſt on the authority of Thiout (Traité d'Horlogerie de Thiout) where there is a drawing of the eſcapement in queſtion; J. B. Du Tertre afterwards made ſome additions, which we have given in *fig.* 8. of *Plate* XXXI., and of which the following is a deſcription, *viz.*; A and B are two balances acting together, like wheels with equal numbers of teeth, and having on one of the croſſes of each a pallet, at *a* and *b* reſpectively; at equal diſtances from the axes of theſe balances is the arbor of the laſt wheel of the train, bearing two ſtars with each five radii, one numbered 1, 2, 3, &c. which is ſmaller than the other, lying the lower in poſition, and the other marked *d e f*, &c. with radii long enough to reach almoſt to the centres of motion of the balances, which they can paſs only when the ſemi-circular parts that are cut away are preſented to them; but at other times they reſt againſt the central ſemi-circular pieces that remain uncut: the radii of the ſmall ſtar reach far enough to fall on the pallets *a* and *b* ſucceſſively, which they impel alternately, and give motion to both balances at the ſame time; but the eſcape takes place by means of the radii of the large ſtar, that reſt ſucceſſively againſt the ſemi-circular portions of metal not cut away, above the centres of the balances reſpectively. The three axes ſtand in the angles of an iſoſceles triangle, and have their upper pivots ſupported by three ſeparate cocks, placed over the upper plate of the frame, the lower pivots of the balances reſting on the upper plate, but the arbor of the two ſtars paſſing acroſs the frame to take the laſt wheel. The action is thus; radius 1 of the ſmall ſtar has parted with the pallet *a* of balance B, and the long radius *d* is eſcaping; preſently radius 4 will fall on the pallet *b* of balance A, and impel it in a direction from 4 to 5, the balance B at the ſame time moving in a contrary direction; this impulſe will continue till the radius 4 falls from the pallet, ſoon after which the long radius *g* will fall on the ſemicircular central piece of balance A, and ſtop the further motion of the two ſtars, which move together on the ſame arbor, and the balances will go on in their vibrations till the ſpring under balance B brings them back again, ſo as to preſent the cut half of the central piece of balance A to the point *g* of the long radius, which, being impelled by the train, now eſcapes; the ſtars go on till radius 4 of the ſmal ſtar meets with the pallet *a* of balance B, the motion o which it now oppoſes, and is itſelf brought back, ſo as to make a recoil of the hands till it has ſtopped the motion o the balances, which now begin each another oſcillation: thi radius 4 eſcapes the pallet *a*, and the long radius *g* falls on th ſemi-circular piece, at the centre of balance B, as it did before on that of balance A; the oſcillation continues forwar again till the ſpring brings it back, when another followin radius of the ſmall ſtar falls again on the pallet *b* of balanc A, as before, and drives it; ſoon after which a ſucceeding lon radius falls on its ſemi-circular central piece, and reſts till a the return of the oſcillation it can eſcape; thus an alternatio of oſcillations is produced by the ſhort radii acting alternat ly on the two balances, while the long radii ſuſpend the in pulſes by reſting on the ſemi-circular parts of the centres the balances, during the latter portion of each excurſio This eſcapement was evidently of the firſt claſs, like its pr deceſſors, and though it avoided the jerk uſually given one balance by the ſtroke of the pallet, yet was ſubject to th friction ariſing from the action of the teeth, like the prece

ing one; it had, however, a capability of making the angle of action and angle of the balance's motion before the eſcape in any ratio to each other, by altering the lengths or number of the radii reſpectively, as well as the diſtance of the pallets from the centres of motion; it had alſo the good property of preventing an increaſe in the maintaining power from affecting the balances in the ſame proportion, by the long lever preſſing againſt the ſemi-circular central part of the balances alternately, during the latter part of the excurſion of the balances, ſo as to check any acceſſion of momentum occaſioned by an acceſſion of maintaining power: the law of this preſſure, however, might be modified by changing the figure of the ſemi-circular piece into a ſpiral ſhape, ſo that the preſſure might bear a proportion to the angular diſtances of the balances from the ſpring's quieſcent poſition. The friction in both caſes, it muſt be admitted, would be detrimental to the performance. The banking, we preſume, in this eſcapement, was the ſame as in an ordinary watch, as no remark is made thereon. The invention, it appears, muſt be attributed to three ſucceſſive artiſts; firſt the German, whoever he was, invented the eſcapement without the balance ſpring, and with the ſmall ſtar only, in which ſtate it would act under the controul of the main-ſpring, without the regulating ſpring: ſecondly, the regulating ſpring was added by Dr. Hooke, and, thirdly, the large ſtar was introduced by Jean Baptiſte Du Tertre, about the year 1724, which addition completed the eſcapement as given in our drawing, which in its preſent ſtate will not act without a regulating ſpring. Of courſe this laſt addition followed Tompion's and De Baufre's eſcapements hereafter deſcribed, from which probably the idea of the large ſtar preſſing on the circular part of the axis of motion was derived. Each addition was evidently an improvement on the original German eſcapement as deſcribed by Thiout; but the number of pivots in motion, and the increaſed friction occaſioned by the preſſure of the ſemi-cylindrical pieces at the centres of the balances, were obſtacles too powerful to be overcome in this conſtruction.

4. *Firſt dead beat eſcapement by Tompion.*—The ingenious Tompion of London was probably the firſt watch-maker who contrived an eſcapement without recoil, or eſcapement of the ſecond claſs, called a *dead-beat* eſcapement from the circumſtance of the ſecond's hand remaining motionleſs, or, as it were, dead, during the motion of the balance after the eſcape. Sully ſays that he ſucceeded in effecting this about the year 1695. In this eſcapement, of which *fig.* 7. of *Plate* XXXV. is a plan, the balance verge carried a cylindrical piece of metal *a b c*, terminating with a pallet *c*, with a notch cut between *a* and *c* to allow the eſcape of each ſucceſſive tooth of the balance wheel. This wheel had its plane parallel to the planes of the plates of the frame, and its teeth bent at the end, and ſo diſtant, that the cylindrical piece and pallet could revolve between any two of them. When the cylindrical part of the pallet preſented its notch to a contiguous tooth of the eſcapement wheel, it received a puſh therefrom, which put the balance in motion, and the next ſucceeding tooth falling on the circular or cylindrical portion of the pallet, now in motion in the direction *c b a*, reſted againſt it without recoil till the balance ſpring had brought the notch back again, when it eſcaped in its turn by giving its puſh, and a third tooth fell on the cylindrical part of the pallet, and in like manner remained motionleſs till the notch came back again and allowed the eſcape: thus one eſcape took place at every alternate vibration, and the contrivance was admirably calculated to prevent the bad effect on the balance of any change in the impulſes derived from the main-ſpring; but the friction on the back of the pallets when large, and at the balance pivots occaſioned by the preſſure of the reſting teeth, conſtituted the ſame objection in practice as applied to Du Tertre's modification of the eſcapement with two balances. This eſcapement, however, was the archetype of all the ſucceeding dead-beat eſcapements, and therefore is deſerving of the notice we have given it.

5. *Cylinder eſcapement in diamond by De Baufre.*—A native of Geneva of the name of Facio had applied rubies to the pivot holes of a watch about the year 1700, and went into partnerſhip with De Baufre, a French watch-maker, eſtabliſhed in London; the latter artiſt finding the advantage of applying the poliſhed ſurfaces of the precious ſtones for diminiſhing friction at the parts of action, contrived a new eſcapement about 1704, of which the pallets were of diamond. Sully ſays that a watch of De Baufre, with the diamond pallets, was put into his hands by ſir Iſaac Newton, who had found its accuracy of performance admirable. The following account will be intelligible, we preſume, to any artiſt who underſtands the mechaniſm of a watch. The balance had two pallets on its verge conſiſting of a ſemi-cylindrical diamond, and the eſcapement wheels, of which there were two, were vertical, with their common arbor at right angles to the verge of the balance; *i. e.* with their planes parallel to the verge: theſe wheels, which were ſimilar, were placed one oppoſite the other on contrary ſides of the verge in ſuch way, that a tooth of one fell in the middle of the ſpace of the other, and *vice verſâ*; the pallets were $\frac{1}{24}$th of an inch thick, and two and a half twelfths in diameter, and the diſtance between the ends of the teeth of the double eſcapement wheel about $\frac{1}{12}$th of an inch, or twice as much as the thickneſs of the pallets; the pallets had their planes parallel to the plane of the balance, and had their ſemi-circle ſloped in an angle of about 45° at the ends for the pallets to ſlide over, after preſſing on their planes alternately during the reſpective oſcillations. We will endeavour to explain the action, as we comprehend it to have been by a verbal deſcription. Let the leading pallet be called *a*, and the following pallet *b*; and let the balance be ſuppoſed in motion with a tooth of the eſcapement wheel reſting on the plane of the diamond; when the ſloped end of pallet *a* arrives at the ſaid tooth, the tooth falls off, accelerating the balance by its ſliding motion, and goes on till an oppoſite tooth of the other wheel falls on the plane of the diamond in motion; this tooth reſts without recoil, as did the former one, till the ſloped end of the pallet *b* comes to it, when it falls off in its turn, and gives motion to the balance, which has thus its ſpring wound up by the momentum of the balance ſufficiently far to bring the balance back again after every impulſe; and thus an alternation of vibrations is continually maintained while the force of the mainſpring laſts. This eſcapement is alſo of the ſecond claſs, or of the dead-beat kind, but is ſubject to the conſtant friction of its immediate predeceſſors, though this friction is greatly diminiſhed by the ſubſtitution of the diamond for metallic pallets, and by the buſhing of the pivot holes with rubies; it poſſeſſed all the good properties of Tompion's eſcapement juſt deſcribed. (See Machines and Inventions approuveés, &c. vol. vii. p. 137.) Larcum Kendal uſed two crown wheels in a ſimilar manner, which W. Howell improved by adding a forked detent to make the eſcapement detached, which was rewarded by the Adelphi Society, in 1792. See their Tranſactions, vol. x. p. 216.

6. *Sully's modification of De Baufre's eſcapement.*—The praiſe which ſir Iſaac Newton beſtowed on De Baufre's new watch induced H. Sully to beſtow much attention on it, and in the year 1721 he adopted an alteration in it, which made only one wheel neceſſary for the eſcape at both oſcillations;

lations; but Berthoud has expreſſed an opinion that his alteration conſtituted no real improvement, but made the adjuſtment of the pallets more difficult. Sully having applied his modification of the eſcapement in queſtion both to a pendulum clock and a marine time-piece, preſented two memoirs on its conſtruction to the Royal Academy of Sciences in the years 1723 and 1724; which are alſo printed in his deſcription of marine time-pieces, publiſhed in 1726. *Fig.* 1. of *Plate* XXXII. of *Horology*, repreſents a ſide view of this eſcapement, where A is the eſcapement wheel, B the contrate wheel between it and the balance C, which has a pinion only on its verge, that is actuated by the contrate wheel; the pallets 1, 2, are two circular pieces of agate, placed at the diſtance from one another of one ſpace of the eſcapement wheel nearly; theſe pallets have each an inclined or ſloped end, like De Baufre's, the ſlopes alſo being at the contrary ends of each; the intention of this modification is not only to make one wheel A perform the whole buſineſs of the eſcapes, but to produce long vibrations of the balance, even beyond a complete circle. The action was thus; on giving motion to the balance C, ſuppoſe the tooth *b* to reſt on the plane of the pallet or agate 1, it ſoon meets with the end ſlope, and falls off till it meets with the pallet 2 below, on which it reſts, after having given a puſh to the pallet during the act of ſliding off; the balance goes on, till the ſpring, now wound up, brings it back, there being in the mean time no recoil, by reaſon of the arbor of the contrate wheel being alſo the axis of the pallets, and at right angles thereto; the tooth *b* now finds, after the return of the balance, the ſloped end of pallet 2, and eſcapes entirely; but at the ſame inſtant tooth *c*, which follows, falls on the plane of pallet 1, and is then in the ſame ſituation we at firſt found *b* in, therefore the ſame action is repeated with this, and every ſucceeding tooth, till the power of the main-ſpring is exhauſted. This modification of De Baufre's eſcapement is conſequently of the ſecond claſs alſo, and enables us to comprehend more clearly the action of the original one, which had its double eſcapement-wheel placed with reſpect to the balance verge, as the preſent one has its ſingle one, with reſpect to the arbor of the contrate wheel. The effect produced muſt have been nearly the ſame on the pallets, though the vibrations of the original balance muſt neceſſarily have been ſhorter than of the latter, but then it had not the friction in the wheel-work between the pallets and balances.

7. *Eſcapement with two cylindrical pallets.*—In the year 1727 Julien le Roy ſhewed Sully ſome watches juſt brought from England into France, which had each two cylindrical pallets with notches cut in them like Tompion's ſingle pallet, which kind of eſcapement ſeems to have differed from his, only in having an eſcape at every vibration, and in having the old crown-wheel as an eſcapement wheel; but as we have not been able to trace the inventor of this eſcapement, we muſt conſider it as a lineal deſcendant from Tompion's, and therefore as a variety of Engliſh extraction. Its utility has been, however, evinced by the circumſtance of Julien le Roy's having adopted it as a favourite, and uſed it in ſome of his productions: it had the property of converting the recoil of the crown-wheel into a dead-beat.

8. *Cylinder or horizontal eſcapement of Graham.*—We are not informed in what particular year Mr. Geo. Graham, the celebrated watch and clock-maker, invented the eſcapement with a cylinder, called alſo the horizontal eſcapement, from its wheel being in an horizontal poſition, but it appears that Julien le Roy introduced this conſtruction into France in the year 1728, when wonderful properties were attributed to it, but particularly the property of compenſating all the inequalities of the maintaining power, which at that time was the great deſideratum among watch-makers. The contrivance bears a great analogy to Tompion's eſcapement, and was probably originally derived from his, which, however, does not leſſen the merit of the contrivance, as it requires as much ingenuity to improve an exiſting inſtrument, frequently, as to invent a new one. *Fig.* 2. of *Plate* XXXII. is a perſpective view of Graham's horizontal eſcapement, in which A is the eſcapement-wheel, B the balance, and C the hollow cylinder fixed on the verge of the balance; each tooth of the wheel, which may have any convenient number of teeth, is formed of a triangular inclined plane or wedge, ſupported by a ſtem projecting perpendicularly from the plane of the wheel at its circumference; the length of the wedge of each tooth is juſt a diameter of the internal part of the cylinder, ſo that the cylinder may revolve round the wedge when the balance is in motion; in this ſituation the anterior point of the wedge juſt touches the cylinder's interior ſurface, but the poſterior point of the ſame is free, ſo as not to touch and ſtick faſt in the cylinder, but to give it a puſh on the edge when the contact ceaſes; the diſtance between the teeth is alſo great enough to allow the exterior portion of the cylinder to come between them, when the eſcape has taken place, and while the balance continues its oſcillation. The action is performed in the following manner; ſuppoſe the wedge to be juſt eſcaping from the hollow part of the cylinder, and to be giving its impulſe to the edge of the cylinder which it quits, the balance goes on and winds up the ſpring, as uſual, at the ſame time preſents its exterior face, or convex ſurface to the point of the ſucceeding tooth or wedge; this point falls on the ſaid convex ſurface and reſts there, without recoil, till the oſcillation is finiſhed, at the return of the balance, by means of the ſpring now wound up, the hollow or concave part of the cylinder comes to the point of this following wedge, and being rounded at this end, admits it eaſily into its concavity, at which inſtant the other edge of the cylinder receives a ſecond impulſe in a contrary direction; the balance now makes another oſcillation, and the point of the wedge reſts againſt the interior face of the cylinder, as it did before on the exterior, without recoil, and in both ſituations of reſt the wedge has no other effect on the balance than that of retarding it by its preſſure againſt the circular ſurface; the ſecond tooth is now in the ſame ſituation as we found the firſt, and preſently in its turn gives another puſh at leaving the cylinder altogether, and leaves the third wedge to perform the ſame office by firſt reſting on the back of the cylinder, then entering it, and laſtly giving its parting impulſe to the ſecond edge of the ſaid cylinder, as the two wedges that preceded had ſucceſſively done before. At one period this eſcapement was in high eſtimation in England, as well as on the continent, and even now the common watches that are conſtructed with this eſcapement will fetch greater prices than thoſe with the ordinary crown-wheel eſcapement, but the detached eſcapements of the beſt chronometers are now held in much higher eſtimation than either. We have ſeen that the hollow cylinder, though conſtituting but one pallet, in effect performs the office of two pallets, and permits but one tooth or wedge to eſcape entirely at two oſcillations, during one of which the point reſts at the outſide, and during the other at the inſide of the cylinder, while the two edges of the cylinder perform the part of ſeparate pallets on receiving ſeparate impulſes in contrary directions, it is, therefore, of importance in this, as indeed in all eſcapements with a regulating ſpring, that the quieſcent poſition be duly adjuſted to render both oſcillations preciſely ſimilar in extent and duration at each ſide, otherwiſe the performance will be a ſpecies of hobbling, and the compound law of motion,

derived from the ſpring's action and impulſes on the pallets conjointly, will be far from regular; conſequently not likely to be an iſochronal law. Berthoud has deſcribed a cylinder eſcapement with two balances connected by two pinions, but it did not prove ſucceſsful.

9. *French eſcapement a Virgule.*— The French eſcapement known by the appellation of *a virgule*, from the pallet's reſemblance of a *comma*, is repreſented by *fig.* 6 of *Plate* XXXV. A, B, C, are three teeth of the balance wheel, placed very obliquely compared to a true radial line, and carry each a pin at their extreme ends, ſtanding vertically like the ſupports of Graham's wedges for his cylindrical eſcapement; the pallet B A has its centre of motion at *c*, the centre of both the concave and convex portion, exactly over the verge of the balance; this centre is in the circumference of the circle that paſſes through the points or pins of the teeth; the pallet, which is of hardened and poliſhed ſteel, has its plane parallel to that of the wheel, and is ſupported between *f* and *e* by a crank piece put over the verge, which cannot be admitted as high as the pallet; this end *a o*, which connects the convex and concave portions, is a portion of an equi-angular ſpiral, and the part *b d* of the pallet is called the *horn*, probably from its reſemblance of the beak of a bird; the inferior face *b* A may be ſtraight like the dotted line, or curved, at the option of the maker, and the ſuperior part *f* A may be of any ſhape: the convex part *a e f* contains about 100°. The length of the pallet from *a* to *d* is ſuch, that when the pin at B preſſes againſt the curved part at *a*, the point *d* of the horn will juſt miſs the pin at A of the preceding tooth, and the height at which the pallet ſtands is ſuch as to make it paſs over the rim of the wheel, but not over the pins at the ends of the teeth. When the balance is at reſt, and has its ſpring in equilibrio, the point *d* of the horn is at the point *i*, about 30° from *d*; but the preſent poſition is that which the pallet has when the tooth A has juſt eſcaped from the point *d* of the horn. To explain the action, on a ſuppoſition that the tooth A has juſt eſcaped, the ſucceeding pin B has juſt fallen on the point *a*, joining the ſpiral and convex portions of the pallet, and the balance has juſt received its impulſe from tooth A as it paſſed from *b* to *d* along the inferior face of the horn; it, therefore, proceeds in its motion in the direction *d g h* of the dotted circle, while the point B ſlides on the convex ſide *e f*, and is detained without recoil; when the point *d* of the horn has arrived as far as *h*, more than 90° from A, the momentum of the balance is exhauſted, and the balance returns; the point *d* comes to about the point *i* before the pin of tooth B comes to *o*, and enters the concave part of the pallet, where it ſlides till the point arrives about *k*, where the momentum of the balance ſpring is again exhauſted; the balance returns again, and when the point *d* comes to *i*, the pin of tooth B eſcapes the concave part at *b*, and ſlides along the inferior face of the horn, at the ſame time giving it a puſh till it eſcapes entirely, and is in the ſituation of tooth A, where the proceſs began; in the ſame manner the following tooth C, and every ſucceeding tooth in its turn, will fall on the convex ſide of the pallet, return and enter the concave ſide, and then finally eſcape. We muſt obſerve, however, that the pallet oppoſes the motion of the balance as it paſſes along the ſmall ſpiral part from *a* to *o*, which may be ſo proportioned as to be a counterbalance to the impulſe previouſly given to the balance by the leading tooth, in caſe the friction on the back of the cylindrical part is not competent to retard the balance's impulſe ſufficiently. The effect produced by this eſcapement muſt be very ſimilar to that produced by Graham's cylindrical eſcapement, but has this advantage, that the inclined plane formed on every wedge of Graham's conſtruction is transferred to the pallet, and ſerves for all the pins to ſlide on in ſucceſſion, thereby removing the difficulty of forming all the wedges alike in ſize and ſhape. Beſides, the convex and concave ſides of the pallet may be reduced to any dimenſions, provided the acting tooth may not ſlide at once from the ſpiral to the horn, and allow the train to run down, which may be the caſe if the parts of action be ſmall, and there be much play in the pivot holes of the wheel and balance. The conſtruction is a compound of Tompion's and Graham's watch eſcapements, to both of which it has certain points of reſemblance. In 1752, Le Paute altered this eſcapement, by putting pins for teeth in both planes of the wheel, as he did in Amant's eſcapement *a cheville*, which addition gave it ſome advantages.

10. *Eſcapement with one pallet and one detent by Thiout.*— Thiout, a French clock-maker of conſiderable eminence, publiſhed a work in 1741, entitled "Traité de l'Horlogerie Mechanique et Practique, approuvé par l'Academie Royale des Sciences," 2 vols. 4to, in which he has deſcribed an eſcapement of a watch that has been miſtaken ſometimes for a real detached eſcapement, and conſidered as the firſt that has been made of ſuch a conſtruction, though the inventor himſelf did not conſider it as ſuch, as is evident from his own deſcription. This eſcapement is given in *fig.* 8. of *Plate* XXXII., and to uſe the author's own account, "it is an eſcapement of a watch in which half of the vibrations *ſeem* independent of the train of wheels, while they are performed. The detent B ſtops the eſcapement wheel, the balance bringing back the pallet A, the detent recedes, to leave the wheel free to ſtrike the pallet; and ſo on. This eſcapement could not perform without a ſpiral ſpring." It hence appears, that the pallet A is on the verge of the balance, but that the detent B is on a ſeparate arbor, while they are connected by the tail of the pallet entering the ſlit in the remote end of the detent, ſo that the balance is never diſengaged from the detent, and therefore cannot be conſidered as of the detached claſs. When the balance moves in a direction from A to B the pallet gets out of the teeth, but the detent falls in, and *vice verſâ*. The curves of the claw of the detent appear to have been drawn from the centre of its motion, and therefore we are diſpoſed to think that there would be no recoil in the eſcapement wheel.

11. *The anchor eſcapement by Clément, or Dr. Hooke.*—While theſe improvements were going on in watch eſcapements, an equal attention was paid to the contrivance of new clock-eſcapements. Huygens had placed the pallets of the crown-wheel eſcapement at an angle of about 60° inſtead of 90°, as they were made for a watch, in order that they might be accommodated to the ſhort vibrations of a pendulum, or rather, perhaps, to the vibrations of ſome length performed in a cycloidal curve, by means of his cycloidal cheeks near the point of ſuſpenſion; but ſtill the arc of action on the pallets was too long to allow practice and theory to coincide, as to the performance of long and ſhort arcs of vibration in the ſame time. The preference that ſeemed due to ſhort arcs, when circular, ſuggeſted the propriety of contriving an eſcapement that would admit of very ſhort arcs of vibration. This was firſt effected about the year 1680 according to Smith's account, by Clement, who was a clock-maker in London; but Dr. Hooke has diſputed the priority of the invention, and has affirmed that he exhibited a pendulum with what is now known by the name of the *anchor* eſcapement, to the Royal Society of London, in the year 1666, ſoon after the great fire of that year. We will not endeavour to ſettle the point that relates to priority of invention, but proceed to deſcribe the contrivance itſelf, which has continued, and is likely to continue, to be of permanent

uſe in ordinary clocks. *Fig.* 3. of our laſt named plate is the repreſentation of the anchor eſcapement, as it is commonly conſtructed for a pendulum clock that ſwings ſeconds, which pendulum, in conjunction with the anchor eſcapement, gained the appellation of the *Royal pendulum.* The eſcapement, or ſwing-wheel A, has uſually thirty teeth, when a vibration is performed exactly in a ſecond, in which caſe a ſecond's hand is uſually inſerted on its elongated pivot, to indicate ſeconds; but if no attention is intended to be ſhewn to the indication of ſeconds, the train may be made to admit of any other convenient number of teeth; B C is the anchor and pallets, taking its name from a reſemblance to a ſhip's anchor, that may be obſerved in its ſhape; the diſtance from its centre of motion a to that of the wheel b is determined by the number of teeth that the pallets take in between them, it being eſſential to the freedom of action that two lines, drawn from the two centres of motion a and b, ſhould conſtitute a right angle at each of the two points of action, as ſeen included by the dotted lines, meeting at the ends of the acting teeth d and e: in the pallets which we have made to include nine teeth, the centre of the pallet's motion falls at the point a, but if they were made to include eleven teeth the ſaid point would fall above at h; and if they included fewer than nine the point for the centre of motion would fall below a: in general ten or twelve are contained between the pallets of a ſecond's pendulum, but this muſt depend on the arc that the pendulum is intended to vibrate; for the more teeth are taken in, the greater is the diſtance of the two centres of motion, and conſequently the ſmaller the angle or arc of action on the pallets. If a circle $f g$ be deſcribed by a radius equal to half the diſtance of the centres of motion $a\,b$, round the point a, the two faces of the pallets B and C uſually lie in the tangent lines $e\,i$ and $d\,g$ of that circle, which lines are the guides for making the ſlopes. The action of the eſcapement before us may be explained thus; ſuppoſe the tooth d, ſeen reſting on the ſlope of pallet C, to be urging this pallet outwards from the centre of the wheel, by which a motive force is applied to the moving pendulum through the medium of the crutch; preſently it eſcapes, and pallet B is brought inwards towards b, ſo as juſt to avoid the tooth e; the wheel is now at liberty to move, and goes on, by the force of the maintaining power, till the ſucceeding tooth k falls on the ſloped face of pallet B, which is now urged outwards, and endeavours to give a contrary motion to the pendulum; but the momentum of the moving pendulum is too powerful for its impulſe, and carries the tooth k back again till the momentum is expended, at which inſtant a recoil of the wheel and ſecond's hand placed on its arbor take place; preſently the pendulum returns, and the tooth k now puſhes it on, and eſcapes; the pallet C is now brought back, ſo that the tooth following d falls on its ſloped face, and in its turn experiences a recoil till the pendulum returns, when it puſhes on and eſcapes; then another tooth next after k falls on the face of B, and experiences the ſame recoil and ſubſequent power of eſcapeing that the others did; and thus the alternate vibrations of the pendulum are perpetuated as long as the maintaining power continues. The effect of this eſcapement on the pendulum is ſimilar to that of the crown-wheel eſcapement on the balance; the pendulum is either accelerated or retarded in every part of its vibration, except during the almoſt inſenſible inſtant of the drop of the ſucceeding tooth, when one has eſcaped; but as the momentum of a heavy pendulum in motion is greatly exceeding that of a balance in motion, the bad effect is ſmaller in degree. When an additional weight is added to the weight conſtituting the maintaining power, the arc of vibration is increaſed, whence one might be led to expect a retardation in the time of a vibration, the arcs being circular; but the fact is, that the vibration is accelerated very ſenſibly by means of the pendulum being both accelerated in its deſcent and oppoſed in its aſcent, and the pendulum comes ſooner back than gravity alone would bring it. Here then the compound law of motion differs from the ſimple law of gravity, but not in the ratio of the arcs to the ſines of the angle of vibration; for if the compound law were to the ſimple law of gravity as the *arcs* are to their *ſines*, the vibrations would be iſochronal, whatever their extent might be. It is hardly neceſſary to add that this eſcapement is one of the firſt claſs.

12. *Graham's dead-beat.*—The dead-beat eſcapement, as originally contrived by Graham, is a modification of the anchor eſcapement we have juſt deſcribed, from which it differs only by taking off a part of the ſlope of each pallet, and by making the pads, that is, the back of one pallet and interior part of the other, portions of circles deſcribed from the anchor's centre of motion, ſo that when the point of a tooth reſts on thoſe parts, while the pendulum is finiſhing a vibration, no recoil takes place, but the wheel continues motionleſs, or, as it were, *dead.* *Fig.* 4. of the ſame plate gives the figure of the dead-beat eſcapement-wheel and pallets, where we have repreſented the wheel, as we did the wheel of recoil, with only four inſtead of ſix radii, that there might be more ſpace for our geometrical lines. In this conſtruction, as in the preceding one, the diſtance of the centres of motion a, b, is determined by the tangent lines meeting the radii at the points of the acting teeth; when this diſtance is an exact diameter of the eſcapement wheel, we find that the pallets take in juſt ten teeth out of thirty, which is the caſe in the figure before us, but when twelve teeth are taken in, the centre of the anchor's motion falls at h, juſt a diameter and a half from the centre of the wheel; and this is Berthoud's rule for giving the diſtance $a\,b$ without any reference to the tangent and radius; for he has found that the arcs of action on the ſlopes of the pallets $a\,m\,n$, and $a\,o\,p$, are each only one degree, but that if fewer teeth than twelve were included between the pallets, the anchor would be ſhorter, and the arcs of action proportionally longer. This rule might be a good one with a given maintaining power, that is, where the whole arc of vibration is of a given extent, but it does not follow that one degree for the arc of action before the eſcape is the beſt in all caſes where the motive powers vary. We are of opinion that experiments might be inſtituted to aſcertain this important point, by applying various weights ſucceſſively, firſt with pallets that have twelve teeth included, and then with ſuch as have eleven, ten, &c. but the experiment could not go beyond 14 teeth, becauſe when half the wheel is included the tangent becomes a vertical line, parallel to the line of diſtance $a\,b$, and therefore this diſtance becomes *infinite.* There is probably a certain maintaining power that is beſt for a certain angle of action, with a pendulum of a given weight, but that does not ſeem to have been aſcertained either by calculation or experiment hitherto. The thing to be aimed at is, to make the compound law of the pendulum's motion ſuch that the varying forces may accelerate or retard it in proportion to the arcs of diſtance from the loweſt point, which is the caſe with the ſimple law of gravity, as it regards the *ſines* of the ſaid arcs. We have put the ſame letters of reference to our preſent figure as to *fig.* 3, that the reader may the more eaſily comprehend the correſpondence between them, and to prevent the neceſſity of further minute deſcription of the parts; the ſlopes of the pallets being determined by the ſame tangent lines $e\,i$ and $d\,g$, as before. We ſhall, therefore, confine the remainder

of our deſcription to the features that differ, and to the mode of action depending thereon. The circle B C, paſſing the points of the firſt and eleventh teeth, including the ten ſpaces between the pallets, forms the interior faces of the ſaid pallets B and C, and the exterior portions B *e* and C *d* are formed by a concentric circle of larger radius. Theſe circles are deſcribed from the point *a*, or centre of the anchor's motion, therefore a tooth reſting at any time againſt any one of thoſe circular portions remains without recoil; the diſtance between the ſaid circles is ſomewhat leſs than one-half of the ſpace contained between the extreme ends of any two contiguous teeth, and the nearer it is to one-half of a ſpace, the ſmaller will be the drop after an eſcape, or, as the workmen ſay, the cloſer the pallets will be laid. The teeth are ſomewhat varied in ſhape from the inclined teeth of the recoil eſcapement, a portion of the ſlope at the bottom being cut away, that the end of the pallet may enter the ſpace, when the pendulum vibrates beyond the arc of action, without coming in contact with the metal of the wheel, which would make the pendulum rebound, and diſturb the regularity of the vibration. Theſe obſervations being premiſed, the reader will now be prepared to comprehend the action. The tooth at *e* has juſt paſſed the ſlope of pallet B, and is eſcaping, after having given its ſtroke or impulſe gradually, in ſliding along the ſlope from *e* to its preſent ſituation; the pallet B is now going from the centre of the wheel's motion *b*, and the pallet C is come back from its excurſion, in time to allow the tooth *b* to fall on its inner circular part, near the angular point of the ſlope; the pendulum goes on in its vibration till its gravity overcomes its momentum, during which time, the pallet B is no longer in contact with the wheel, but the pallet C enters the ſpace between *b* and *d*, and the point of the tooth *b* reſts on the inner circle of the pallet; preſently the pendulum returns, the point of tooth *b* ſlides back again till the ſlope *b d* preſents itſelf, when urged by the maintaining power, it eſcapes after having made its puſh to the pallet C, which now continues its motion outwards, and conſequently pallet B falls in the way of the tooth *k*, which follows, but which reſts on the exterior circle B *e* of this pallet, till the pendulum returns as before; it then meets the ſlope at *e*, and, giving its puſh to the pallet, eſcapes, as its preceding tooth had done; and thus the vibrations are alternately aided in future, while, as has been ſeen, one tooth only completely eſcapes at the interval of two vibrations: which is the reaſon why a wheel of 30 teeth is proper for the indication of 60 vibrations of a ſecond's pendulum. When the wheel is made of hardened ſteel, and the pallets of ruby or agate, the friction is greatly diminiſhed, and will admit a ſhort angle of action, or diminution of power.

13. *Modification of the dead beat by Grignon.*—When we gave the "Hiſtory of the ſucceſſive Improvements in Clocks," under our article Clock, we ſaid that the ſenior Thomas Grignon, of Covent Garden, London, improved the dead-beat eſcapement of Graham, and preſented a clock to the Society of Arts in 1759, which remains in one of their rooms to this day, that has got this improved eſcapement, the peculiar property of which is ſaid to be, that it performed alike with *four* and with *twelve* pounds ſuſpended as a maintaining power; if this is a fact, the eſcapement muſt have the property, ſo much deſired in all eſcapements, of rendering all the arcs of vibration iſochronal. We have been favoured with a manuſcript account of this eſcapement, and of its principle of conſtruction. It will be doing but juſtice to the memory of departed genius, if we give the author's own figures, demonſtration, and account of his improvement, as he has left it in his own hand-writing. *Fig.* 5. *of Plate* XXXII. is the *ſcheme*, and *fig.* 6. the *demonſtration*, as the author himſelf has intitled the figures, the latter of which has no letters of reference, but is ſufficiently intelligible in conjunction with the other. "It appears from the ſcheme," ſays the author, "that the diſtance of the centre of the pallets from the centre of the ſwing wheel in that machine (at the Adelphi) is *one whole diameter* of the wheel, which has this peculiar excellence, that the triangles formed at the ends of the pallets, by drawing the tangents for the ſlopements are *equal*; (nor indeed can they ever be equal, continues he, where the diſtance is more or leſs than *one whole* diameter of the ſwing wheel,) and, on the contrary, where that diſtance is duly obſerved, all the triangles will ever be equal; for then all the interſections, made by drawing the two tangents to the circle of the pallets, will fall exactly alike, (*fig.* 6.) interſecting the intermediate circle, as may be ſeen by the figure, conſequently the tangent lines, together with the chord of the ſwing wheel form a rectangled triangle, the upper angle of which, by altering the ſlopement only, changes its place in the circumference of the circle, the ſame chord always continuing its baſe. For a farther demonſtration of which, ſee 21ſt propoſition of the the 3d book of Euclid.

"Again, when the diſtance is duly obſerved, we ſhall find that one of the lines for the ſlopement of the pallets will be the hypothenuſe, and the other the perpendicular of rectangled triangles, whoſe baſes are equal to 120°, the halves of which muſt be 60°. That they are rectangled triangles may be eaſily proved; for if the baſe be 120°, and perpendicular 60°, the hypothenuſe muſt be 180°. See 1ſt Prop. of the 12th book of Euclid."

In another manuſcript paper, Mr. Grignon ſays, "that the teeth of the ſwing wheel have an equal effort, when they act upon the ſlopements or faces of the two levers or pallets, may be thus demonſtrated.

"Draw the lines A, A, upon the faces or ſlopements of the pallets or levers *a*, *a*, now theſe are the lines of direction; let fall the perpendiculars B, B, from the centre of motion of the pallets C; now, I ſay, that if you meaſure the lengths of theſe perpendiculars, they give you the efforts of the arms of the levers or pallets D C, D C; for by the 9th prop. of Mr. De la Hire's Treatiſe of Mechanics, the efforts of a weight or power are not to be meaſured by the length of the arms of the levers, but by perpendiculars drawn from the hypomochlion upon the lines of direction of the weight or power. That theſe levers are equal is thus proved; for, taking C for your centre, deſcribe the circle E E E; now if the perpendiculars B, B, are both radii of the circle E E E, they muſt, of conſequence, be equal, which is what was to be proved. Again, that the faces or ſlopements of the pallets or levers are equal may alſo be thus proved: *a* A, *a* A, are the lines of direction of the action of the teeth, and being both tangents of the ſame circle E E E are conſequently equal."

The remarks that have occurred to us on contemplating Mr. Grignon's *ſcheme*, as he has called it, are, firſt, that his diſtance between the centres of motion require *ten teeth* out of thirty to be taken in by his pallets, as we have ſhewn in our laſt article; ſecondly, the circle E E E is deſcribed with leſs than half the diſtance of the centres, and is yet made the circle to which the tangents are drawn, that form the ſlopes, the reaſon of which he has explained, the radius C B of this circle, it appears, muſt be determined by a line *a* A, drawn parallel to the line of diſtance, which muſt be a tangent to the ſaid circle, and which affords an eaſy and practicable mode of drawing the ſlopes agreeably to this conſtruction; thirdly, if the ſlopes thus formed by tangents drawn to a diminiſhed circle have the iſochronal property, they are worthy of future imitation, under the circumſtance particularly of ten teeth being included between the pallets; and laſtly, we obſerve, that the *ſame circle* forms the *exterior* curve of one pallet, and the *interior* one of the other, which is not the caſe with Graham's pallets, but which certainly makes the friction alike on both pallets, ſeeing the circular ſurfaces rubbed by the points of the wheel's teeth are at equal diſtances from their common centre of motion. Theſe conſiderations are all in favour of Mr. Grignon's modification of the dead-beat eſcapement, as each excurſion of the pendulum muſt be influenced by ſimilar circumſtances, and if moreover it poſſeſſes the iſochronal property attributed to it, it is ſomewhat remarkable, that the Adelphi ſociety have been labouring to reward inferior eſcapements in great variety, while one of the beſt *dead-beat* eſcapements is beating *dead* to the ſociety, having *eſcaped* their notice, while performing its functions within their own walls.

14. *Mr. Bennett's modification of the dead-beat.*—Mr. J. Bennett of Norwich has publiſhed an account of what he conſiders an improved method of deſcribing the curves and faces of Graham's dead-beat pallets (ſee Nicholſon's Jour. vol. xv. 8vo.) which account we think deſerves a place here in common with Grignon's method.

Draw the line A B (*fig.* 7. *Plate* XXXII.) ſays the author, on which deſcribe the circle B, the ſize of the intended ſwing wheel; then, according to the number of teeth the pallets are intended to eſcape over ſay, as 60 (the double of the number of the wheel's teeth) is to 360°, ſo is double the number intended and one more to that proportion; thus, ſuppoſe the number intended to eſcape over nine, the double of which is 18, to which add one, and there are 19; then ſay,

As 60 : 360° :: 19 : 114°; the half of 114°, which is the whole arc included, is 57°; then on the circle already drawn ſet off on each ſide of the line A B 57°, from which points draw lines to the centre of the circle; then on theſe points where the circle is croſſed erect perpendiculars, which will interſect at the centre of the pallet's motion in the line A: from this point as a centre draw the arc C C, to cut the points where the radial lines cut the circle; the arc thus drawn deſcribes the receiving and leaving pads of the pallets. The inclination or inclined plane of each pallet muſt form an angle of 60° with the ſaid radial lines; thus from the points of interſection, near E and G, draw the ſmall ſemicircles D and G with any radius, and ſet off 60° from *f* to *g* on the ſemi-circle D, and from *h* to *m* on the ſemi-circle G, then will lines drawn from the centres of the ſemi-circles, through the points *g* and *m* reſpectively, give the proper direction of the ſlopes of the pallets' faces.

This conſtruction is very ſimilar to Grignon's, though differently projected: the centre of motion A is determined in the uſual way, and the odd unit given to double the number of teeth included is an allowance for the breadth of the pallet, to have as little drop as poſſible; the ſlope of the pallet G is parallel to the line A B, in Grignon's conſtruction, but is not quite ſo here, for the difference of the angles at the oppoſite ſides of the radial line is $\overline{60^{\circ}-57^{\circ}}=3^{\circ}$, which is what theſe lines want of being parallel, which quantity of deviation ſeems to conſtitute the principal difference between the two conſtructions; if the radial line of pallet G had been drawn to the lower point of the pallet, ſo as to have made the angle at the centre 60°, and the teeth included had been exactly ten, then the two methods would have coincided, and the point A of the pallets' motion would have been an exact diameter of the wheel from its centre. We conceive that the effects of the two conſtructions may be ſo nearly alike, that their difference in practice may be almoſt imperceptible. If there is any difference, varying the maintaining power conſiderably in different trials will detect it, by rendering the alterations in the rates perceptible from the compariſons. Otherwiſe the alternate angles might each have been 57°, inſtead of one of them being 60°.

15. *Iſochronal eſcapement for a pendulum.*—So long ago as about the year 1720 Saurin, Julien le Roy, and Enderlin, wrote memoirs on the nature of the curve that was neceſſary to give to the pallets of an anchor, inſtead of the concentric circles, in order that the ſwing wheel may have juſt ſo much recoil only, as will render all vibrations, performed in arcs of different extent, iſochronal; and ſince their time Berthoud in France, Reid in Edinburgh, Melville and others in London, have put in practice a method of conſtructing pallets founded upon the ſame principle. We think it not improbable, however, but that the Scotch and Engliſh artiſts have borrowed their contrivance from the French author, who publiſhed his conſtruction in his "Eſſai ſur l'Horlogerie" in the year 1786, before which time we do not find any traces of an iſochronal eſcapement except Grignon's juſt deſcribed, and Smeaton's, which follows. The conſtruction of the eſcapement in queſtion differs from the dead-beat only in one particular, which is, that the circular portions of the pallets, which in the dead beat are concentric, deſcribed from the centre of the pallet's motion, in the iſochronal eſcapement are *excentric*, with reſpect to each other, thoſe curves on which the ends of the teeth of the ſwing wheel reſt being deſcribed from points out of the centre of motion. Berthoud had made ſeveral experiments with different eſcapements, and different maintaining powers, from which he found that the ſame addition to the power which accelerated the vibrations of the pendulum, when a recoil eſcapement was uſed, retarded the ſame when a dead-beat eſcapement was ſubſtituted; hence he concluded that there muſt be a medium between much recoil and no recoil, which would make the pendulum vibrate in the ſame time in all arcs, or, which is the ſame thing, with any addition or diminution of the maintaining power; he therefore fixed, after various trials, on a conſtruction producing but a *ſmall recoil*, which anſwered his moſt ſanguine expectations, and which we ſhall be happy to deſcribe here, particularly as it promiſes to anſwer a better purpoſe than the common dead-beat, which has been long in high eſtimation; and as it has not, we believe, been deſcribed by any Engliſh author. *Fig.* 1. of *Plate* XXXIII. is a plan of Berthoud's iſochronal eſcapement, where A, as before, is the ſwing-wheel, B and C the pallets of the anchor, and *a* the centre of their motion; the diſtance of the centres *a*, *b* alſo, as before, depending on the number of teeth taken in by the pallets; the angles *m a n* and *o a p*, are the angles of action by which Berthoud has given his ſlopes of the pallets without the tangent lines *e i*, and *d g*, but we have thought it right to ſhew how they may be given both ways. Berthoud's method of ſloping to ſuit any angle previouſly given is more extenſive in its application, but the quantity and direction of the impulſe will vary as the angles *m a n*, and *o a p*, vary; whereas the method of ſloping by the tangent lines can only vary by varying the circle *f g*, as Grignon has propoſed: in our plan we have taken the circle's diameter equal to the diſtance *a b* of the centres for the ſake of uniformity of plan, that the reader may ſee how the pallets, ſo formed, differ in ſhape from the dead-beat pallets. The exterior portion of the circle *d* C, of pallet C, is deſcribed with the extent *a d* from the centre *a*, but the interior portion *b* 4 is deſcribed with the ſame extent from a point

below the centre; the difficulty conſiſts in determining the true ſituation of this excentric point 5; Berthoud's rule, founded on the reſult of experiments, is this; having determined the breadth of the pallets, equal to ſomewhat leſs than half a ſpace of the ſwing-wheel, deſcribe from *b*, in the line *a p*, the concentric dotted circle 1, 2, 3, &c. ſet the diſtance between the two concentric circles, or breadth of the pallet, *three times* over along the inner curve to 1, 2, and 3, then in a direction from 3 towards *a* ſet the ſame *once* to 4; in the next place, with the extent *a b* find the point 5 by interſection from the points *b* and 4, and this point 5 is the excentric point deſired, from which the curve *b* 4 is deſcribed with the extent *a b* as before, which is the interior curve to be ſubſtituted for the concentric curve 1, 2, 3 of the dead-beat eſcapement; and it is evident that while the pendulum is in motion inwards, with a tooth reſting on this excentric curve, the wheel muſt have a certain recoil. Again, the exterior curve of excentricity, of pallet B, is thus deſcribed; the curve 1, 2, 3, &c. is deſcribed, from the point of the tooth that is in the line *a m*, and the points therein are taken as before at the diſtance from each other of the breadth of the pallet, or at ſomewhat leſs than half a ſpace of the wheel; the point 4 is here ſet outwards in the direction from *a* to 3; then with the extent *a e* the excentric point 6 is determined by interſection from *e* and 4, which point is above the centre; laſtly, with the extent *a e*, as before, deſcribe the excentric curve *e* 4 from the point 6, which being ſubſtituted for the concentric circle 1, 2, and 3, will produce a ſimilar recoil in the pallet B, as the curve *b* 4 produces in pallet C. The inner curve of pallet B having no action, like the outer curve of pallet C, may be deſcribed from *a*, or be a ſtraight line. The writer of this article has a half-ſecond's pendulum clock with this eſcapement, and Troughton's tubular pendulum, which goes admirably with any power that will keep it in motion.

16. *Smeaton's eſcapement of the turret-clock at Greenwich.*—The eſcapement which Mr. Smeaton contrived for the turret clock at Greenwich reſembles the iſochronal eſcapement, which we have juſt deſcribed, in a certain degree, and was, no doubt, intended to anſwer the ſame purpoſe. *Fig.* 2. of *Plate* XXXIII. contains the plan of this eſcapement, in which A B is the radius of the eſcapement wheel; B C a tangent line at $3\frac{3}{4}$ teeth from the vertex, drawn from C, the centre of the pallet's motion; B D E is a circle deſcribed from the centre C through the points B and E, which are each $3\frac{3}{4}$ teeth from the vertex; F G is a line drawn parallel to the vertical line A C at the diſtance from the vertex of $3\frac{1}{2}$ teeth, and cutting the circle B D E in the point G; then G C B is half of the angle of vibration, and ſetting off the arc B H = B G, G C H will be the whole angle of vibration. Draw the line C H cutting F G in I, and through the point G of this pallet from the centre A deſcribe a circle that may cut the radius A K in the point K; this will be the point of the other pallet; the line E C being alſo a tangent to the wheel at $3\frac{3}{4}$ teeth from the vertex. Now ſetting off K L on the circular arc = G H, the angle of vibration K C L will be equal to the other angle of vibration G C H, and if through the point L the line C L be produced, and L M be ſet off = I H, then will the wheel move equally forward, by a ſimilar motion of each pallet. Again, with the radius K C, upon K as a centre, deſcribe the arc C N, and alſo with the ſame radius from the point M deſcribe the interſecting arc O P; then from Q, the point of interſection with the radius unaltered, deſcribe the curve through the two points K and M to R, which curve will give the working face of the pallet that will produce a ſmall recoil nearly equal to that produced by the plane G I; in this conſtruction the depth of the teeth is equal to a ſpace contained between two contiguous teeth, and the acting ſide of the tooth is a portion of a circle deſcribed from the bottom of the ſloped ſide of the *fifth tooth* incluſive. The circle to which the ſlope of the tooth is a tangent is $\frac{1}{6}$th of the diameter of the wheel. When the ſwing-wheel has a greater number of teeth than 30, $7\frac{1}{2}$ teeth are ſtill contained between the pallets, and the centre of their motion is determined, as in the former conſtructions, by a tangent line drawn from the point of the acting tooth. The two ends of the anchor may be made more apparently equal in length by letting the pallet K eſcape over $3\frac{1}{4}$ teeth and the pallet G over $4\frac{1}{4}$, in which caſe the arc B D will be of a greater radius than the arc N D. The ſteel pallets or end-pieces are fixed by ſcrews that allow an adjuſtment for diſtance or depth of the pallets, ſo that they may be detached, newly formed, and replaced, at any time after they have been in uſe.

17. *Eſcapement with two levers by De Bethune.*—Thiout ſays that De Bethune was the firſt contriver of the clock eſcapement with two detached levers, and that the origin of this conſtruction was derived from the eſcapement of Dr. Hooke, or of a German artiſt, with two balances, which we have deſcribed. Thiout made the firſt of his in the year 1727, and ſays that from that time the eſcapement with two levers became common among clock makers in France. *Fig.* 3. of our laſt plate is a repreſentation of this eſcapement as made for a pendulum; where A and B are the two levers placed faſt on each a ſeparate arbor included within the frame; to the lever B is attached the crutch or fork that communicates with the pendulum not ſeen, and the fork C which is viſible in the figure; the lever A has a bar of metal D faſt to it, that carries the roller E, of a diameter equal to the aperture of the fork C; and the ends of theſe levers conſtitute the pallets placed at the diſtance from each other of five out of thirty teeth of the ſwing wheel. During the action of this eſcapement, when one of the levers is acted on by a tooth, the roller and fork are raiſed up, and the other lever becomes a detent to the wheel; then when at the next vibration the other lever is acted upon, the roller and fork are depreſſed, and the firſt lever in its turn becomes a detent; and thus the vibrations are alternately aſſiſted while the maintaining power continues to actuate the ſwing wheel. This eſcapement has a recoil, and Julien le Roy diſcovered (Memoire ſur l'Horlogerie par M. le Roy, fils ainé de Julien le Roy, 1750) that when the levers are each the exact length of the radius of the ſwing wheel, it poſſeſſes the iſochronal property, that is, all arcs of vibration will be performed with it in the ſame time. We are not aware that this eſcapement was ever made in England.

18. *Dead-beat eſcapement for a pendulum by Amant, (a cheville)*—*Fig.* 4. of the ſame plate ſhews the plan of an eſcapement by Amant, formerly a clock-maker at Paris, that has an eſcapement wheel without teeth, but with pins or pegs inſerted in a concentric circle in the plane of the wheel, as appears in the figure; the pallets A and B are both faſt to the verge or arbor of the crutch, in the uſual way, and are brought ſo nearly together that the ſame pin that ſlides along the ſloped face of one pallet B immediately falls on the inner circle of the other pallet A, and continues without recoil till the pendulum has made its vibration; at the return of the pendulum the pin meets with the ſloped face of pallet A and eſcapes; then the next pin falls on the interior circle of pallet B, and remains without recoil till the pendulum returns from its vibration, when it ſlides down the ſlope and gives a puſh to the pallet as the firſt one did before; thus the two pallets are alternately actuated by the ſame pin before

its final eſcape, and ſixty vibrations are made during one revolution of the plate with thirty pins. The ſlopes appear to ſtand at right angles to each other, but it is not ſaid, in the account we have ſeen, how either of the ſlopes ought to be drawn geometrically. This is the kind of eſcapement at preſent uſed in the large turret clock at Hampton Court, and we have ſeen many other clocks in England with a ſimilar eſcapement, which, we have no doubt, may perform as well as with the ordinary dead-beat eſcapement as originally conſtructed by Graham, provided the drop from the firſt to the ſecond pallet, which muſt neceſſarily be equal to the thickneſs of the pin, do not produce a jerk that may affect the vibrating pendulum.

19. *Dead-beat eſcapement* (*a cheville*) *by J. A. le Paute.*—In Le Paute's "Traité d'Horlogerie," publiſhed at Paris in 1755, is an account of a dead-beat eſcapement as made by him for a clock, which differs from our laſt by Amant only in its mode of poſition, and which therefore requires no figure for its deſcription; the levers of the two pallets open like a pair of dividers to any extent, but are not in the ſame plane, one of the levers being over the anterior plane of the pin wheel, and the other over the poſterior plane; hence two ſets of pins are neceſſary, one on each plane; but the action is the ſame as we have deſcribed it in Amant's eſcapement, which it probably excels inaſmuch as the drop may here be made as little as poſſible, becauſe the ſame pin is not required to paſs between the ends of the pallets in eſcaping; but one pin acts only with one pallet before it eſcapes; there are conſequently ſixty pins in all, thirty on each plane of the wheel.

The ſame author alſo publiſhed an account of a watch eſcapement with pins (a cheville) which the reader will find deſcribed at page 198 of the ſame treatiſe.

It is eaſy to conceive, after what we have ſaid about the iſochronal pallets, that both Amant's and Le Paute's eſcapements, and indeed all the dead-beat eſcapements, may be made to have a little recoil, ſo as to become of the iſochronal kind, provided the acting concentric circles of the pallets were made in a certain degree excentric; that is, if they were deſcribed from points out of the centre of motion of the pallets themſelves. The only difficulty is in determining the ſituation of thoſe points under different circumſtances, which we think is a fair object for future experiments.

20. *Harriſon's clock eſcapement.*—The eſcapements which we have hitherto deſcribed require oil on the pallets, to diminiſh the friction of the parts that rub againſt one another in action; but the eſcapement we are now going to deſcribe as the invention of the ingenious Harriſon requires no oil, on account of his conſtruction being free from rubbing at the time of the pallets' action. *Fig.* 5. of *Plate* XXXIII. exhibits the ſhape of Harriſon's eſcapement. G D O is a portion of the ſwing wheel, moving round M as a centre: A is the verge or arbor of the crutch that communicates with the rod of the pendulum; to this are attached the pallets, each conſiſting of a long and a ſhort lever with a joint at the place of union; the ſhort lever A B is faſt to the arbor or axis of motion, and carries the longer lever B C which has a claw or hook *a* C, and a ſlender ſpring is ſo applied as to keep theſe two levers nearly at right angles to each other; at right angles to A B is alſo the other ſhort lever A E faſt likewiſe to the axis of motion, and bearing the longer lever E F, as A B bears the lever B C; the joints are at B and E, and a ſimilar ſmall ſpring holds the levers A E and E F in like manner at right angles to each other, when not otherwiſe acted on. The lever E F has not only a claw, like the other long lever, but a heel to it, or projecting part *f*. The action of this contrivance may be thus explained; ſuppoſe the tooth D urging the pallet or claw C, while the pendulum is moving towards the right hand in its excurſion; this preſſure of the tooth produces a tendency in the lever B C to move round, but the joint at B yields, and opens the angle A B C a little; during this motion round A, the ſhort lever A E is lowered a little, and with it the long lever E F, which we will call the detent; its claw F therefore falls in the way of the tooth G, which now drops on the back part of the claw, and is inſerted into a notch under the projecting heel *f*; the further motion of the pendulum, and conſequent depreſſion of the ſhort lever A E, carry the end of the tooth G back again till the vibration is finiſhed, and produce a recoil. At the moment when the tooth begins to have a recoil, the tooth D at the pallet or claw C is withdrawn and eſcapes; the ſlender ſpring of the lever B C, which had been bent from its quieſcent ſtate, now reſumes its original ſituation, and throws out the lever B C, till its angle formed at B is again nearly a right angle; in the mean time the wheel is detained by the heel of the detent E F, in which ſituation it oppoſes the vibration through the medium of the two levers E F and E A, which are attached to the crutch of the pendulum. The vibration being finiſhed, the pendulum returns towards the left, and the wheel is at liberty to advance again; the preſſure of the tooth G on the claw of the detent now aſſiſts the vibration through the arc of eſcapement or arc of action, and cauſes the pallet C to approach the wheel, till the tooth following D falls on it and experiences a recoil in its turn. This recoil ſets the detent F at liberty from the preſſure of the tooth G, which now flies back by means of its ſlender ſpring to its rectangular ſituation, as it regards the ſmall lever A E: preſently this vibration terminates and the pendulum returns, while the tooth following D aids its vibration by pulling forwards the pallet C, when the proceſs of making two ſucceſſive vibrations is gone through, and the ſame operation is repeated. The reader will have obſerved in this account that the tooth and pallet, or tooth and detent, do not *ſlide* on one another, but give each other a *direct puſh*, or pull, the buſineſs of the ſmall ſprings being to remove them from contact by one ſudden leap, where rubbing is altogether avoided, which contrivance ſuperſedes the neceſſity of having oil applied to the pallets, and is certainly an ingenious contrivance, as well as uſeful in practice. It muſt be obſerved, however, that the recoil, ſuch as it is, takes place at the extremities of the vibration, when the momentum of the pendulum is almoſt exhauſted, and is therefore the moſt unfavourable part of the vibration to occur in; notwithſtanding which diſadvantage the eſcapement has performed as well as any other that had preceded, perhaps as well as any that has followed it, as the regulator to which it was applied has ſeldom if ever been excelled in ſteadineſs and accuracy of performance for fourteen years of uninterrupted ſucceſſion. The imperfection ariſing from the recoil taking place at the extremities of the vibrations ſeems to have been compenſated by the immenſe momentum of the pendulum that this eſcapement admitted of with a comparatively ſmall maintaining power, while the abſence of friction and of oil gave it the advantage of permanently uniform action. Of courſe the pendulum was of the grid-iron form, that compenſated the effects of varying temperature, and allowed the eſcapement to have its merit appreciated. The report of the performance of Harriſon's regulator with the eſcapement in queſtion was, that it did not vary *one ſecond* per day from any preceding or following day for the ſpace of fourteen years, and that the aggregate of the variations from true mean time did not amount to half a minute.

Haley alſo conſtructed clock pallets that required no oil, but as none of them have fallen under our notice, we pretend not to ſay how they differed from Harriſon's.

21. *Eſcapement by Alex. Cumming for a clock.*—Mr. Cumming publiſhed his elements of clock and watch-making in the year 1766, in which, among other matters, he deſcribes a conſtruction of an eſcapement of his contrivance, that removes the friction and influence of oil not only during the time of reſt of the pallets, but alſo during the motion of the ſwing wheel, ſo far as they can influence the vibrations of the pendulum; and alſo obviates all the irregularities that can poſſibly ariſe from the maintaining power as tranſmitted through the train. *Fig.* 6. of *Plate* XXXIII. exhibits as much of this eſcapement as is neceſſary for explaining its general action, but thoſe readers who wiſh to ſee all the minutiæ of the conſtruction, as repreſented by different plates of ſections, muſt have recourſe to the book itſelf, as the complexity of the parts repreſented in various points of view demands more minute repreſentation than our plan admits of. Our figure is a copy of plate 5 of the author, in which A B C is the eſcapement or ſwing-wheel; D E the pallets ſeparately moveable on the axis of motion, and having each a little ball or weight H and I reſpectively ſupported by horizontal arms; each pallet with its attached weight is ſeparately moveable from the other round its reſpective axis of motion, ſo that when one is raiſed by the wheel the other remains at reſt; F and G are two detents firmly attached together, like the ordinary pallets of a common dead-beat or recoil eſcapement, and are fixed to a cylinder of braſs P P, that ſurrounds the two axes of motion of the pallets, which are in the ſame ſtraight line but ſeparated from each other at the middle of the cylinder, where is a partition that bears the interior pivot of one axis and the exterior one of the other; the crutch of the pendulum is alſo faſt to the cylinder; ſo that the two detents and crutch move together along with the cylinder, without the motion of either pallet; and each pallet can move ſeparately without the detents and crutch. M is a load to counterpoiſe the detents and crutch in any poſition given them; and *n o* are two pins carried by the pendulum that project far enough to fall alternately in the way of the arms that carry the balls H, I, as the pendulum vibrates.

To explain the action of this eſcapement, let us ſuppoſe the pallets D and E, the detents G and F, the crutch L, and pins *n* and *o*, together with the balls H and I to be exactly as repreſented in the figure, where the lever of the detent G is hid behind the lever of the pallet E, but may be conceived to be parallel to it, the pallet D having been previouſly lifted from its quieſcent poſition, where its point reſted on the rim near the foot of tooth A; then if we conceive the pendulum moving from right to left with the ball I urging the pin *o* attached to an arc fixed to the pendulum, or crutch of the pendulum, the vibration is aided by the gravity alone of this ball. The arc, that bears the pins *n* and *o*, has a contrivance not ſeen in the figure for unlocking the detents at the moment when either of the pins bears againſt its ball, which contrivance it will be ſufficient for our purpoſe to call Z. Conceive now the pin *n* brought into contact with the arm of ball D by the moving pendulum, the detent F is unlocked, and the tooth A of the wheel quits the end of pallet D; the ball H now acts by its gravity on pin *n*, and deſcends, at the ſame time aiding the returning vibration, while the pallet D, united to the arm of ball H, deſcends alſo towards the wheel; but as ſoon as the pendulum firſt began its original vibration, the pin *o* was withdrawn from the preſſure of the ball I, by means of the attached pallet E falling on the tooth C of the wheel, ſo that all the latter part of the vibration was free; this preſſure of pallet E on the tooth C diminiſhed the preſſure of tooth A on the detent F at the inſtant of the unlocking, which we have mentioned; the wheel now in motion by the action of the maintaining power, (through the medium of the train,) goes on till the tooth C, acting on the pallet E, raiſes it outwards, together with its attached ball I, till the detent G ſtops the wheel's motion, when all the parts are at reſt till the pendulum nearly finiſhes its returning vibration, and then its pin *o*, meeting with the elevated arm of ball I, preſſes againſt it and concludes the vibration; at the moment this preſſure is felt the contrivance Z unlocks the detent G, and allows the tooth C to eſcape; in the mean time the ball I by its gravity urges the pendulum for a ſhort time, while the tooth following A, meeting with pallet D, raiſes it and the ball H a ſecond time, the tooth following C comes in the way of pallet E, and ſtops the further action of the ball I on the pendulum, which now vibrates, as before, free, till its pin *n* again meets with the arm of ball H, when the ſame proceſs is repeated; and thus the weights H and I are alternately raiſed by the wheel, and then alternately act for a ſhort time on the pendulum, at the beginning of each vibration, ſo that gravity alone is properly ſpeaking the maintaining power of the pendulum, and whatever may be the maintaining power of the train, it never affects the motion of the pendulum; but only raiſes the balls, that afterwards act on the pendulum by their gravity alternately exerted from a ſtate of reſt. Thus, whatever may be the effects of oil, duſt, friction, wear, &c. on the action of the train of wheel-work, as it has no immediate connection with the pendulum, except during the ſmall inſtant of unlocking the detents, theſe effects are almoſt entirely avoided, as they regard the pendulum or regulating part of the motions. The greateſt objection in theory to this conſtruction is, that the additional gravity commences inſtantaneouſly, and alſo ceaſes inſtantaneouſly, and at a part of the vibration where the inſtantaneous exertion of extraneous force of any ſort is the leaſt favourable for aiding the ſimple gravity of the pendulum's ball, which conſideration is analogous to the obſervation we had occaſion to make on Harriſon's eſcapement: but, like his, the eſcapement before us has ſtood the teſt of practical experience, notwithſtanding its complexity, in his majeſty's private obſervatory. If, however, this eſcapement is not *better* than any of the other eſcapements, the number of its adjuſtments, and variety of its parts, conſtitute a practical objection to its general adoption; and we believe no proof has been given of its being preferable to Harriſon's, or even to the common dead-beat or iſochronal eſcapements, except that the works of the clock that has this eſcapement may not require to be ſo often cleaned. This eſcapement leaving the pendulum free or detached from the wheel-work during the greateſt part of each vibration, is of the third claſs of eſcapements.

22. *Eſcapement by Mudge for a clock.*—The clock eſcapement contrived by Mr. Mudge to detach the pendulum from the train, ſo as to allow it to have nearly a free vibration maintained by gravity alone, may be conſidered as a ſimplification of Cumming's eſcapement juſt deſcribed, from which its principal difference is, that each of his two ſeparate pallets act alſo as detents; the mode of action and effect produced are very ſimilar in both. Mr. Mudge's eſcapement is repreſented by *fig.* 7. of our laſt plate, in which L M is a portion of the ſwing wheel; G A and G B are two levers ſeparately moveable round one common axis of motion, and have each a pallet at the lower extremities; theſe pallets are formed like the common recoil pallets, except that each has a claw at the loweſt point, that prevents the eſcape of the ſliding tooth when acting thereon: the pallet G A has a lever,

which may be called its tail-piece G O, attached to it, and alſo a ſmall metallic ball *u* ſurmounted on a pin over the pallet, which may be eaſily changed for one of a different weight; the pallet G B has a ſimilar tail-piece I O, with a ſimilar ball *v* over its pallet B; and the dark circular ſpot at N is the end of a ſtiff pin projecting from the pendulum, or its crutch, far enough to fall in the way of the tail-pieces alternately, as the pendulum vibrates. After having peruſed our account of the action of the preceding eſcapement, the reader will anticipate the explanation we have to offer of this mechaniſm. Suppoſe the wheel to be urged by the train in its proper direction from I towards M, and an impulſe given to the pendulum, to produce a motion in it in a contrary direction; the pin N keeps pace with the pendulum towards L, while the tooth at L is locked in the claw of pallet A, (which it is ſuppoſed to have raiſed ſo as to bring the tail-piece G O out of its vertical direction,) and at length meets with this tail-piece, to which it gives a puſh, at the extremity of the vibration, ſufficiently ſtrong to drive the pallet A from its locked tooth L, when the wheel is at liberty to proceed, till the tooth near pallet B raiſes it and its ſurmounted ball *v* until the claw detains the further motion; in the mean time the returning vibration commences, and the ball *u* urges the pendulum, by means of its tail-piece G O being in contact with the pin N; when, however, the tail-piece has gained its vertical ſituation, the pallet A meeting with the rim of the wheel ſtops; the pendulum now finiſhes its vibration in a detached ſtate, having gained an acceſſion of force by the impulſe from the ball *u* downwards, which has been greater than the reſiſtance it met with in moving upwards at the inſtant of unlocking: the tail-piece I O is now in the ſituation of I P, by reaſon of the ball *v* being elevated by the wheel, therefore when the pin N of the pendulum arrives at I P, which is at the other extremity nearly of the returning vibration, its ſtroke drives the pallet B in its turn from the locked tooth near M, which now eſcapes; the wheel is again at liberty to proceed till the tooth behind L has raiſed the pallet A a ſecond time, when it is again locked; the pendulum begins another vibration, aided by the ball *v*, till its tail-piece reſumes its vertical poſition, and then the pendulum is again detached, after being a ſecond time urged down a longer arc than it was oppoſed up; and thus the vibrations are maintained by the exceſs of the downward puſh over the reſiſtance upwards at every new vibration, which exceſs, derived from gravity alone, is in fact the maintaining power of the pendulum. This eſcapement is alſo of the third claſs, and being more ſimple in its conſtruction than its predeceſſor and parent, perhaps we may add, is better adapted for practice. The external force derived from the gravity of the balls in aid of the pendulum's gravity is here alſo both applied and withdrawn ſuddenly, as well as at the moſt unfavourable parts of the vibration, as was the caſe with Cumming's eſcapement; but it poſſeſſes the ſame advantages of detachment from the train.

23. *Detached eſcapement by Peter le Roy in* 1748.—We have deviated a little from the regular order of time, in having noticed the detached clock-eſcapements before thoſe that were previouſly applied to the balance, in order that the ſucceſſion of improvements made in clock-eſcapements might not be interrupted by an intermixture with watch-eſcapements. We now go back again to the year 1748, when Peter, the eldeſt ſon of Julien le Roy, invented an eſcapement for a balance that vibrated a conſiderable portion of its total arc without any connection whatever with the eſcapement wheel, and which therefore may be conſidered as the father of the third claſs of eſcapements, and the origin of the ſubſequent more recent improvements in the eſcapement of chronometers. *Fig.* 8 *of Plate* XXXIII. will afford us the means of explaining this eſcapement, a model of which was preſented to the Academy of Sciences at Paris in the year 1748, previouſly to which year, no detached eſcapement had been made public, though Du Tertre is ſaid to have invented one, and even to have made it at the time; but as the invention, or at leaſt the conſtruction, was kept a ſecret, it did not derogate from the merit of Peter le Roy's contrivance, which muſt be conſidered as original. G H is the eſcapement wheel of the contrate kind, actuated by a pinion on its arbor, receiving the force of the maintaining power; its profile is ſeen contiguous to it, at *g h*; T V is the balance, the verge of which has a ſpiral ſpring attached to it at the interior end in the uſual way; a curved pallet A E is faſt to the verge under the balance, and the ſemi-circular piece C I is affixed to the ſame above the balance, but under the ſpiral ſpring; the end C of this piece is rounded, and ſo ſituated, that a line drawn from it to the centre of the balance would form with the curve A E an angle of about 80°. An angular lever Q P X, turning on pivots under a little cock on the plate at C, is ſo proportioned, that the branch P Q will reach the pallet, while the other branch P X with a concave end will reach to a tooth G in the balance wheel, when not reſting on a pin K, to which in its quieſcent ſtate it is kept by the ſpring R M, made faſt to the plate on the other ſide at R. Suppoſe now, the regulating ſpring moved from its ſtate of natural reſt, and the balance to move with it through a certain arc of vibration, more or leſs, till the rounded end C of the ſemi-circular piece falls on the branch P Q of the angular lever near Q, and puſhes it from its ſituation, at the ſame time bringing the concave end of branch P X into the way of a tooth G of the wheel; when the acting tooth, which we will call D, eſcapes the pallet A E; the wheel is then at liberty till its tooth G falls on the concave end of the branch P X, which may be called the detent, becauſe it now *detains* the wheel from moving further under exiſting circumſtances. The balance is now perfectly free from all contact of the acting part of the branch P Q, and continues its vibration, after having received a puſh from tooth D on its pallet: preſently its velocity is deſtroyed by the tenſion of the regulating ſpring, the re-action of which now makes it return with an accelerated motion, when the pallet comes into contact with the eſcapement wheel at the tooth following D, which now experiences a recoil for about half of a ſpace in the wheel: the branch P X, or detent, is relieved by this partial recoil, and obeys its ſpring R M, which takes it back again to its ſtate of reſt at the pin K; when the wheel, having ſtopped the balance, ſends it off again with a new impulſe, by ſtriking the pallet in a contrary direction, when the ſame operation of the angular lever is repeated, and the vibrations are maintained as in other eſcapements. It muſt be remarked of this eſcapement, that it does not allow the balance to be detached for an entire vibration, but oppoſes the balance back from the point where it gave its forward puſh, thereby producing a certain recoil, which, ſo far as this is a leading conſideration, would entitle us to rank the eſcapement among thoſe of the firſt claſs, but inaſmuch as the balance vibrates in a detached or free ſtate in the remaining portion of its vibration, we may place this eſcapement with propriety at the head, in point of time of the third claſs.

24. *Peter le Roy's ſecond or improved detached eſcapement.*—Some time after Peter le Roy had completed his firſt detached eſcapement, and had conſidered its principal defects, he ſet about contriving another, leſs liable to objections, in which he ſucceeded in a very conſiderable degree; when in

the year 1766 he preſented a time-piece to the Academy of Sciences, which was afterwards tried at ſea by the French government, with his improved eſcapement, which we ſhall now deſcribe. *Figs.* 1, 2, and 3, of *Plate* XXXIV. exhibit ſufficient of Peter le Roy's improved eſcapement to enable our readers to form a complete idea of its conſtruction; the leading feature of which is to give the balance one temporary puſh that ſhall maintain its motion for two ſucceſſive vibrations, one forwards and the other back, and that this puſh may be given at a moment of the balance's vibration that is moſt favourable for avoiding a derangement of the law of the ſpring's forces. *Fig.* 1. is a view of the balance-wheel, which has ſix radial levers for teeth, but no rim, that it may be as light as poſſible, the ends of which levers are bent downwards, that is, in an oppoſite direction to thoſe on the horizontal wheel with Graham's cylinder eſcapement; the connection of this horizontal balance-wheel with the train is by means of the pinion on the oppoſite end of its arbor; *fig.* 2. is the arbor of the detents, on which there are three levers, one double one for locking, and two ſingle ones for unlocking, all clearly ſhewn in the figure; *fig.* 3. ſhews the wheel, detents, unlocking levers, and balance in their relative ſituations, and in one of the acting poſitions: A is a portion of the balance, on the plane of which is ſcrewed a pallet *p*, ſo as to fall in the way of one of the levers of the balance-wheel. The ſame letters denote the ſame parts in *fig.* 3. as in *figs.* 1 and 2, which therefore explain themſelves. The action may be explained thus: ſuppoſe one of the levers of the balance-wheel to be detained by the claw of the detent D, while the balance put in motion is vibrating in the direction from *i* to A; when the force of the balance ſpring, not ſeen, overcomes the momentum of the balance, it returns by means of the ſpring's force, which is now at its greateſt tenſion, or diſtance from the point of quieſcence; the direction of the balance, we have ſaid, is now from A towards *i*; in this return a pin at *i*, ſituated in the ſuperior plane of the balance, ſtrikes the end of the lever H F of the detent arbor, unlocks by this ſtroke the detent D from the claw of the wheel's radial bar or tooth, and at the ſame inſtant directs the other end H *e* of the double detent into the way of a ſucceeding radial bar of the wheel K *r*, which now reſts on this end of the detent; this part of the action is called by the inventor the *preparation*, the vibration goes on to finiſh, and the ſpring brings the balance back; at a certain part of this vibration the balance receives its ſtroke from the radial bar K, which impels the pallet *p*, ſcrewed on the balance itſelf, in this manner; a pin, ſituated like the former pin at *i*, but placed on the inferior plane of the balance, out of ſight, and a little farther from the balance's centre than the former pin, ſtrikes the end of the ſhort lever H *c*, and unlocks the radial bar of the wheel, that has been reſting againſt the oppoſite end of the detent D, and that now runs on to D, which is in the way to catch it; during this ſhort period the wheel is free, the pallet *p* of the balance being at that inſtant in the ſituation F, the point K of the radial bar K *r* of the wheel purſues the pallet and makes its ſtroke on it, about the time when the balance-ſpring, as we ſuppoſe, is at its quieſcent point, and therefore when the balance is moving with its moſt accelerated velocity; the ſtroke is of ſhort duration on that account, as well as on account of the ſhort diſtance the wheel has to run before it is again detained by the detent D: the backward vibration is made as before, and the ſame proceſs is repeated of two lockings and unlockings at each ſtroke of the wheel on the balance. The ſtroke, however, which the balance receives, has more force than both the ſtrokes that its pins give in the acts of unlocking, and therefore the difference of theſe contrary ſtrokes conſtitutes the real maintaining power of the balance, which was of the thermometrical kind, with alcohol and quickſilver, as deſcribed under our article COMPENSATION-*balance*. The ſtep made towards perfection, when this eſcapement was deviſed, was very long, and the principal objection to it in practice is, that it has too many pivots that require oil, as well other parts that come ſucceſſively in contact during the action, which therefore are not ſufficiently free from friction and conſequent wear. It may be neceſſary to add, that to prevent the detent's being diſplaced by any jerk, a long tail-piece behind it is contiguous to a circular appendage of the balance, ſeen from *i* to F, againſt which it falls, but only when any derangement of the detent accidentally takes place, and thus reinſtates it. The ſtroke is given to the balance not only when its velocity is greateſt and leaſt liable to be deranged, but the pallet that receives it, being removed from the centre of the balance, requires but a comparatively ſmall impulſe in this ſituation; beſides, the ſpring, which the inventor conſidered as not deſirable, for holding the angular lever to its place of locking, is here entirely diſpenſed with. This was conſidered as an improvement at the time, but ſubſequent experience has proved the utility of ſpring detents, which are now in univerſal uſe in the beſt Engliſh chronometers.

25. *Detached eſcapement by F. Berthoud.*—Ferdinand Berthoud, one of the members of the National Inſtitute of France, and the author of various works on horology, has contrived different eſcapements for clocks and watches at different times, and has written more on the ſubject than any other author, but it will not come within our plan to detail here all the alterations that have preſented themſelves to him; we ſhall ſatisfy ourſelves with deſcribing a few of thoſe which he has himſelf ſelected as moſt worthy of public notice in his laſt publication; "Hiſtoire de la Meſure du Temps." Others may be ſeen in his "Traité des Horloges Marines;" or in the "Supplement" to that work. The firſt that we mean to deſcribe is contained in *fig.* 4. of *Plate* XXXIV., which is a perſpective view of all the parts neceſſary to be ſeen: A repreſents the verge of the balance, to which is affixed by two ſcrews the circle of eſcapement B as a pallet; C is the eſcapement wheel, *a b c* the detent, which has at *b* a claw to catch a tooth of the wheel, when it ſuſpends its motion, during the period of the balance's free vibration; the portion *a b* of the detent is a flexible ſpring, that yields firſt at the point *a*; this, therefore, is the *ſpring of the detent*; the other part *b c* properly forms the detent, which has a claw rounded at the end *c*; another ſlender ſpring *b e* lies croſs-wiſe near the ſaid end, and is held faſt to the circle B by a ſcrew and fixing-piece *f*; this ſecond ſpring carries a pin *d* near its extreme end, which acting on the end of the detent, diſengages the locked tooth of the wheel, when the balance vibrates in a direction from B towards A; at that inſtant the ſucceeding tooth of the wheel acts on the notch or pallet part of the circular piece B at *h*, and tranſmits an acceſſion of force to the balance, which now vibrates in free ſpace; at the balance's return, the pin *d* of the ſmall ſpring *d e*, borne by the balance's circular piece B, applies itſelf to the end of the detent, ſo as to ſlide paſt it without diſturbing its poſition with regard to the claw, againſt which the next tooth is now reſting; when the balance has finiſhed this ſecond vibration it returns, the pin *d* again puſhes aſide the detent, and unlocks the wheel, which now gives another puſh at *h*, and the ſame operation is reſumed that we have been deſcribing. Thus two vibrations are performed at once unlocking, and at one ſtroke of the wheel on the notch of the circular pallet piece. The ſmall ſpring *b e* may

be called the lifting ſpring, in oppoſition to the detent ſpring, or ſpring detent; and to give a clear idea how it detaches the claw of the detent in paſſing forwards, but not in paſſing back again, it may be neceſſary to obſerve, that this lifting-ſpring has a pin in the circular piece B, againſt which it reſts, to prevent its laying too much hold on the back ſloping part of the detent's extremity; but it is at liberty to yield in the contrary direction towards the verge of the balance; and as the ſpring is very ſlender, and has its yielding point or centre of motion at the remote end *e*, it gives way to the detent in the direction that puſhes the detent againſt the tooth of the wheel, which becomes a prop to ſteady it; but when the impulſe is in a contrary direction, the detent, having no ſuch prop, and its end being at that ſide ſuited to receive the blow of the pin without its ſliding, itſelf yields and withdraws its claw from the wheel, which is then unlocked. The ſpring of the detent is alſo confined from rebounding too far by a pin *g* fixed in the plate. Here we have an inſtance of a retrograde ſtep in the improvement of eſcapements, the ſpring which Peter le Roy laboured to reject in his ſecond conſtruction is here reſumed with an additional ſpring, and the adoption of the *ſpring-detent* has become general in the ſubſequent conſtructions. Berthoud began his detached eſcapements in the year 1754.

26. *Another modification of a detached eſcapement by Berthoud.*—The eſcapement which Berthoud employed in ſome of his watches, particularly N° 60, was conſidered by him to be more ſure in its action than the preceding one, as well as more eaſy of conſtruction; *fig.* 5. of the ſame plate repreſents the plan of one of theſe eſcapements, where L is the eſcapement wheel; *m* the circle of eſcapement carried on the verge of the balance; *p o r* the detent, the claw of which at *r* ſuſpends the motion of the wheel; the verge carries above the circle *m* a ſmall tube made faſt by friction, and to this tube is made faſt a projecting forked claw, in which a pin is adjuſted to act on the detent and raiſe it. The pin, which we will call *s*, in turning in one direction, acts on the part *p* of the detent, and withdraws the claw *r* from the wheel; this is now at liberty to impel the circle *m* by its notch and with it the balance; the ſlender ſpring *u* brings back the claw of the detent, and the vibration goes on; at its return the pin meets with the end of the detent-ſpring fixed on an arm at *t*, this ſpring yields to the retrograde motion of the balance. The balance at its return makes its pin (of the fork) urge the ſpring *p* againſt a pin *s* in the arm *n* of the detent; this arm turning on its centre of motion, withdraws the claw of the detent from the wheel, which now acts again on the notch of the circle *m*, as before. The pin *q* ſerves as a ſtop to the detent, and the arm *k* of *precaution* is to lock the wheel when the balance is diſmounted.

27. *Another eſcapement without a ſpring by Berthoud.*—*Fig.* 6. of the laſt plate is a view of an eſcapement by Berthoud, in which he has diſpenſed with ſprings altogether. The action of the wheel A is tranſmitted to the balance, as before, by the notch of the circular piece B on the verge; the preſent poſition of the parts is for the moment when the detent allows the wheel to begin its action on the notch of B. The detent C has two arms, with each a claw *a* and *b*, the faces of which are circular; the claw *a* ſerves to ſuſpend the action of the wheel after its ſtroke is made; but the claw *b* receives the tooth of the wheel when the balance in its return makes the tooth at *a* to eſcape. Theſe effects are produced by two levers C *d*, C *e*, forming the fork that moves the detent C: this fork is fixed on the centre C of the detent, and its levers lie one above the other. The lever C *d*, which is contiguous to the detent, correſponds to the ſmall ſemi-circular piece *d e*, placed on the circle of eſcapement B; this ſemi-circle is notched by lines, one of which tends to the centre; this ſide of the notch unlocks the wheel by its action on the arm C *d* whenever the balance retrogrades from the firſt vibration of the pair; during this effect the wheel advances but a ſhort way, juſt ſufficient to unlock the claw *a*, and to ſuffer the balance to proceed in its retrogradation. The balance, having finiſhed in a detached ſtate this ſecond vibration, returns, when the ſemicircle *f g*, placed over the other ſemi-circle, and notched in like manner, preſents its acting ſide to the upper arm *f* C of the fork, and unlocks the tooth at claw *b*; at this moment another tooth, catching the notch at *c* of the circular piece B, gives it another impulſe, and conſequently puts the balance in a ſtate of renewed force, and the proceſs already deſcribed is renewed, while the ſemi-circular pieces *d e* and *f g* on the verge alternately ſerve to keep the arms C *d* and C *e* of the fork in a firm poſition to enſure the deſired effects of the eſcapement. It is eaſy to perceive that there muſt be much friction in this eſcapement, and that the ſemicircular pieces on the verge of the balance, if not ſomehow counterpoiſed, muſt affect the rate of going in different poſitions of the time-piece.

28. *Detached eſcapement with a detent and ſpring by Berthoud.*—*Fig.* 7. of the ſame plate is the plan of another of Berthoud's eſcapements with a detent and ſpring, and that which we underſtand has been moſt copied by others. It was uſed in the author's marine time-piece N° 9. A is the circle of eſcapement; C the wheel; *a b d* the detent with three arms; the arm *a* ſuſpends the motion of the wheel while the balance oſcillates in a free ſtate; the ſpring *d* ſerves to bring the detent *a* back again as ſoon as the pallet *c* has ceaſed to act on the arm *b*; at that moment one of the teeth of the wheel impels the circle by acting on the roller *h*, and communicates its force to the balance; this having finiſhed its oſcillation returns, and in the return the pallet *c* meets with the end *b* of the detent, which turns the pallet back towards B, the centre of the circle, till it has paſſed without unlocking the wheel; its ſpring *b* brings the pallet back again to its original ſtate of reſt on the pin at *c*, the oſcillation ceaſes, and in the return of the balance the pallet *c* again meets with the arm *b* of the detent, which it turns aſide, the tooth being no prop to it in this direction; the unlocking therefore takes place; the wheel's motion is reſumed, and a new impulſe is given to the moving balance. Here the detents are arms or levers acted on by a ſeparate ſpring, as is alſo the pallet, conſequently there ſtill remain pivots that require oil, though we are diſpoſed to conſider this as the beſt of Berthoud's watch eſcapements; perhaps equal to any of the Engliſh conſtructions.

29. *Iſochronal eſcapement of a watch by F. Berthoud.*—Among the other contrivances of Berthoud is an eſcapement for a watch with iſochronal pallets, ſimilar to thoſe applied to a pendulum which we have deſcribed above, but the mode of applying them is different. In *fig.* 8. of our laſt plate, A is the eſcapement wheel; B the anchor with the iſochronal pallets producing a ſmall recoil, and formed in the manner before deſcribed, (ſee *fig.* 1. of *Plate* XXXIII.) C D the balance; *a* a pinion on the verge above the wheel, that is actuated by a ſectoral toothed piece *b*, attached to the anchor of the pallets, and moving with it round the common centre of motion of it and the pallets at E; the intention of this conſtruction is to produce a long oſcillation of the balance compared to the motion of the wheel and toothed ſectoral piece, and to render all the oſcillations, however long or ſhort, of equal duration, the arcs of action being large in proportion to the whole oſcillations. This conſtruction

may have given riſe to that which is now known by the name of the Liverpool eſcapement, which ſo greatly reſembles it, that they may be conſidered as the ſame thing. We obtained a watch by Litherland of Liverpool, with a view of giving a ſeparate deſcription and drawing, but we found that the only difference is, that the pallets are placed a little on one ſide of the wheel, inſtead of the three pivots being in one ſtraight line, and that the centre of the pallet's motion is between the verge and pallets requiring a counterpoiſe behind: a further deſcription is therefore unneceſſary.

30. *Modern eſcapements of Engliſh chronometers.*—If we had not already anticipated our deſcriptions of the modern eſcapements for chronometers, as they are now made in England, we ſhould have given them a place here; but as we have been very minute in our account of the eſcapements of Meſſrs. Mudge, Arnold, the Brockbanks, and Earnſhaw, under our article CHRONOMETER, and have given drawings of them in our *Plates* XIII. XIV. and XV., it would be ſuperfluous to enter into a ſecond detail of the ſame here, and therefore we paſs over them by a ſimple reference to the article already named.

It may not be improper to mention here, that Mr. John Watkin, of Weſt Smithfield, has propoſed an alteration in the ſituation of the pallets in the modern ſpring-detent eſcapement, for which he received thirty guineas as a premium from the Adelphi Society, in the year 1804. His alteration conſiſts in bringing the pallets into a ſituation between the centre and circumference of the wheel, and making the wheel a contrate one with the teeth upwards. (See the Tranſactions of the Society, vol. xxiii. p. 375.)

31. *Mudge's forked eſcapement.*—Mr. Mudge contrived another detached eſcapement beſides the one we have referred to as already deſcribed, which we ſhall now notice, though he did not ſeem to place ſo much value on it as Emery, Margetts, and others have done after him; we ſhall not be able to make the reader comprehend the conſtruction without two figures: *fig.* 1. of *Plate* XXXV. is the plan of this eſcapement, and *fig.* 2. a profile or ſide view of the frame that contains the mechaniſm: A is the eſcapement wheel, B the anchor of the pallets, which are of Graham's dead-beat kind adapted to a watch, and which give the neceſſary force to the balance for maintaining its motion; *a* is the centre of motion of the anchor, nearer to the wheel than to the balance; *b* is the forked part of the anchor, the two prongs of which appear in *fig.* 1. to be cloſe together in the ſame plane, but *fig.* 2. ſhews that they are one above the other. The pallets are on the verge of the balance, and are of the cylindrical ſort, one above the other, ſo as to fall in the way of the two prongs alternately, pallet 1 is urged by *b*, and pallet 2 by the other prong in its turn; the time of action of the prongs on the two pallets is very ſhort, and the blows are made alternately one in each vibration; the remainder of the vibration is perfectly free, the wheel being in the intervals reſting on the circular portions or pads of the anchor's pallets, which may in this caſe be conſidered as detents and pallets alternately. A timepiece by Emery with this eſcapement performed with wonderful accuracy, though the detachment continues only for a portion of one vibration before the balance has its force renewed, which conſequently might be ſuppoſed to have its motion more diſturbed than if the impulſe had been given at each alternate vibration. The queen's watch by Mudge with this eſcapement had a ſlight recoil, which kept one of the prongs preſſing gently againſt the cylinder of the verge to ſteady the fork. The performance was excellent.

32. *Margetts' modification of Mudge's forked eſcapement.*—The late ingenious Margetts adopted Mr. Mudge's eſcapement, which we have juſt deſcribed, for his chronometers that indicated both ſolar and ſiderial time, but made ſome alterations with the fork. *Fig.* 3. of the ſame plate ſhews the plan and profile of Margetts' modification, where A is the wheel; *a b* the anchor moveable at *a*; *b* the fork where the prongs are in the ſame plane; *c* a piece of ſteel carrying a pin *e* under its extreme end that ſtrikes the prongs of the fork *b* alternately, one at each oſcillation of the balance *g*, which ſtrokes unlock the wheel; *h* and *i* are two banking ſcrews, the points of which act as ſtops to the anchor at oppoſite ſides of the centre of motion, and keep the fork in its place to be caught by the pin *e*, one or other of them at each vibration; *d* is a circular piece of metal, under the pallet piece *c*, that has a notch in it bounded by ſtraight lines going towards its centre; and *f* is a pin carried under the anchor, as ſeen in the figure, the end of which gives the circular piece *d* a puſh, by acting on its notched ſide at each unlocking of the wheel, thereby aiding the vibration: the pin *f* is always at the notch when the pin *e* is in the fork, therefore the notch in *d* and the pin in *c* are always placed in the ſame vertical line over one another, and as they move together on the verge will always remain ſo, while the pin *f* and fork *b* are alſo together on the anchor. The writer of the preſent article has a chronometer by Margetts with this eſcapement, which acts very well when ſtationary, but when carried in the pocket the pin is apt to catch the outſide of the prong, when any jerk has ſent the anchor back during the balance's excurſion.

33. *Modification of Mudge's forked eſcapement by R. Robin of Paris.*—R. Robin, a watch-maker of Paris, publiſhed a memoir in 1794, containing an account of a free eſcapement, which he conſidered as new, but which we conſider as another modification of Mr. Mudge's forked eſcapement, though we allow that in theory it appears to be an improvement. *Fig.* 4. of the ſame plate is a plan of this eſcapement, in which the wheel reſtores the exhauſted force of the balance once only in two vibrations, which circumſtance conſtitutes the improvement; to effect this, pallets G *a*, and G *b*, acting as detents, are made of unequal length from G, the centre of their motion, and the fork, which is ſeen ſeparately at *e*, as well as the tooth or pallet *d* and lever *f*, are concealed under B, the circular piece carried by the balance; the fork *e* is faſt to the end of one of the pallets *a*, inſtead of forming an anchor with the pallets, but this ſhape makes no difference in the action; the lever *f* is alſo faſt to the ſame underneath the fork; but the tooth *d*, which acts with the fork, is faſt to the verge under B, as we have already ſaid. We have given three poſitions of the circular part B and pallets, to ſhew more clearly the nature of the action, as ſome of the acting parts are concealed. One of the claws *a* of the pallets being removed, the wheel A eſcapes, and acts on the notch of the piece B, thereby aiding the balance; the claw *b* receives another tooth and holds it as a detent, and the balance finiſhes its oſcillation; at its return it unlocks the tooth at *b*, which is the longer pallet, and the wheel runs on a very ſhort way till a leading tooth falls on the pallet *a*, and the balance vibrates without a new puſh; at its return the tooth at *a* is unlocked, and its eſcaping tooth gives the notch of B another puſh, which ſerves for other two vibrations; but if the two ends of the pallets G *b*, and G *a*, had been of equal lengths, the eſcapement would have acted in the uſual way, and would have given its puſh at each oſcillation. The manner in which this effect is produced, however, does not yet appear evident; the lever *f*, which is faſt to the end *a* of the pallet or detent G *a*, reſts in a groove made in a circular collet on the verge, and holds the fork *e* from going on one ſide, like as the banking

ſcrews do in Margetts' eſcapement, then the tooth *d*, faſt to the balance, ſtrikes the two prongs of the forks alternately, one at each vibration, which ſtrokes make two unlockings during the time that one puſh is made to the balance by a tooth; becauſe the ſaid tooth previouſly made two ſteps forward, one long and one ſhort, before it eſcaped to make its puſh. We have not been informed how this modification performed, but we ſee no reaſon to doubt its competency, while we ſee much reaſon to admire the ingenuity of the application of two detents of unequal length, formed like the pallets of the anchor eſcapement, which detents we have named pallets on that account.

34. *Prior's modification of Mudge's forked eſcapement.*—In the year 1798 Mr. John Prior received 30 guineas as a premium from the Society for the Encouragement of Arts at the Adelphi, for his invention of what he conſidered a new detached eſcapement; but its fork differs from Mudge's principally in its having a roller for a pallet borne by an arbor carried by the balance itſelf; the wheel of eſcapement, together with its acting pallets, were ſimilar to Le Paute's improvement on Amant's wheel, and therefore had nothing original in it. The reader who wiſhes to ſee the account and drawings of this eſcapement, compoſed as it is of Mudge's and Le Paute's contrivances, which notwithſtanding the author might not have ſeen or known, may find it in the 16th vol. of the Tranſactions of the Society juſt named, and alſo in the 2d vol. of Nicholſon's Journal, 4to. ed. p. 363 and 364, where the editor has remarked that Mr. Croſthwaite of Dublin had made a pendulum clock with ſimilar pallets in 1788, which was deſcribed in the Memoirs of the Iriſh Acad. vol. ii.

Prior junior has very recently been rewarded by the ſame ſociety for another eſcapement contrived by him for a clock, but the account of it is not yet publiſhed in their Tranſactions, and therefore cannot with propriety be given here.

35. *Duplex eſcapement.*—We are not informed who was the original contriver of the eſcapement known by the name of *Duplex* eſcapement, a name probably taken from the circumſtance of its having a wheel with *two* ſets of teeth neceſſary for the eſcaping; neither are we aware of its date; but the eſteem in which it is held by thoſe who have tried it, entitle it to a place in our collection. *Fig.* 5. of *Plate* XXXV. exhibits on a large ſcale enough of the acting parts to enable us to convey an idea of its action. A B is a part of the eſcapement wheel, having teeth *a*, *b*, *c*, &c. at the periphery, intended for detaining the wheel while it oſcillates beyond the angle of action. An agate cylinder *d e f*, placed on the verge of the balance, acts with theſe teeth to produce the deſired effect. This cylindrical agate has a notch *d*, which paſſes by the tooth at D, that is ſuppoſed to reſt on the cylindrical ſurface, when the motion is in the direction *d e f*; but when the motion of the cylinder is in the contrary direction *f e d*, the tooth at D falls into the notch and accompanies it, preſſing on one of its ſides till the notch comes into the ſituation *d*: the tooth, then at the ſituation of *b*, eſcapes from the notch, and a ſucceeding tooth falls on the convex ſurface of the cylinder at D. The other ſet of teeth are erect on the plane of the wheel's rim, and are ſtrong and ſquared at the ſides; they ſtand a little ſhort of the middle of the ſpaces between the pointed teeth on the edge of the wheel, but conſiſt of the ſame number; they are to be ſeen at *h*, *i*, &c. denoted by darkened parallelograms: above the ſmall cylinder we have named as being made of agate, is a larger one E F G without a notch, and placed high enough on the verge to go over the edge of the wheel's rim; this bears a pallet of ruby or ſapphire G, long enough to fall in the way of the ſquare vertical teeth, when they happen to be near the line joining the centres of motion of the balance and wheel, but ſhort enough to avoid touching the teeth when not near that line. The larger cylinder is ſo placed with reſpect to the ſmall one, that when the tooth *b* has juſt eſcaped from the notch, the pallet G has juſt paſſed the ſquare tooth *h*, which was at A, while D reſted on the ſmall cylinder, but is moved from A to *h*, while D moves to *b*. The wheel is now free, and the tooth *h* exerts its force, derived from the main-ſpring, in the moſt direct way on the pallet G, and urges it forward till another tooth on the edge falls on the convex part of the ſmall cylinder *d e f*, and the ſame action that has been deſcribed is reſumed. The angle of action in this eſcapement depends partly on the length of the pallet G, and partly on the diameter of the ſmall agate cylinder, and advance of tooth D into the notch; for when a horizontal tooth on the edge falls on the ſaid ſmall cylinder, the motion of the wheel is arreſted, and the vertical ſquare tooth ceaſes to impel the pallet G ſo far as it otherwiſe would have done. This eſcapement requires very little oil on the ſmall agate cylinder, and none at all on the pallet G, which receives a direct puſh without friction, and its excellence is conſidered as at leaſt equal to that of Graham's horizontal or cylindrical eſcapement.

36. *Free eſcapement under the pendulum.*—The clock eſcapements which we have before deſcribed ſuppoſe a connection with the upper end of the pendulum, which is the moſt common connection, but there are eſcapements that give their impulſe at the inferior end, one of which is repreſented by *fig.* 8. of *Plate* XXXV. which we ſhall now deſcribe, though we know not who was its original contriver. The part A B D C is made faſt to the rod of the pendulum, and vibrates therewith; at B is a joint on which the lever B C is moveable; ſo that when the end C meets with any reſiſtance the lever mounts upwards at this end, but cannot fall below a horizontal line; it terminates in a claw with both an interior and exterior ſlope or inclined plane; D is a pallet of agate or other poliſhed ſtone, with a flat face next the end C of the lever, and made faſt into the vertical part A D; F G H I is a two-armed detent, moveable round H as a centre, but kept in its preſent poſition againſt the ſtop or pin K, by means of the weight G, when not otherwiſe acted on. In the preſent poſition the arm H I, which forms the detent, detains the tooth I of a vertical wheel of eſcapement, while the pendulum is ſuppoſed to be vibrating clear of all the teeth. Let us ſuppoſe the end C of the horizontal lever, moving with the pendulum, to be approaching the end F of the ſecond arm of the detent; preſently it gives the end F a blow, the lever C flies up, ſlides over the inclined face of F, and returns into its horizontal poſition; when the vibration terminates, the pendulum returns by virtue of its gravity, and the interior face of claw C catches the exterior one of the arm F, and gives it a pull ſufficient to draw the end of H I from the tooth I; the wheel is then at liberty to run on till the tooth E, moving faſter than the pendulum, overtakes the pallet D, and gives it a direct puſh forwards; this puſh aids the claw C to get over the claw of F, and the weight G replaces the arm H I to catch the following tooth M, which prevents the further impulſe of the wheel on the pallet D, and ſuffers the pendulum to finiſh its vibration in free ſpace; at the return of the pendulum the ſame operation is repeated, and the pendulum continues to receive one puſh at every two vibrations, and that when the pendulum is in its vertical poſition, or moving with its greateſt velocity, which we have ſaid is the moſt favourable point of the arc. The arc of action, before the pallet is quitted, depends greatly on

the radius of the wheel compared to the length of the pendulum, when the number of teeth is limited. The pendulum, however, ought to be of the compenſating kind, otherwiſe an increaſe in the length of the rod will derange the action of the claw C, with the claw F, as well as of the tooth on the pallet D, in all the extremes of atmoſpheric temperature. The maintaining power of the train that actuates the wheel E M may be either a ſpring or weight, as the mechaniſt may think proper. Berthoud has propoſed this conſtruction of a free eſcapement for a half-ſecond's pendulum in his " Hiſtoire de la Meſure du Temps," tome i. p. 214; but he does not clearly ſay that it was of his own contrivance; on examining his drawings, ſince our obſervations were written on this eſcapement, we find that this author propoſed a compenſation pendulum to be uſed with it; and he propoſes ſuch a combination of parts as a proper model for an aſtronomical clock to vibrate half-ſeconds. Mr. Nicholſon, who has alſo deſcribed the ſame eſcapement as one he has noticed in England, does not venture to aſcribe its invention to any particular artiſt.

37. *Detached eſcapement of a clock by Berthoud.*—Among the numerous contrivances of F. Berthoud in clock-work, we frequently find this author applying the ſame contrivance to anſwer different purpoſes; for inſtance, when he had hit upon an iſochronal eſcapement for a clock, he adapted it ſoon after, as we have ſeen, to a watch; and in the inſtance before us, he has converted a free or detached eſcapement of a watch into a clock eſcapement, which we ſhall here deſcribe, not knowing the exact date of the application. *Fig.* 1. of *Plate* XXXVI. is a repreſentation of an eſcapement of the third claſs adapted to a half ſecond's pendulum, as deſcribed by Berthoud himſelf. F is the eſcapement wheel, and *a*, *b*, the detents of eſcapement, (formed like the pallets of the dead-beat eſcapement of Graham,) the action of the wheel F is tranſmitted to the pendulum by means of the notch made in the circular portion of the eſcapement piece A B, thus; the detent has two claws, *a* and *b*, formed by portions of a circle, at the holding parts. The claw *a* ſerves to ſuſpend the action of the wheel, when it has communicated its motion to the notch of the eſcapement piece, which this does again to the pendulum, by means of the lever C, which it carries, and of the roller D, correſponding to the pendulum. The claw *b* ſerves to receive, and to detain the wheel, when the pendulum returns. Theſe effects are produced by two levers *d c*, *e c*, fixed on the centre *c* of the detent; but one of them more diſtant from the plane than the other. Theſe two levers form a fork that correſponds to the circle of eſcapement *b g*. The lever *d e*, which is neareſt to the detent, anſwers to one portion of the circle *g*, carried by the circle of the eſcapement D. This part *g* preſents a ſtraight line to the fork *d*, which being acted on, detaches the claw *a* of the detent, and, conſequently, ſets the wheel at liberty. The notch *f* preſents itſelf, and the tooth of the wheel acts on the notch, and reſtores to the pendulum the force that it had loſt. The wheel having finiſhed its action on the notch *f*, a tooth preſents itſelf to the claw *b*, and the pendulum finiſhes its vibration in a free manner, at its return, the portion of the circle *g*, which is moſt elevated, meets with the arm *e* of the fork, and diſengages the claw *d*; the tooth that was here detained now eſcapes, and runs on a ſhort ſpace before another tooth drops on the claw *a*, and the proceſs is repeated. We have not ſeen this eſcapement in England.

38. *Eſcapement by Mr. Nicholſon.*—Some time in the year 1784, Mr. Nicholſon ſays (Phil. Jour. vol. ii. 4to. p. 59.) that he contrived a clock eſcapement to go without oil, and which is of the dead-beat kind; it was conſtructed in the year 1798, and when the account was written had been going freely for a year or more. His account is this, *fig.* 2. of *Plate* XXXVI. "is a ſketch, in which G H repreſents a ſteel wheel; D and E are pallets of agate, with flat poliſhed faces. The pallet D is fixed to the lever D C, which is confined to its preſent ſituation by the loaded branch or arm C B reſting on the ſtop *k*. The lever E C is alſo kept in its ſituation by the loaded arm C A reſting upon I. A pin N proceeds from the pendulum rod to its ſituation between the levers. The centre of motion of the pendulum is in the continuation of the axis of the pallets. Suppoſe the vibrations to be begun; the pin N in its progreſs will lift the pallet D towards L, while part of the weight B will be ſupported by the tooth of the wheel which will follow, and at laſt eſcape and ſuffer the oppoſite tooth F to fall on the pallet E. But in its return, or deſcent, the pendulum will be acted on by the whole weight B, and, conſequently, its vibration will be kept up. When the pin N raiſes the pallet E, a ſimilar effect will take place on the ſide of the perpendicular towards M, and thus the proceſs will go on as long as the wheel G H retains any force." In this eſcapement, the two weights are not raiſed entirely by the action of the wheel, but are chiefly lifted by the pendulum itſelf; therefore though the vibration is made during the repoſe of the wheel, in a ſtate detached from the train, yet the pendulum is not detached from the weights, and, conſequently, the compound law of forces by which the pendulum is maintained conſiſts of the action of the pendulum's gravity, of the action of the ball's gravity, which acts in concert with the other, and of a ſhort action of the wheel on the agate pallet; this compound action differs from Mudge's and Cumming's in this reſpect, that their weights are raiſed by the wheel entirely without oppoſing the pendulum, otherwiſe than by the ſhort ſtroke made at unlocking.

39. *Crank eſcapement by Simon Goodrich.*—In the year 1799 the Adelphi Society rewarded Mr. Goodrich for his contrivance of a crank eſcapement, which is exhibited in *figs.* 3. and 4. of *Plate* XXXVI. of which *fig.* 3. is a front view, and *fig.* 4. a ſide view of the ſame, where the ſame letters of reference apply to both. A A A A is the back plate of a clock frame; B the crank fixed to the end of C the arbor of the laſt pinion of the train; D, D, are two ſmall wire chains, compoſed of two links only attached to the crank B, by means of two collets, with great liberty of play. Theſe chains are faſtened to E, E, two ſmall ſprings ſcrewed to F F F, a bar that goes acroſs, and is faſtened in the middle to G G, the crutch of the pendulum. I, I, are two ſcrews going through the bar F; the ends of which being made to act againſt the ſprings E, E, ſerve to adjuſt them to a proper diſtance and degree of ſtrength, and by that means eaſily to put the pendulum into proper beat. In *fig.* 3. the pendulum is partly repreſented by dotted lines, in order to ſhew the crank, &c. The advantages attributed to this conſtruction are, ſimplicity of conſtruction and conſequent cheapneſs; total ſilence during the eſcape; uniformity of action on the pendulum; durability and certainty of continuance; and the power of acting without oil. Theſe properties may recommend the eſcapement before us, but as its influence on the pendulum is conſtant, it is but ill calculated to counteract any irregularities in the maintaining power as tranſmitted and varied by the train under different circumſtances of wear, dirt, and friction. The originality of the contrivance is that of a rotatory motion converted into a vibratory one, which Soumille had done very nearly in the ſame way in the year 1746. (See Machines et Inventions approuvées par l'Academie Royal des Sciences; tome xiii. p. 325.) As there is no eſcapement wheel, a

further explanation is unneceſſary to every one who has ſeen a treadle in action; but it may be neceſſary to remark that an additional wheel and pinion muſt be requiſite in the train where the laſt pinion revolves more frequently than in other eſcapements.

40. *Eſcapement without a verge on the pallets by Ed. Maſſey.*—Mr. Maſſey's eſcapement without a verge was one of two eſcapements which together gained him twenty guineas from the Adelphi Society in 1803; the other, being of the 4th claſs, will be deſcribed in another place. *Fig.* 5. of *Plate* XXXVI. is a plan of this eſcapement, which is of a novel conſtruction, borrowed probably from the ſpring detent eſcapement of the modern chronometers, and adapted to a clock, where the pendulum is free, during a large portion of its vibration. The pendulum rod is ſeen at *a*, ſuſpended by a piece of watch ſpring in the uſual way, but without a crutch and verge; *b* is the ſwing wheel with its teeth ſhaped like the dead-beat kind, except that they are rounded at the end; this wheel is not within the frame as uſual, but on the outſide of the back plate; *c* and *d* are the arms of the pallets *f* and *g* reſpectively; theſe arms are attached to the frame, and are adjuſtable for the included angle by the ſcrews *h* and *i*, which preſs againſt the upper ends of the arms, that open like a pair of tongs, and are kept open by a ſlender ſpring *e* forced into notches at the ends. A croſs bar *k*, carried by the pendulum, gives alternate ſtrokes to the two pins fixed in the pallets *f* and *g*, at the time of unlocking. In the figure the pendulum is ſuppoſed to be in motion with the pin of pallet *g* reſting againſt the croſs bar *k*, which bar it impels on the returning vibration, and aids the pendulum, while the inclined plane of pallet *f* is raiſed by the wheel to give its ſtroke, when unlocked, in a contrary direction. Thus the pallets are raiſed partly by the wheel and partly by the pendulum, as is the caſe with Mr. Nicholſon's pallets; for the ſpring in this caſe performs the ſame office that the weight does in that; but in this eſcapement the inclined planes muſt require oil, which is not neceſſary in the other, where the wheel acts by a direct puſh without any ſliding motion. The inventor tells us, that a more than uſually large maintaining power is neceſſary when this eſcapement is adopted, which indeed muſt be the caſe with all detached eſcapements, where the duration of the impulſe is ſhort.

The reader may have obſerved that we have not yet noticed in this article the fourth claſs of eſcapements which act by the aid of *remontoirs*; this omiſſion has been intentional, not only for the purpoſe of avoiding the further enlargement of the article, but that we may give the hiſtory of the invention of the *remontoir*, and of its modifications by the different ingenious men, who have preferred its uſe to that of a detached eſcapement without ſuch additional aid. We have already had occaſion to ſpeak of Harriſon's and Mudge's auxiliary ſprings, or remontoirs, under our article CHRONOMETER, and it will ſuffice, for our preſent purpoſe, to name here that Huygens, Leibnitz, Gaudron, Haley, Breguet, De Lafons, Maſſey, Mendam, Antis, and others have taken a part in bringing the remontoir into notice, as we ſhall have occaſion to relate more particularly under the article REMONTOIR.

ESCARAY, in *Geography*, a town of Spain, in Old Caſtile; 5 miles S. of Calzada.

ESCARIGO, a town of Portugal, in the province of Beira; 12 miles N.W. of Penna Macor.

ESCARPE, or SCARP, in *Military Affairs*, relates to the exterior ſlope of each defence, while on the other hand the interior ſlope of every excavation beyond or facing the eſcarpe is deſignated the counter-ſcarp. It may be neceſſary to remark, that, in ſtrictneſs, the term is not applicable, except where ſome talus or ſlope is given to the exterior, though it is in very general and indiſcriminate uſe. Originally, when the ſides of hills, &c. were to be defended, it was found neceſſary to remove all ſuch maſſes as might afford cover to an approaching enemy, or enable them to aſcend to the aſſault; each rugged exuberance being in ſuch caſes adequate to the ſteps of a ladder, and offering a footing to the aſſailants.

To avoid this facility of attack, it became cuſtomary to chip away the prominent parts, and to render the ſurface inacceſſible; this was effected by eſcarping it, (from the French verb *eſcarper*, to cut ſteep or ſloping,) in ſuch manner as to render it impoſſible for any one to aſcend without the aid of ladders, &c.; giving at the ſame time a direct line of fire to the defenders, and enabling them to roll down ſtones, &c. with prodigious effect, upon ſuch as ſhould have the temerity to aſſault.

Latterly, however, the term has been applied to the exterior face of the works, whether the wall, or revetement, be inclined or perpendicular. Nor does the corruption ſtop here; for many are in the habit of calling the berm the eſcarpe, and of confounding the covert-way with the counter-ſcarp: whereas neither the eſcarpe nor the counter-ſcarp have any thing to do with the terre-pleine, or level ground; but are applicable ſolely to the inclined faces of the ditch and ramparts reſpectively.

It is true that modern engineers, who often allow their phraſeology to follow cuſtom rather than etymology, make little, if any, diſtinction between ſuch revetements as are inclined, and ſuch as are perpendicular: not that many opportunities exiſt for indulgence in this error; there being very few walls or revetements intended for military works, and eſpecially for the faces of parts ſubject to be battered, which have not a talus equal to at leaſt one-ſixth of their reſpective heights.

In ſome fortreſſes leſs reliance is placed on the artillery mounted upon the ſeveral works than upon the advantages afforded by the inclination of the eſcarpe. Thus, where a fort or redoubt is built upon a conical mound of rock, of which the interior may be excavated for lodging the defenders and their ſupplies, if the face of the cone be every where eſcarped to an angle of about 40°, or more, from the horizon, a very moderate perpendicular, ſay to the depth of ſeven feet, around the ſummit, will prevent any aſſailants, however numerous, from carrying the place by ſtorm; provided that perpendicular be properly manned and ſupplied with large ſtones, perhaps from twenty to a hundred pounds weight, which being rolled down the eſcarpe, invariably precipitate all who may be in the line of their deſcent; ſuch a defence is not to be overcome ſo long as vigilance is maintained, and a ſupply of ſtones is at hand.

In India, (as well as in other parts of the world,) ſmall forts are often eſcarped on this principle; there the ſtones held in preparation for defence, all along the interior of the parapet, are deſignated "Mut-wallahs," (*i. e.* drunken men,) in alluſion to the manner in which they roll, and in which thoſe whom they overſet are tumbled down to the plain below.

ESCARS, in *Geography*, a ſmall town of France, in the department of the Upper Vienne; 15 miles S.W. of Limoges, which, before the French revolution of 1789, conferred the title of count on the lords of the manor.

ESCARTELE', in *Heraldry*, quartered, or quarterly. See QUARTERING.

ESCATALENS, in *Geography*, a ſmall town of France, in the department of the Lot; 6 miles W. of Montauban.

ESCATARI, a ſmall iſland about 5 leagues N. of Louiſbourg, in the iſland of Cape Breton.

ESCATRON, a ſmall town of Spain, in the province of Aragon, above the conſluence of the Martin and Ebro, nearly oppoſite to Rueda, between Saragoſſa and Mequinenza.

ESCAUT, The, more generally known in England by its Flemiſh or Dutch appellation of the *Scheldt*, or *Schelde*, was formerly a river of Auſtrian Flanders, and is now a river of France, which gives its name to one of the northern departments. It has its ſource in the department of the Somme, near Beaurevoir, a few miles to the north of Saint Quentin, a town of the department of the Aiſne; runs by Beauvoiſi, Catelet, Homécourt, Crévecœur, Cambray, Houdain, Bouchain, Neuville, Denain, Valenciennes, Fraine, and Condé, where it becomes navigable, after having received the Aiſne; it then flows to Mortagne, where it receives the Scarpe; from thence it goes on to Tournay, Gand, and Antwerp, where it is 701 metres, or 360 fathoms wide, and 10 metres, or 30 feet deep at low water; the tide at high water riſes 15 feet. After having paſſed Antwerp, the Eſcaut branches out into two channels; the eaſtern one paſſes by Bergen-op-Zoom, the weſt channel, called the Upper Eſcaut, loſes itſelf between the iſlands of Zealand into the North ſea, near Fleſſingue or Fluſhing. From Antwerp to this place its courſe is 74 miles; it widens gradually, and has pretty nearly the ſame depth every where; but its bed is obſtructed by ſand-banks, which render its navigation difficult and dangerous.

The Eſcaut has a communication with the river Somme by means of a canal, part of which is under ground.

Escaut, *the department of the*, is the ninth department of the firſt region or United Countries (pays réunis) of France, and derives its name from the river Eſcaut (Schelde) which traverſes it from ſouth to north. It is compoſed of part of Auſtrian Flanders; its chief place is Gand. The limits of the department of the Eſcaut are to the north, the kingdom of Holland; to the eaſt, the departments of the Dyle and of the two Nethes, from which it is ſeparated by the Eſcaut; to the ſouth, the department of Jemmapes, and to the weſt, that of the Lys. Its principal rivers are the Eſcaut, the Lys, the Durenn, the Liévre, the Dender, &c.

There are ſeveral canals in this department; that which goes from Gand to Bruges, and from Bruges to Oſtend, is the moſt important. Another towards the north opens a communication between Rodenherpen and Sao-de-Gand; a third one, near Morbeck, communicates by one of its branches with Axel, and by the other with Hulſt. There are alſo ſeveral leſſer canals for the purpoſes of irrigation, or of draining low marſhy grounds.

The ſoil is in general fertile, and produces all ſorts of corn and vegetables, chiefly hemp, flax, and hops. It abounds in game. Domeſtic fowls and ſweet water fiſh are plentiful. The chief manufactures are thoſe of linen yarn, linen cloth, cobalt, Pruſſian blue, ribbands, woollen cloth, earthenware, glaſs, writing paper. There are alſo ſeveral paper mills, ſugar-houſes, ſalt-works, and bleaching grounds.

The territorial extent of the department of the Eſcaut is 2888½ ſquare kiliometres, or 159¾ ſquare leagues; its population 595,258, or 3720 inhabitants to the ſquare league. The whole department is divided into four diſtricts, Gand, Audenaërd, Termonde, and l'Ecluſe; 41 cantons, and 338 communes. The average contribution of every individual to the expences of the ſtate is about 9*s.* 2*d.* ſterling annually. Herbin Statiſtique de la France.

Escaut *and Meuſe, the department of the*, in Dutch the department of the Schelde and Maas, is one of the new diviſions of the kingdom of Holland, and is reported to compriſe the weſtern part of the ancient Dutch Brabant, Zealand, and the iſlands of the Maas or Meuſe. Middleburg is its chief place.

ESCH, a town of the duchy of Luxembourg, on the Sour; 7 miles W. of Dicrich.

Esch, in *Ichthyology*, a name given by Hildegard and others to the fiſh we call the grayling, or umber, and the generality of authors, the thymallus. It is of the coregonous kind, and is diſtinguiſhed by Artedi by the upper jaw being longer, and the back fin containing twenty-three bones. The Germans call it *aſch*, and the Italians *temello*. See Salmo *Thymallus*.

ESCHALLOT, *Cepa Aſcalonica*, in *Botany*, a ſpecies of onion, cultivated in gardens for its uſe in cookery, and nearly reſembling the Welch onion. See Cepa.

ESCHAR. This term, in *Surgery*, implies a portion of fleſh, deadened by the application either of actual fire or cauſtic ſubſtances. In caſes of violent burns we frequently ſee eſchars produced; and whenever we wiſh to make a common iſſue, for the relief of any ſuch diſeaſe as a white-ſwelling, a caries of the vertebræ, &c. we cannot accompliſh our object better, than by forming an eſchar with the kali purum cum calce vivâ. The ſeparation of an eſchar, or its detachment from the living parts, is a work of nature, being chiefly effected by the action of the abſorbent veſſels, which remove the particles of matter, connecting the dead and living parts together, ſo as to looſen the eſchar, and allow it to be taken away, without pain, bleeding, &c.

ESCHARA, in *Natural Hiſtory*, the name of a ſpecies of coralline, &c. the characters of which are theſe: they are of a ſtony or coral-like hardneſs, and reſemble a woven cloth in their texture; and the microſcope ſhews us that they conſiſt of arrangements of very ſmall cells, whoſe ſurfaces appear much in that form. (See Millepora.) For other ſpecies, ſee Flustra and Madrepora.

ESCHAROPEPA, a word uſed by the old writers in *Medicine*, to expreſs a coarſe kind of barley-meal, which had been torrified over the fire.

ESCHAROTICS, in *Surgery*, are certain ſubſtances and applications which, when put on any part of the body, occaſion an eſchar, or ſlough. Although the ſtrict meaning of the word eſcharotic is the ſame as that of *cauſtic*, yet, modern practitioners uſually underſtand by the firſt term ſome application that is milder in its action, than ſuch ſubſtances as are denominated cauſtics. By the latter, a ſurgeon generally means the kali purum, with or without quicklime, or the argentum nitratum, antimonium muriatum, &c. But by eſcharotics he commonly implies applications like the cuprum vitriolatum, hydrargyrus præcipitatus ruber, &c.

The chief uſe of eſcharotics, in the practice of ſurgery, is to deſtroy excreſcences, funguſes, and high exuberant granulations. When mixed with ointment, ſo as to have their action weakened, they are alſo ſometimes employed for ſtimulating ſores, which are of an indolent nature.

ESCHATON, in *Muſic*, the difference between the dieſis enharmonica and the hyperoche; that is, what remains, after taking the difference between the ſemi-tone minor and dieſis enharmonica, from the latter. Henfling, in Miſc. Berolin. vol. i. p. 279, 280.

Thus the difference between the ſemi-tone minor and the enharmonic dieſis is $\frac{25}{24} : \frac{128}{125} = \frac{3125}{3072}$, and this taken from ſrom the dieſis, is $\frac{128}{125} : \frac{3125}{3072} = \frac{393216}{390625} = 6\Sigma - f + m$, and is the *major reſidual;* which ſee. This interval is about $\frac{53}{100}$ of a comma, as will eaſily appear by logarithms. Mr. Henſling has taken notice of this interval. He calls it eſchaton, from its being the leaſt and the laſt interval that occurs in his ſyſtem.

The word is Greek, εσχατον. See Interval.

Eschaton of Dr. Callcott's MSS., is an interval whoſe ratio is $\frac{16,677,181, \&c.}{16,777,216, \&c.} = 5\ \Sigma + 2\ f$, and is the *greater reſidual*, which ſee.

ESCHE, in *Geography*, a town of Switzerland, in the canton of Uri; eight miles S.E. of Altorff.

ESCHEAT, Eschet, or *Echet*, formed from the French *eſchoir*, or *échoir*, *to happen*, in *Law*, denotes an obſtruction of the courſe of deſcent, and a conſequent determination of the tenure, by ſome unforeſeen contingency; in which caſe the land naturally reſults back, by a kind of reverſion, to the original grantor or lord of the fee. (1 Feud. 86. Co. Litt. 13.) This was one of the fruits and conſequences of feodal tenure: and is incident to tenure in ſocage, as well as to tenure in knight-ſervice; except only in gavel kind lands, which are ſubject to no eſcheats for felony, though they are to eſcheats for want of heirs.

The civilians call ſuch eſcheats, or forfeitures, *bona caduca*; and in the ſame ſenſe, as we ſay the fee is eſcheated, they ſay *feudum aperitur*.

The word *eſcheata* ſometimes alſo ſignifies a lawful inheritance deſcending on the heir. But then it is uſually diſtinguiſhed by the addition of *recta*; as *recta eſcheata*.

Escheat is alſo uſed for the place or circuit within which the king, or other lord, hath eſcheats of his tenants.

Escheat is alſo ſometimes uſed for a writ, lying where the tenant having eſtate of fee-ſimple, in any lands or tenements holden of a ſuperior lord, dies ſeiſed without heir, general or ſpecial: in which caſe the lord brings this writ againſt him that poſſeſſes the lands, after the death of his tenant; and thereby recovers the ſame in lieu of his ſervices.

ESCHEATOR, an officer who anciently took care of the king's eſcheats in the county, and certified them into the exchequer, or chancery.

He was appointed by the lord treaſurer; held his office only for one year; nor could any perſon be eſcheator above once in three years. But this office, having its chief dependence on the court of wards, is now out of date.

ESCHEFELD, in *Geography*, a ſmall town of Saxony, near Wolfftitz, in the circle of Leipzick, remarkable for its quarries of beautiful jaſper, known by the name of Bandſtein von Gnandſtein.

ESCHEL, in *Mineralogy*, a term uſed by the ſmalt-workers, to expreſs a ſort of grey ſubſtance reſembling aſhes, which is uſually mixed with the ſmalt when in fuſion. This is carefully ſeparated from it before it is powdered for uſe, otherwiſe it would debaſe the colour. Phil. Tranſ. N° 396.

ESCHELLON, or Eçhellon, in the military acceptation, is a term borrowed from the French language, in which it ſignifies a ladder; alluding to the regular and parallel gradations of any ſeries of lines, more or leſs inclined from any given baſe line. Thus if we ſuppoſe in *fig.* 1. *Plate* I. *Tactics*, the line A B to be divided into any given number of equal parts, as 1, 2, 3, 4, 5, 6, and ſuppoſe the left end of each diviſion to be moveable on a pivot, the other end ſwinging round at pleaſure, we ſhall find that thoſe ſeveral diviſions are capable of being moved forward, at the aſſumed angles from the baſe line A B.

Now it is neceſſary to be well underſtood, that, according to the military ſtep, the number of files from any given pivot will determine the number of paces to be taken to make a wheel, correſponding with a right angle: thus when the 8th file from the pivot makes eight paces in wheeling, the whole of the diviſion performing ſuch evolution will make a wheel equal to the quarter of a circle, becauſe all diſtances from the centre muſt invariably correſpond with the quarter of a circle, of which ſuch diſtances are reſpectively radius.

But the eçhellon movements are never underſtood to amount to the quarter of a circle; that being conſidered a full wheel, changing from line into column: yet the eçhellon is itſelf a ſpecies of column, diſpoſeable with equal promptitude either to flank or front; thus affording peculiar advantage, while it gives at the ſame time a parallel movement of a line, broken for the moment, into ſmall portions, towards any object obliquely ſituated towards either flank; in front or rear. Theſe important advantages have not been overlooked by modern tacticians, who have amply availed themſelves of the mutability thus afforded: conſequently we find the eçhellon adopted in the exiſting code of evolutions, on an unlimited ſcale.

It being aſcertained that the eighth file, by moving forwards eight paces in a regular curve on the given pivot, makes a wheel of one quarter of a circle; it is obvious, that any intermediate part, of which one pace is the multiple, may be wheeled, by taking the deſired number of paces; thus, four paces will make an octave, or the eighth part of a circle, which is the moſt frequent declination from the baſe line; two paces will give the ſixteenth of a circle, or the fourth part of a quadrant; and thus of any number.

Let us ſuppoſe it requiſite to change the front of a battalion to a new poſition, forming, as nearly as the eye could eſtimate, an angle of 75° from the baſe line A B. Now, as each ſtep of the eighth file gives a change of front equal to about eleven degrees, it is obvious, that ſeven ordinary paces will rather exceed the given angle; therefore, if very great preciſion ſhould be indiſpenſable, the eighth file ſhould make ſix long, and one ſhort pace, which would throw the whole battalion into eçhellon at ſuch an angle as would allow the ſeveral diviſions to march with a full front to their poſitions in the new line. This is a moſt important object; becauſe it admits the utmoſt freedom of individual movement, and avoids that oblique tendency which muſt be reſorted to whenever ſuch full frontage cannot be preſerved.

Eçhellon may be formed towards either flank; whether to the rear or to the front; the open column may be readily formed by wheeling ſo as to complete the quarter of a circle, including the original portion, and adding it to the ſupplement: both wheels being in the ſame direction. Thus if only the eighth of a circle was wheeled into eçhellon, another wheel, of another eighth, will be needful to bring the corps into open column.

To form the line from eçhellon; either a back wheel may be made equal to the wheel forward: thus, if a battalion has broken into eçhellon by wheeling an octave *to* the right, it will, by wheeling *back* an octave *on* the right of diviſions, be inſtantly formed into line. In this inſtance the right flank gives the point d'appui. But if the left is to give it, there the whole of the diviſions muſt wheel *forward* on their left pivots, as many degrees as were included in the original wheel to the right. If the firſt wheel was only the

16th part of a circle to the right, the complementary wheel to the left muſt be equal to only one ſixteenth. In ſaying this, it is neceſſary to be underſtood, that all the diviſions are ſuppoſed to be of equal ſtrength; otherwiſe it will be indiſpenſably neceſſary that the reſpective pivots, which are to guide the alignement, be properly dreſſed; that is, cover correctly, before any wheel is made under their guidance.

Eçhellon diviſions do not always move with a full front towards that point on which the wheel is made; on the contrary, it is often expedient to wheel to the right, when the new front is towards the left. This is done for the purpoſe of giving the flanks of the diviſions a proper direction, that they may reſpectively march by files, towards their ſtations in the new line; and is particularly neceſſary in broken ground, as well as in countries covered with wood. The ſeveral leaders of files muſt, in this caſe, be extremely correct in maintaining their original direction; attending to their ſeveral pivot-men, if ſuch be in ſight: where that guide cannot be afforded, the greateſt care muſt be taken to obſerve any two diſtant objects that may be in the given direction; ſo as to proceed, as nearly as poſſible, to the appointed ſpot.

From the foregoing it will be collected, that, while *direct* changes of front are made by full wheels (*i. e.* the quarter of a circle,) to either right or left, oblique changes are effected by means of a due degree of paralleliſm, produced in conſequence of wheeling in any proportion leſs than the quarter of a circle. Therefore, as the code of regulations now in uſe for the movements of battalions properly inculcates, the eçhellon poſition and movements are not only neceſſary and applicable to the immediate attacks and retreats of great bodies; but alſo to the previous oblique or direct changes of ſituation, which a battalion, or a more conſiderable corps, already formed in line, may be compelled to make, to the front or the rear, or on a particular fixed diviſion of the line.

When a battalion marches in eçhellon its route muſt be on the reverſe principles of Marquois's parallel rule, which conſiſts of a ſcale, having a triangular piece ſliding at liberty along its edge, as ſhewn in *fig.* 2. In that the inclined plane A B even follows a line not perpendicular to its front, and this is the main diſtinction between the eçhellon movement and the oblique-ſtep; the former may continue for any diſtance, rather giving eaſe, than proving unuſually fatiguing, to the men; whereas the oblique-ſtep is peculiarly diſtreſſing, if kept up for a length of time; while it beſides poſſeſſes the great diſadvantage of gaining but little ground. In the above figure the line A B may proceed the whole length of C D, without gaining ground towards its oppoſite, or exterior flank B; becauſe it is, in a manner, fixed by the inner flank A, which may be ſaid to run in a groove on the line B C; whereas if we applied the eçhellon movement to the line A B, that is perpendicular to its own front, its courſe would be according to A E, B F, and ground would be gained to its right, as well as to its front, in exact proportion to the angle D A B; if that be ſmall, there will be a greater tendency to the front of the line C D, than towards its left flank, and *vice verſâ*; ever carrying in mind, that ſo ſoon as the wheel amounts to a quarter of a circle, the term eçhellon is annulled.

We ſhall here exhibit the uſe of an eçhellon movement as applicable to the reinforcing of a line advancing at the *debouchure* of a *detroit*; where, in conſequence of the regular expanſion, it becomes neceſſary to keep adding to either, or perhaps to both flanks, in order to prevent the enemy from penetrating; ſo as to attack the rear. It may be expedient to obſerve that not only companies, but whole battalions, may form in eçhellon; and that it is an evolution ſuited equally to cavalry and to infantry. When a park of artillery has to flank an enemy, in a poſition where the proper line cannot be aſſumed, ſo as to bring the ſeveral guns to a line perpendicular to the direction of their fire, they muſt then, properly ſpeaking, be individually in eçhellon. Thus when guns are mounted in *barbet*, (*i. e.* where there are no embraſures, the muzzles traverſing over the parapet,) whenever the object does not bear at right angles with the face of the battery, each gun is obliqued, and the ſhots fired from the whole would repreſent the movements of diviſions thrown into eçhellon. *Fig.* 3. ſhews a line forming as the army iſſues from a detroit, the ſeveral battalions compoſing it being allowed to reinforce the centre until due ſpace be gained for the whole to wheel into eçhellon. Now it will be ſeen, that each battalion formed in column, in by files, ſucceſſively aſſumes a poſition perpendicular to that line; but, that when ſpace admits, the wheel is made, whereby each diviſion is directed towards the poſt it will occupy on the flank, as the expanſion takes place. Here S S is the line, and O P the battalion deſtined to cover the right flank; its ſeveral diviſions, being thrown into eçhellon, muſt in their progreſs fall into their reſpective poſts, at the new poſition *a a* one after the other, filling up the augmenting ſpace with celerity and exactneſs. It is, however, to be underſtood, that each, as it approaches its ſituation in line, muſt accelerate or retard its pace according to circumſtances; ſince it cannot be expected that the ground will expand with perfect regularity.

In caſe of an attack, in which the enemy may ſucceed in getting round the flank, thoſe diviſions cloſe to that flank muſt wheel back into line; leaving to two or three of the rear diviſions to join on their flank in the direction of the eçhellon front; thus forming a re-entering angle, effectually cutting off the enemy's progreſs, and ſubjecting him to a concentrated fire; as ſhewn by the dotted poſitions at E. The dotted lines emanating from the ſeveral eçhellons ſhew their direction when marching: their prolongation would ſhew how they would fall in on the flank, ſo as gradually to extend the front; compleating the new line *a a*. When neceſſary, the ſame operation is performed towards the left.

It has been obſerved that the eighth file gives a determinate meaſurement, in regard to the wheel of diviſions into eçhellon; it is therefore expedient, when the given direction is aſcertained, to cauſe the eighth file to ſtep out the required diſtance, (ſay four paces for the eighth of a circle,) obſerving, that his advance muſt be on a wheeling principle: that is to ſay, curved; the pivot being conſidered as the centre, and the diſtance between that and the eighth file being radius. Each diviſion thus ſending forth its eighth file, the whole are ordered to wheel until thoſe files are reſtored to their places in their diviſions: during the wheel of the diviſions, each muſt neceſſarily remain motionleſs; that all may dreſs by them; ſo as to give a true parallel throughout the line of eçhellon.

ESCHENAU, in *Geography*, a town of Germany, in the archduchy of Auſtria; eight miles S. of St. Polten.

ESCHENBACH, a town of Germany, in the circle of Bavaria, and Upper Palatinate; 34 miles E.N.E. of Nuremberg.

ESCHENBERGA, a ſmall town of Germany, in the duchy of Saxe Gotha, with a population of 504 inhabitants, remarkable for its trade in madder. It was anciently of more importance.

ESCHERSHEIM, a town of Germany, in the circle of the Upper Rhine, and county of Hanau-Munzenberg; 10 miles.

10 miles W. of Hanau, and 3 N.N.W. of Francfort on the Main.

ESCHEVIN, or Echevin, *Scabinus*, in the French and Dutch *Polity*, a magiſtrate elected by the inhabitants of a city to take care of their common concerns, the good order, conveniency, and decoration of the city, &c.

At Paris there is a prevot and four eſchevins; in moſt other cities a maire, or mayor, and eſchevins. In Languedoc, Provence, and Dauphiné, they are called *conſuls*; at Thoulouſe *capitouls*; and *jurats* at Bourdeaux.

Anciently, the eſchevins were the aſſeſſors and counſellors of the comites, or judges of cities; on which account they were called, in ſome places, *pairs*, *pares*; they even took cognizance of petty cauſes themſelves.

Du-Cange obſerves, that the judges, and their aſſeſſors, who were choſen by the inhabitants, were called *ſcabini*, eſchevins, and their college, *ſcabinagium*, or *eſchevinage*. He adds, that ſome authors call them *paciarii*, becauſe their office and juriſdiction extended to the ſecuring peace in their city and baulieue, called *pax villæ*.

In Holland, the *ſcabins*, or eſchevins, judge of all civil affairs at firſt hand. They alſo take cognizance of criminal matters; and if the criminal confeſs himſelf guilty, they can ſee their ſentence executed without appeal. They can even give torture. The number is not the ſame in all cities; at Amſterdam there are nine, at Rotterdam ſeven, &c.

ESCHLBERG, in *Geography*, a town of Germany, in the archduchy of Auſtria; 14 miles S.W. of Freuſtadt.

ESCHLKAMP, a town of Germany, in Lower Bavaria; 3 miles E. of Furth.

ESCHRAKITES, or Esrakites, a ſect of philoſophers, among the Mahometans, who adhere to the doctrines and opinions of Plato.

The word is derived from the Arabic שרק, *ſchraka*, which in the fourth conjugation אשרק, *aſchraka*, ſignifies *to ſhine, glitter like the ſun*; ſo that Eſchrakite ſeems to import *illumined*.

The Eſchrakites, or Mahometan Platoniſts, place their higheſt good and happineſs in the contemplation of the Divine Majeſty; deſpiſing the groſs imaginations of the Alcoran touching Paradiſe. See Mahometanism.

They are very careful in avoiding all vice; they preſerve an equal and eaſy temper, love muſic, and divert themſelves with compoſing little poems, or ſpiritual ſongs. The ſheics, or prieſts, and the chief among the preachers of the imperial moſques, are Eſchrakites.

ESCHWEGE, in *Geography*, a ſmall town of Germany, in the landgraviate of Heſſe Caſſel, which now forms part of the new kingdom of Weſtphalia. It is ſituated on the Werra, 33 miles E. of Caſſel, near a lofty hill called the Meiſner, which has ſome coal-mines. Eſchwege is a place of high antiquity.

ESCHWEILLER, a ſmall town of France, in the department of the Roer, chief place of a canton, in the diſtrict of Aix-la-Chapelle, with a population of 1713 individuals. The canton has 18,588 inhabitants, diſperſed in 28 communes.

ESCHYLUS. See Æschylus.

ESCHYNOMENOUS Plants. See Æschynomenous.

ESCLAIRCISSEMENT, or Eclaircissement, a French term, which we find retained in ſome late Engliſh writers; it properly ſignifies the act, or effect, of clearing a thing, or rendering it more bright and tranſparent; being formed from the verb *eſclaircir*, to clear, &c. It is chiefly uſed in a figurative ſenſe, for an explanation of an obſcurity or difficulty. The eſclairciſſement of difficult paſſages in the bible, is to be ſought for from ſimilar paſſages, or paſſages of the like kind occurring in other places.

ESCLAME, in the *Manege*, an obſolete French word, formerly uſed to ſignify a light-bellied horſe.

ESCLATTE', in *Heraldry*, is applied to a thing violently broken. Thus a bend or rather partition, eſclatté, is repreſented torn, or broken off, like a ſhield ſhattered with the ſtroke of a battle-ax.

ESCOBAR, Anthony, ſurnamed *De Mendoza*, in *Biography*, a Spaniſh Jeſuit, who flouriſhed in the beginning and middle of the ſeventeenth century. The opinions which he maintained have been cenſured by more modern writers; and the principles of his morality have been expoſed by Paſchal in his "Lettres Provinciales," and by other authors of leſs note. He left behind him many works, among which are "Theologia Moralis;" "Commentaria in Vetus et Novum Teſtamentum;" and "Examen y Pratica de Confeſſores." Moreri.

ESCOL, in *Ancient Geography*, a valley or torrent of Paleſtine, in the ſouthern part of the tribe of Judah; mentioned in the book of Numbers.

ESCORT, in *Military Affairs*, ſignifies that guard granted, either under military authority, or of military perſons, for the ſafe conveyance of perſons, property, &c. from one place to another. This may be ſaid to diſtinguiſh an eſcort from a convoy; the latter being generally applicable to ſuch extenſive affairs as relate rather to the guarding of ſupplies, &c. on their way to an army, or to a fortreſs. The extent of an eſcort is uſually proportioned either to the dignity of the perſon attended, if it be meant as a compliment; or, if of treaſure, according to the ſum, and the dangers lying in the way. In ſome caſes, eſcorts are taken only from particular corps; as, for inſtance, thoſe which attend upon his majeſty, which are ſelected from certain regiments only, unleſs on extraordinary occaſions. When an eſcort is employed on ſuch an occaſion, its commander is uſually placed under the orders of the perſon to be guarded; but when treaſure, priſoners, &c. are in queſtion, the commander is in every reſpect paramount; he being reſponſible for the ſafe arrival, and the delivery, of whatever is under his charge. Such is the ſtrictneſs with which the reſponſibility of an eſcort is upheld, that a few years back, when a deſerter who was under charge of a guard made an attempt to abſcond, one of the party fired at him, but unhappily miſſing the fugitive, killed an unfortunate paſſenger in the ſame ſtreet; the man who fired was conſidered to have done no more than his duty. We naturally view ſuch an occurrence with much concern, and commiſerate the ſufferer; but when we contemplate what might have been the ſituation of the ſoldier, had he omitted to do his beſt towards preventing the eſcape, though we cannot exactly applaud his conduct, we muſt aſſuredly ſee much in extenuation of the manſlaughter.

When travelling any diſtance, and that ſpeed is eſſential, it is uſual to relieve the eſcorts, when convenient, at certain ſtages. In ſuch caſe, it behoves the commander of each party to be very careful in examining every matter previous to taking charge. If there be treaſure, or other valuables, &c. under ſeal, the impreſſions ſhould be minutely inſpected; and if the articles, or packages, be numerous, but more eſpecially if ſubject to damage, he ſhould cauſe the whole to be counted, and aſcertain, in the preſence of the perſons from whom he receives them, the exact ſtate and appearance, noting every point worthy of obſervation in the way-bill, and excluſively giving a receipt, in which all caſualties or deficiencies ſhould be fully deſcribed. This inſpection ſhould always be made in the preſence of others of his own party, and it would not be amiſs were he to cauſe them to atteſt the condition in which the articles ſhould be, at the time of his receiving charge. Should any accident take place while under his own protection, the hour, the place, and the cauſe, ought to be in like manner noted, ſo ſoon as poſſible, under the certificate of credible perſons on the ſpot; or at leaſt of ſome of his own party. By ſuch precautions much imputation will be avoided; while at the ſame time a character for correctneſs, and for aſſiduity, will be gained.

ESCOT, L', in *Geography*, a ſmall town of France, in the department of the Lower Pyrenées; 6 miles S. of Oleron, remarkable for a cooling mineral ſpring.

ESCOUADE, or SQUAD, is uſually the third or fourth part of a company of foot; ſo divided for mounting guards, and for the more convenient relieving of one another. It is equivalent to a brigade of a troop of horſe. See BRIGADE.

ESCROL, or SCROLL, in *Heraldry*, a long ſlip, as it were, of parchment, or paper, wherein a motto is placed.

Leigh obſerves, that no perſon, under the degree of a knight, might, long after king Henry V. place his creſt on a wreath, as is now uſually done, but only on an eſcrol.

ESCROW, in *Law*, a deed delivered to a third perſon, to be the deed of the party making it upon a future condition when ſuch thing is performed; and then it is to be delivered to the party to whom made. It is to be delivered to a ſtranger, mentioning the condition; and has relation to the firſt delivery. 2 Roll. Abr. 25, 26. 1 Inſt. 31. See DEED.

ESCU, or ECU, the French crown, of ſixty ſols, or three livres. The eſcu was thus called, becauſe the eſcutcheon, or arms of France, which they call eſcu, was ſtruck thereon. See COIN.

ESCU, *Emaux de l'*. See EMAUX.

ESCUAGE, or SCUTAGE, an ancient kind of knight's ſervice, called alſo "ſervice of the ſhield;" the tenant holding by which was obliged to follow his lord to the Scottiſh or Welſh wars, at his own expence. But perſonal attendance being inconvenient, the tenants compounded for it by a pecuniary ſatisfaction, which was levied by aſſeſſments at a certain rate for every knight's fee; and thus it became a pecuniary in lieu of a military ſervice. The firſt inſtance that occurs was in 5 Hen. II. on account of his expedition to Toulouſe; it afterwards became more general and oppreſſive; ſo that king John was obliged to conſent, by his Magna Charta, that no ſcutage ſhould be impoſed without conſent of parliament; but the clauſe was omitted in the charter of Hen. III. which directs, that it ſhould be taken as it is uſed to be in the time of Henry II. or in a reaſonable and moderate manner. However, it was afterwards enacted by ſtat. 25 Edw. I. cap. 5 and 6. and many ſubſequent ſtatutes, that the king ſhould take no aids or taſks but by the common aſſent of the realm; and it appears that ſcutages were the ground work of all ſucceeding ſubſidies, and of the land-tax of later times. Blackſt. Com. vol. ii. p. 74.

ESCUAGE was alſo a reaſonable aid, demanded by the lord of his tenants, who held of him by knight's ſervice. See AID.

"Conceſſerunt domino regi ad maritandum filiam ſuam de omnibus qui tenent de domino rege in capite de ſingulis ſcutis 20 ſolidos ſolvendos." Matt. Paris, anno 1242.

ESCULAPIUS. See ÆSCULAPIUS.

ESCULENT, in *Gardening*, is a term frequently applied to ſuch roots or plants as are replete with nutritious matter, and conſequently proper for being eaten as a food. Carrots, parſnips, turnips, cabbages, and various others of a ſimilar nature, are of this kind.

ESCULUS, in *Botany*, a name given by many authors to the phagus, or ſweet oak, called alſo the eſculent oak.

ESCULUS, or *Æſculus*. See ÆSCULUS.

ESCURA, in *Geography*, a province of the empire of Morocco, called by Leo Africanus *Aſcora*, which, together with that of Ramna, formerly compoſed only one government. It has been divided to keep the people of theſe countries, ſo near to the mountains, more eaſily in ſubjection. Ramna and Eſcura have the province of Morocco to the ſouth, that of Duquella to the weſt, the river Morbeya to the north, and mount Atlas to the eaſt.

ESCURIAL, by the Spaniards written *Eſcorial*, a term that denotes the place of reſidence of the kings of Spain. Eſcurial originally ſignifies a little village in Spain, ſituated in the kingdom of New Caſtile, 22 miles to the N.W. of Madrid, on the ſide of a chain of mountains, called by ſome the Carpetane, or Carpentanian mountains, and by others the Pyreneans, as being the branch of the Pyrenean ridge, and environed by wood-lands and green fields. Here king Philip II. built a ſtately monaſtery of the order of St. Jerom, held by the Spaniards for one of the wonders of the world, and called the Eſcurial. It was begun in 1557, and finiſhed in about twenty-two years, at the expence of ſix millions of piaſtres.

Fa. Franciſco de los Padros, in a deſcription thereof, intitled "Deſcription breve del Monaſterio de S. Lorenzo el real del Eſcorial, &c." aſſures us it was built by that prince in memory of the battle of St. Quintin, gained on the day of St. Laurence, Lorenzo, a famous Spaniſh ſaint, and at his interceſſion; accordingly the plan of the work reſembles a gridiron, the inſtrument of the ſaint's martyrdom.

The king and queen have their apartments there; the reſt being poſſeſſed by the monks. Whence many of the great tranſactions of that court are dated from the Eſcurial.

This ſuperb palace is a long ſquare, 740 by 580 Spaniſh feet, beſides 460 for what may be termed the handle of the gridiron. The height of the roof is 60 feet; and at every angle is a ſquare tower, 200 feet high. In the weſt front there are 200 windows, and 366 in the eaſt.

The Eſcurial has a very fine church, the dome of which is 330 feet, ſupported by four rows of pillars, and paved with black marble, containing 40 chapels, and 48 altars. To this church Philip IV. annexed a beautiful mauſoleum, called the Pantheon, or Rotondo, built on the plan of that temple at Rome, 36 feet in diameter, and incruſted with marble; in which the kings and queens of Spain, who leave any poſterity, are interred; the reſt being laid in another vault of the ſame church, together with the infantas, and other princes.

The palace poſſeſſes every convenience and ornament that can render a place agreeable in ſo hot a climate; ſuch as an extenſive park, groves, fountains, caſcades, grottos, &c. The adjacent country contains ſpecimens of all the mineral ſubſtances, ſtones, earths and vegetables, which are found in other parts of the kingdom. The library belonging to this palace is ſaid to conſiſt of 30,000 volumes, contained in two magnificent apartments, each 194 Spaniſh, or ſomewhat more than 182 Engliſh feet in length. In the lower room are chiefly printed books; and in this is depoſited the famous MS. of the four goſpels, written in gold letters, ſaid to be a work of the 11th century. Over theſe are collected 4500 MSS., of which 567 are Greek, 67 Hebrew, 1800 Arabic, the latter of which are well deſcribed in a catalogue publiſhed by Caſiri. In the middle of the lower room is a temple, with a great variety of figures, containing 1448 ounces of ſilver, and 43 of gold, beſides rich gems. In every part of the convent of the Eſcurial, are ſeen the works of the beſt maſters, and ſome of them moſt capital performances. The beſt of the pictures are collected in five principal apartments; the great ſtaircaſe is beautiful, adorned with freſco-paintings of the battle of St. Quintin, by Luca Jordano. The ſituation of the Eſcurial, as a reſidence, is not pleaſant: expoſed, as it is, to the full ſtroke of the meridian ſun, and raiſed up near to regions covered with eternal ſnow; without ſhelter and deſtitute of ſhade, it has no local charms at any ſeaſon of the year. (Townſend's Travels, vol. 2.) Part of this ſuperb palace was burnt in 1671.

ESCUROLLES, in *Geography*, a ſmall town of France, in the department of the Allier, chief-place of a canton, in the diſtrict of Gannat, with a population of 1042 individuals. It is 6 miles N. of Gannat. The canton contains 15 communes, and 11,408 inhabitants, on a territorial extent of 237½ kiliometres.

ESCUTCHEON, or SCUTCHEON, in *Heraldry*, the field or coat, wherein the bearing, or arms, of any perſon are repreſented.

The word eſcutcheon is formed of the French *eſcuſſon*, and that from the Latin *ſcutum*, ſhield; which was the place arms were originally borne on, before ever they came on banners; and ſtill, wherever they are placed, it is on ſomething repreſenting the form of a ſhield. The Latin *ſcutum*, no doubt, came originally from the Greek, *σκυτος*, *leather*, wherewith the ſhields were uſually covered. See SHIELD.

The eſcutcheon is of a ſquare figure, excepting the bottom part, which is uſually a little rounded, ending in a point in the middle.

Till within a few hundred years, the eſcutcheons of the French and Engliſh were triangular; thoſe of the Spaniards are ſtill quite round at bottom, without any point; thoſe of the Italians are oval; and thoſe of the Germans in form of a catoozes.

The ancient eſcutcheons were generally couched, or inclined; and they only began to place them upright, when crowns, &c. were put over them by way of creſt.

In France *eſcuſſon*, eſcutcheon, was formerly reſtrained to a ſhield, or coat, pointed at bottom; by which it was diſtinguiſhed from the eſcu, which was quite ſquare, and was only allowed to be borne by the counts and viſcounts. Thoſe of the inferior quality were confined to the eſcuſſon or pointed eſcu.

The ſeveral parts or points of the eſcutcheon have their proper names: the point A, for inſtance, is the dexter chief point; B the middle chief; and C the ſiniſter chief point; D is the honour point; E the feſſe point; F the nombril point; G the dexter-baſe; H the middle; and I the ſiniſter baſe point. See *Plate* of *Heraldry*.

The dexter ſide of the eſcutcheon anſwers to the left hand, and the ſiniſter ſide to the right hand of the perſon that looks on it.

The eſcutcheon is differently denominated, according to its diviſions. It is called dextered, when the perpendicular line that divides it is to the right of a third part of the eſcutcheon; ſiniſtered, when on the left; tierced in pale, when this line is double, and divides the whole eſcutcheon into three equal parts; paled, when increaſed to the number of ſix, eight, or ten. A horizontal line makes the chief, when at one third part from the top; the plein, when at a third from the bottom; and when double, in the middle at an equal diſtance from both extremes, it makes the feſſe, and the tierced in feſſe: when it is multiplied, it denominates it feſſed; when there are eight or ten equal ſpaces burrelle. A diagonal from the dexter point of the chief to the ſiniſter of the baſe, makes it tranché; the contrary doublé; if it be double at equal diſtances the firſt makes bandé, and the tierce in bend; and the other barre, or tierce in bar; increaſing the number of the firſt makes bandé, and cotticé; and increaſing that of the ſecond barré, and traverſe.

ESCUTCHEON *of pretence*, is an ineſcutcheon, or little eſcutcheon, which a man who has married an heireſs, and has iſſue by her, may bear over his own coat of arms, and in it the arms of his wife; and, in this caſe, the ſurviving iſſue will bear both coats quarterly.

ESCUTCHEON, in *Sea Language*, a name ſometimes given to the compartment for the names or arms of the owner, or of the perſon whoſe title the veſſel aſſumes. It is uſually fixed on the middle of the ſhip's ſtern; and is more peculiar to the French, and other foreigners, than to Engliſh-built veſſels. Falconer.

ESCUTCHEON, *Secret*, is a contrivance to be placed before a lock, which cloſes up, and conceals the key-hole, and renders it inacceſſible for any perſon except the owner, who is acquainted with the ſecret.

The marquis of Worceſter appears to have invented ſome ſecret eſcutcheons, for in his "Century of Inventions," publiſhed in 1663, at N° 72, after having ſpoken of three kinds of locks invented by him, ſays, "an eſcutcheon to be placed before any of theſe locks with theſe properties:

"The owner, though a woman, may with her delicate hand vary the ways of coming to open the lock ten million times beyond the knowledge of the ſmith that made it, or of me who invented it."

Many attempts have been made to form a machine equal in its properties to the deſcription here given; and from thence, it is probable, aroſe the kind of padlocks which have been long made in this country, in great numbers, which having ſeveral letters on different rings, can only be opened when a certain ſet of thoſe letters is arranged in one order; but this was in no degree equal to the end propoſed; for beſides the workman who made it, being at all times informed of the poſition the letters muſt be in, and conſequently enabled to open it, the letters and rings admitting of no variation of place, at the will of the owner; reſerving, at the ſame time, a power of opening the locks; whenever the proper arrangement became known, the ſecret was divulged, and all ſecurity at an end; but by the improvement lately made by Mr. Marſhall (for which the Society of Arts rewarded him with ten guineas,) the letters or figures allowing an almoſt infinite variety of changes, the owner may, in one minute, alter the ſecret in ſuch a manner, that even the maker would be as unlikely to open it, as he would be of gaining the higheſt prize in a lottery, by the chance of a ſingle ticket. Thus this kind of eſcutcheon is infinitely more ſecure than any hitherto in uſe, eſpecially as the alteration of the letters may be made every day for years, without recurring to their firſt ſtate; and as the owner may at one time chuſe to truſt a friend, or a domeſtic with the ſecret, ſo that they might have recourſe to his valuables, &c. he may alſo at another time wiſh to exclude them from that privilege, which this contrivance renders very eaſy to be done. As this improvement relates only to the eſcutcheon, it is obvious that every attempt to pick the lock it covers, or to open it by means of falſe keys, is prevented; a circumſtance of no ſmall importance, when locks of a curious conſtruction, and when a number of fine wards are made uſe of.

The eſcutcheon for which the bounty was given is reſerved in the repoſitory of the ſociety for the inſpection of the public.

Figs. 2, 3, 4, 5, 6, 7, 8, and 9, *Plate* XII. *Miſcellany*, repreſent this contrivance: *fig.* 3. is a view from behind the machine, ſuppoſing it to be firſt removed from the door. *Fig.* 2. is an elevation of the machine, as it appears upon the door; A B C D is a braſs box, faſtened over the key hole; it has a ſquare hole through it, covered by a ſmall door E; this door is kept ſhut by a pin fixed into a ſmall lever *a*, *fig.* 3, which enters a projection from the ſide of the door, and thus prevents it being open, unleſs the lever is firſt drawn back; a ſpring *b* is applied behind the lever to force it outward, and another at E always preſſes againſt the door, and acts to throw it open as ſoon as the lever *a* is drawn back, which is accompliſhed by means of a pin, which comes through a groove in the plate; this pin is faſtened in a ſquare bar F, *figs.* 2 and 5. (ſhewn ſeparately in *fig.* 4.) on the front of the plate. The ſmall perſpective, *fig.* 8. repreſents two braſs cocks *d*, *d*, which ſupport the ends of a cylindric wire *g*, in which is a groove for the bar F to ſlide backwards and forwards; theſe cocks are ſcrewed to the plate within-ſide, as ſhewn at *d d*, *figs.* 2, 3, and 5, and come through an opening in the Plate; ſo that the bar F is in front of the plate; the wire *g* is the common axis for five ſmall rollers *a*, *c*, *ſ*, *m*, *o*, the ſtructure of one of theſe is explained by *figs.* 5, 6, 7, and 9; *b* is a circular piece of braſs which fits upon the centric wire: this, as is ſhewn in the ſections, *figs.* 5 and 9, is thicker at the outſide than the middle; and the front view, *figs.* 6, 7, ſhew how a receſs is cut, communicating with the centre hole; now when the five rollers are turned round upon the central wire *g*, ſo that the receſſes are all brought into the front, the projecting teeth *x*, *x*, of the ſlider F will meet with no obſtruction, and may be drawn back ſo as to open the eſcutcheon; but when any of the rollers are turned round, ſo that the thin parts near the centre are brought between the teeth of the ſlider, then the ſlider cannot be withdrawn. The poſition of the roller, when the ſlider is at liberty, is known by bringing five of the letters which are engraven on the outſide of the rollers uppermoſt, and it is in theſe letters that the ſecret conſiſts. But to render the combination of letters variable, the letters are not engraved upon the outſide of the rollers themſelves, but upon a thin braſs hoop *e*, which is fitted on round the roller; a ſpring *n* is faſtened to the roller, and preſſing upon the inſide of the hoop cauſes ſuch a friction, that they go together in general; but when the ſecret is to be changed, the ſlider F muſt be drawn partly back, ſo that its teeth *x* come in the way of the thin parts of the rollers, and they cannot, therefore, be turned round; the outſide hoop *l* is then forced round upon the inſide one, and a freſh letter brought oppoſite the receſs; by this operation the ſecret is altered, and the eſcutcheon cannot be opened till the ſame combination is produced. Each roller has four letters upon it, in all twenty letters, and the combinations which they are capable of are ſo numerous, that the chance is ſtrongly againſt any perſon not acquainted with the ſecret opening it.

Escutcheon-*grafting*. See Grafting.

ESDEN, in *Geography*, a town of Germany, in the kingdom of Weſtphalia, and biſhopric of Liege; 3 miles S.S.W. of Stocklim.

ESDRAELON, or Esdrela, in *Ancient Geography*, a village of Paleſtine, in the tribe of Iſſachar, the ſame as Jezreel, 10 miles from Scythopolis, according to the old Itinerary. (Joſh. xix. 18.) It gave name to a plain, which extended eaſt and weſt from Scythopolis to mount Carmel; called likewiſe the "Great Plain," the "Valley of Jezreel," and the "Plain of Eſdrela,"

ESDRAS, See Ezra. We have four books of ſcripture under the name of Eſdras; of which, only the two firſt are acknowledged as canonical; and they were formerly reckoned by the Hebrews as one, according to St. Jerom. The firſt of theſe is allowed to be the work of Ezra; for he relates events of which he was witneſs, and often ſpeaks in the firſt perſon. Some, however, have ſuppoſed that the ſix firſt chapters were compoſed by a more ancient writer; and they allege, that the author of theſe chapters was at Jeruſalem in the time of Darius the ſon of Hyſtaſpes. (Ch. v. 4.) From this paſſage it is inferred that the writer was then at Jeruſalem; but Ezra did not come thither till the reign of Artaxerxes, as appears by the beginning of the 7th chapter. To this argument it is replied, that Ezra ſpeaks in the name of the Jews, and that it is uſual for hiſtorians of a country to ſpeak in the firſt perſon in the name of their own nation, although the hiſtorians themſelves had no participation in the events which they record. Another difficulty occurs in explaining the genealogy and number of thoſe who returned from Babylon to Jeruſalem under Nehemiah, mentioned in the ſecond chapter, and related in the ſame manner, though with ſome additions and alterations in the 9th chapter of Nehemiah. Some ſuppoſe that Nehemiah tranſcribed this out of the book of Ezra, adding the names of thoſe perſons who came to Jeruſalem in the ſecond return from the captivity. Others, on the contrary, imagine that Ezra copied the paſſage from Nehemiah, ſince mention is made in it of Nehemiah. Others pretend that the genealogy of Ezra was afterwards corrected from that of Nehemiah. However, none of theſe conjectures are reconcileable with the differences that occur in the two genealogies. But after all, there is no neceſſity for ſuppoſing that one of theſe authors tranſcribed from the other, for they might both of them have written theſe genealogies: Ezra having ſurvived the ſecond tranſmigration made under Nehemiah, and not having written his book till the latter end of his life. The ſecond book under the name of Ezra, is attributed to Nehemiah; though ſome inconſiderable particulars have been added to it, which cannot belong to Nehemiah: ſuch as the mention of the high-prieſt Jaddua, and king Darius. (Neh. xii. 22.) This Jaddua is Jaddus, in whoſe time Alexander the Great came to Jeruſalem; and Darius is Darius Codomannus, overcome by Alexander 100 years after Nehemiah. The firſt of theſe two books contains the hiſtory of the deliverance of the Jews from the captivity of Babylon, and of their re-ſettlement in Judea, from the firſt year of Cyrus to the 20th of Artaxerxes Longimanus; and the ſecond begins at the 20th year of the ſame prince, to the reign of Darius Nothus. The chronology of this ſpace of time depends on the duration of the reigns of the kings of Perſia.

The third book, under the name of Eſdras, is thought by the Greeks to be canonical. Its author is not known, but he is ſuppoſed to have been an Helleniſt Jew. The book is the ſame in ſubſtance as the firſt of Eſdras, but interpolated; and in different parts of it we have a ſummary repetition of the two laſt chapters of the ſecond book of Chronicles, as well as of the books of Ezra and Nehemiah. Againſt its authority there are ſeveral material objections, for which we refer to Arnald's excellent Commentary on the Apocrypha, p. 122;

The fourth book of Eſdras is written with ſufficient art, as if Eſdras himſelf had compoſed it; but the marks of falſhood are diſcernible in it. Neither the Synagogues, nor the Greek or Latin church ever unanimouſly received it as canonical; though ſome of the fathers have cited it, and the Latin church has borrowed ſome words out of it. It is not now extant in Greek; and it never was in Hebrew. It ſeems moſt probable that the author was a Jew, converted to Chriſtianity, who, in hopes of converting others, compoſed this work under the name of a writer, for whom the Jews had the higheſt eſteem. And there ſeems good reaſon for concluding that the author lived in the times of the firſt heathen perſecutions, from many paſſages encouraging faith, and a ſpirit of conſtancy under perſecution.

ESEBON, a name given, by ſome of the chemical writers, to common ſea ſalt.

ESENS, in *Geography*, a town of Germany, in the kingdom of Weſtphalia, and county of Eaſt Friſeland; 24 miles N.N.E. of Emden.

ESFARAIN, a town of Perſia, in the province of Choraſan; 80 miles E. of Aſterabat.

ESGÚEVA, a river of Spain, which runs into the Piſuerga, at Valladolid.

ESGUEYRA, or Esgueria, a town of Portugal, in the province of Beira, containing about 1600 inhabitants; 8 miles S. of Aveiro.

ESH, in *Rural Economy*, a term provincially employed to denote the aſh-tree.

ESHANESS, in *Geography*, a cape on the weſt coaſt of Main-land, the largeſt of the Shetland iſlands. N. lat. 60° 38′. Long. 1° 7′ E. of Edinburgh.

ESHCOL. See Escol.

ESHTAOL, in *Ancient Geography*, a town of Paleſtine, in the tribe of Dan, which belonged firſt to Judah. According to Euſebius it was 10 miles diſtant from Eleutheropolis, towards Nicopolis.

ESHTEMOTH, a city in the ſouth of Judah, which, according to Euſebius, was a large town in the diſtrict of Eleutheropolis, north of that city. It was ceded to the prieſts. 1 Chron. vi. 57.

ESI, in *Geography*, a town of Italy, in the ſtate of the church, and marquiſate of Ancona; 11 miles S.S.W. of Ancona.

ESK, South and North, rivers of Scotland, which deſcend from the Benakinnan mountains on the north border of Angus. The former runs S.E. and E. by Cortachie, Tannadyce, Brechin, and falls into the German ocean below Montroſe, to which town it is navigable from the tide-way in the German ocean. (See Canal). The direction of the latter is E. and S.E. through a narrow valley, till it reaches the ſtrath lying between the Grampians and the ſea. In the lower part of its courſe it forms the common boundary of Angus and Kincardine.

Esk, a river in Cumberland, which is navigable from the Solway firth up to the town of Longton.

ESKARMAKRUN, a town of Perſia, in the province of Chuſiſtan; 90 miles S. of Suſa.

ESKE, a river in the Eaſt Riding of Yorkſhire, which is navigable only from the ſea up to Whitby-bridge. See Canal.

Eske, a river in Cumberland, which is navigable from the ſea near Ravenglaſs to Mulcaſter. Near to Ravenglaſs it is joined by the Irt river.

ESKER, a river of European Turkey, which runs into the Danube; 20 miles W. of Nicopolis.

ESKI-Baba, a town of European Turkey, in Romania; 30 miles S.E. of Adrianople.

ESKIER, a town of Arabia, in the country of Yemen; 60 miles N. of Aden.

ESKIJALFA, a town of Perſian Armenia, in the country of Erivan; 120 miles S. E. of Erivan.

ESKI-HISAR, a town of Aſiatic Turkey, in the province of Natolia; 16 miles W. of Mogla.

ESKI-HISSAR, a town of Aſiatic Turkey, in the province of Natolia, formerly Laodicea, now almoſt a heap of ruins; 8 miles N. of Degnizlu.

ESKIMAUX, or Esquimaux. See Esquimaux and Labrador.

Eskimaux *Bay*, a bay on the ſouth-coaſt of Labrador. N. lat. 51° 30′. W. long 57° 50′.

Eskimaux *Iſlands*, a cluſter of ſmall iſlands in the gulf of St. Lawrence, near the ſouth-coaſt of Labrador. N. lat. 50° 15′. W. long. 63°.

ESKISADRA, a town of European Turker, in the province of Romania; 48 miles E. of Filippopoli.

ESKISHEHR, a town of Aſiatic Turkey, in the province of Natolia, on the river Sakharia; 116 miles S.E. of Conſtantinople. N. lat. 39° 48′. E. long. 32° 58′.

ESLA, a river of Spain, which runs into the Duero, between Zamora and Miranda de Duero.

ESLINGEN, a town of Germany, in the circle of Suabia, which, till the peace of Luneville, was a free imperial city. It now belongs to the king of Wirtemberg, and is ſituated on the Necker, 30 miles N. E. of Tubingen, and 6 miles S. E. of Stutgard.

ESMONA, or Azemona, in *Ancient Geography*, a town of Arabia Petræa, which was one of the ſtations of the Iſraelites in the Deſert. The book of Joſhua aſcribes it to the tribe of Juda, ſo that it is probably the ſame with *Eſem*.

ESMOUTIER, in *Geography*, a ſmall town of France, in the department of the Upper Vienne; 21 miles E. of Limoges.

ESNA, in *Ancient Geography*, a town of Paleſtine, in the tribe of Juda. Joſh. ch. 15.

ESNECY, *Æſnecia, dignitas primogeniti*, in *Law*, a private prerogative, allowed to the eldeſt coparcener, where an eſtate has deſcended to daughters for want of heirs male, to chuſe firſt after the inheritance is divided. Fleta, lib. v. cap. 10. "Jus eſneciæ *is* jus primogenituræ," in which ſenſe it may be extended to the eldeſt ſon, and his iſſue, holding firſt. In the ſtatute of Marlbridge, cap. 9. it is called "initia pars hereditatis."

ESNEH, Esné, or *Aſna*, in *Geography*, one of the moſt important towns in Upper Egypt, ſeated on the left of the Nile, in N. lat. 25°. E. long. 49° 15′. This town is governed by an Arabian prince and by a Cachef, dependent on the Bey of Girgé. The Mahometans have ſeveral moſques here, and the Copts a church, that is ſerved by two prieſts. According to the deſcription of Abulfeda, which correſponds in a great degree to its preſent ſtate, Eſné is remarkable for its public baths and its commerce: it is built on the weſtward of the Nile, between Aſſouan and Cous, but nearer to the latter. The Copts are ſaid to be its founders. The well-cultivated territory abounds in grain and palm-trees. Situated on the edge of a rich country it is ſhaded by groves of orange-trees loaded with fruits and flowers, and immediately ſurrounded with gardens amply ſtocked with fruit-trees. It preſents to view ſeveral ancient monuments conſtructed by the Copts, and ſuperb ruins. This town, formerly called *Latopolis*, revered Minerva and the fiſh *Latus*. (Strabo, l. 17.) It contains within its boundary an antique temple, encloſed on three ſides by thick walls. Six large fluted columns, crowned by a capital, ornamented with the palm leaf, form the façade of it; eighteen others ſupport the roof; which is compoſed of large ſquares of marble; the building is ſurrounded by a frieze, and innumerable hieroglyphics cover its exterior aſpects. Thoſe of the inſide, executed with greater care, mark the progreſs made by the Egyptians in ſculpture. Theſe hieroglyphics contain, among other ſubjects, a zodiac and large figures of men with crocodiles' heads; the capitals, though all different, have a very fine effect; and as an additional proof that the Egyptians borrowed nothing from other people, it is remarked, that they have taken all the ornaments, of which theſe capitals are compoſed, from the productions of their own country, ſuch as the lotus, the palm-tree, the vine, the ruſh, &c. The portico of this temple is repreſented by M. Denon, (Travels in Egypt, vols. 2. and 3.) as the moſt perfect monument of ancient architecture. Denon has given a plan and elevation of this portico, and delineated the varieties of its capitals, and part of the ſculptures on the cieling; but he was ſurpriſed that, after all his reſearch, he could find no repreſentation of the fiſh *latus*, from whoſe name the town was called *Latopolis*. At preſent this temple is ſoiled by the ordure of the cattle kept there by the Turks, who convert the moſt beautiful monuments of ancient Egypt into ſtables. About a league to the weſt of Eſné is another temple, on the walls of which is carved in ſeveral places a woman ſeated, repreſenting an Egyptian deity called "Neith," to whom the ancient Greeks gave the name of Minerva. The columns of this temple, as ſome have conjectured, gave to the Greeks the idea of the Corinthian order; the capitals being ornamented with a foliage very much reſembling the Acanthus. Several animals painted on the cieling have preſerved their colours. To the ſouth of Eſné are ſeen the ruins of a monaſtery founded by St. Helena, and near it the burying place of the martyrs, adorned with tombs crowned by cupolas, ſupported by arcades. The inhabitants of Eſné having revolted againſt the perſecution of Diocleſian, this emperor deſtroyed the town, and put them to the ſword. This place, conſecrated by religion, is become a celebrated pilgrimage among the Copts, who repair hither from the moſt diſtant provinces of the kingdom. In the chain of mountains, which ſtretches to the eaſtward of the Nile, and nearly oppoſite to Eſné, are quarries of a ſoft ſtone, called "Baram," which hardens in the fire, and is uſed in the manufacture of kitchen utenſils. Savary's Letters, &c. vol. ii.

ESO'CHE, from εσω, *within*, and εχω, *to have*, in *Surgery*, a tubercle within the anus.

ESOPUS. See KINGSTON.

ESOTERIC. See EXOTERIC.

ESOX, in *Ichthyology*, a genus of the abdominal kind, diſtinguiſhed by the following eſſential particulars. The head flattiſh above; mouth and throat large; jaws toothed, unequal, the upper one flat, lower punctated; tongue broad, looſe; palate ſmooth; eyes round, moderate ſize, and lateral; noſtrils double, near the eyes; gill-covers large, aperture ample, with from ſeven to twelve rays; body elongated, covered with hard ſcales; above convex, and compreſſed at the ſides; lateral line ſtraight, neareſt the back, and ſcarcely viſible; dorſal and anal fin very ſhort, and generally placed oppoſite.

Species.

LUCIUS. Snout depreſſed; jaws nearly equal. Linn. Fn. Suec. Art. Gen. Rondel. *Brochet*, Bell. *Pike*, Penn. Donov. Brit. Fiſhes.

The pike is an inhabitant of moſt of the lakes of Europe, and the north of Aſia, and alſo of many of the larger rivers in Lapland, Siberia, and countries adjacent. It grows to a conſiderable ſize, thoſe of four or five feet in length not being uncommon in the northern regions, and ſometimes even they attain to the length of eight feet or more. The pike is highly prolific, and from its extreme voracity as well as cunning, is called the wolf, or the fox of fiſhes; it ſubſiſts on fiſhes, on frogs, ſerpents, and other reptiles, and on the young of ſwans and other aquatic fowl, and is reputed ſo undaunted in its attacks that it will even contend with the otter for its prey. This fiſh ſpawns in ſpring between the months of February and May. The colours vary in brightneſs at different ſeaſons; in general the upper part is olivaceous green, with the back nearly black, and the whole ſpotted with yellow, whitiſh, or orange, according to the health of the fiſh. The belly white, and the fins beautifully variegated with vivid colours and ſpots of blackiſh purple. The jaws contain a formidable armament of teeth diſpoſed in longitudinal rows. The longevity of the pike is well known to be very great; but what credit ought to be repoſed in the aſſurances of ſome writers, that it lives to the age of two or three hundred years, muſt remain for others to determine. Their multiplication is immenſe; in the northern parts of Ruſſia, and in Siberia, where they are taken in the greateſt plenty, they conſtitute an article of commercial importance, being prepared by means of ſalting and drying, for exportation.

VIRIDIS. Green; lower jaw longer, ſcales thin. Gmel.

This is regarded by Boſc as a variety only of the common pike, (Eſox lucius,) the accuracy of which opinion appears rather uncertain, as we may perhaps be unacquainted with the ſpecies or fiſh intended by Gmelin; the reference of the latter author to the Acus maxima ſquamoſa viridis for the ſame fiſh is ſuppoſed to be incorrect.

SPHYRÆNA. Dorſal fins two, the firſt ſpinous. Linn. Arted. *Sea pike or Spit-fiſh*, Charlt.

There is ſome remote reſemblance between this fiſh and the common pike, from which among other particulars it is diſtinguiſhed by having the lower jaw advanced, the body more ſlender, the tail furcated, and the back furniſhed with two dorſal fins inſtead of one. The rays of the firſt dorſal fin are ſpinous, and are deſcribed both by Linnæus and Artedi as five in number, but according to Bloch theſe amount to only four. The fiſh is blueiſh above, beneath white; the pectoral, ventral, and anal fins red. It grows to the length of two feet, and inhabits the Atlantic and American ſeas. The fleſh is in eſteem.

The Barracauda pike of Shaw's Gen. Zool. deſcribed after Cateſby, appears very cloſely allied to the preceding, if it be not the ſame; the character "brown, elongated, whitiſh beneath, with two dorſal fins and forked tail," differs from that fiſh only in having the upper part brown inſtead of blueiſh. It is found in the Weſt Indies, and grows to the length of eight or ten feet.

BECUNA. Silvery-blueiſh, marked on each ſide by a row of deep-blue ſpots, with two dorſal fins, and forked tail. Shaw. Gen. Zool. *Sphyræna becuna*, Cepede.

This accords ſo nearly with the Eſox ſphyræna that we cannot ſuppreſs our ſuſpicions of its being the ſame. The only authority on which it is deſcribed is a drawing by Plumier; this, indeed, repreſents a fiſh of ſomewhat more elongated form, in which the ſides are marked with a ſeries of blue ſpots not obſervable in the former. If it prove diſtinct it is certainly very analogous. It is deſcribed as a native of the American ſeas.

AUREO-VIRIDIS. Body golden-green, with two dorſal fins, a ſpine before the firſt; lower jaw longer. *Sphyræna aureo-viridis*, Cepede. *Gold-green pike.*

Deſcribed and figured by Cepede from the drawings of Plumier; the body is deep, as in the ſparus, the head ſharp pointed; ſcales middle ſized; tail forked and lunated. The ſpecies inhabits the American ſeas.

VULPES. Dorſal fin in the middle of the back; the gill membrane three-rayed. Gmel. *Vulpes bahamenſis*, Cateſby. *Fox pike.*

Reſembles the common pike, but is more ſlender in proportion towards the tail, the colour brown above, beneath paler. Native of Carolina and the Weſt Indies.

SYNODUS. Dorſal fin in the middle of the back: gill membrane five-rayed. Gmel. *Synodus*, Cateſby.

Cloſely allied to the former, and inhabits the ſame ſeas, and according to Cepede the Mediterranean alſo. The body is marked with duſky bands; abdomen ſilvery; fins ſtriped with black.

HEPSETUS. Lateral line ſilvery. Gmel. *Argentina pinna dorſali pinnæ ani oppoſita*, Linn. Amœn. Acad. *Piquitinga*, Marcgr. Inhabits America.

MARGINATUS. Dorſal and anal fins oppoſite; lateral line ſilvery; lower jaw ſix times as long as the upper. Forſk. Fr. Arab.

This and the preceding are ſuppoſed to be the ſame. The latter is deſcribed by Forſkal as an inhabitant of the Red ſea; its length about a ſpan and a half; the body linear, tapering each ſide, and covered with broad lax, entire ſcales, the colour brown above, beneath white; the anal fin ſmall, triangular, glaucous, and yellow without; dorſal yellow externally; tail bilobate, the upper lobe pale yellow, the poſterior edge brown.

CHINENSIS. Head ſlender, lower jaw longer; eyes large and protuberant. *Sphyræna chinenſis*, Cepede.

Slightly deſcribed by Cepede from the manuſcripts of Commerſon as a native of the Indian ſeas. The general colour is ſaid to be green with a ſilvery hue, and the ſcales of the middle ſize.

CHILENSIS. Jaws equal; lateral line blue. Molina. *Chili pike.*

Native of the Chileſe ſeas. Length from two to three feet; body round, covered with bony angular deciduous ſcales, above golden, beneath ſilvery; fleſh white, and excellent.

ARGENTEUS. Brown variegated with yellowiſh characters. Gmel. Forſter, &c. *Silver pike.*

Inhabits freſh waters of New Zealand and other iſlands of the ſouthern ocean.

BRASILIENSIS. Lower jaw very long; body ſerpentine. Linn. Muſ. Ad. Fr.

Theſe are ſeveral figures of this fiſh in different authors, moſt of which are defective in one particular or other. Nieuhoff omits the anal and ventral fins, Valentyn and Renard conſtitute two ſpecies of the ſame fiſh; and in other repreſentations the dorſal fin is omitted. Linnæus erroneouſly refers to the Timucu of the Braſilians as being ſynonymous; the fiſh ſo named by theſe people has both the jaws elongated, and ending in a point, and is ſuppoſed to be the ſpecies Belone. Gmelin adopts the ſame miſreference. The length of this fiſh is from twelve to fifteen inches; the upper part of the body green, beneath yellow, and the back marked with about ſix broad and equidiſtant bands of fuſcous. The ſpecies inhabits the Braſils, and is eſteemed a delicacy for the table.

GYMNOCEPHALUS. Jaws equal; gill-covers very obtuſe; head naked. Linn. *Naked-headed pike.*

Native of India, according to Linnæus, who ſpeaks of it as being the ſize of the ſand launce.

MALABARICUS. Two canine teeth in each jaw; gill-membrane with five rays. Bloch.

Found in the rivers of Malabar. The length is about twelve inches; its form ſomewhat reſembling that of the common pike. The colour above greeniſh-blue, beneath yellow; fins yellow; at the baſe purpliſh, and marked with ſeveral diſtinct bands of brown. The lower jaw is rather longer than the upper, and the tail is rounded.

CHIROCENTRUS. Breaſt armed on each ſide by a ſpine over the ventral fin; lower jaw longer. Cepede.

Deſcribed from the manuſcripts of Commerſon. Its form reſembles in ſome reſpects that of the common pike. The ſpine is ſaid to be ſtrong, and ſlightly curved; its length about two-thirds that of the fin, of which it appears to be the firſt ray.

BELONE. Each jaw long and ſubulate. Gmel. *Sea pike, gar-fiſh, or ſea needle*, Penn. Donov. Brit. Fiſhes.

Length from eighteen inches to three or four feet, of a very ſlender eel like form, with long projecting ſnout, the back fine green; belly ſilvery. It is a common ſpecies in all the European ſeas; migrating annually in large ſhoals from the depths of the ocean to the ſhore. They appear on our coaſts in the ſpring, commonly announcing the arrival of the mackarel, but remain with us for a much ſhorter period than that fiſh. They depoſit their ſpawn cloſe to the ſhore among the rocks and ſea weeds, where the young are hatched, and after a certain time retire. We have ſeen the fry of this fiſh on our coaſts during the ſummer months. As an article of food the gar-fiſh is held in far leſs eſtimation than the mackarel, to which its flavour in ſome degree approaches. By many people the fleſh is conſidered unwholeſome, and even poiſonous; ariſing, no doubt, from the ſingular circumſtance of the bone becoming of a fine graſs green colour in boiling. This ſpecies grows to the length of eight feet. Donov. Brit. Fiſhes.

SAURUS. Jaws ſubulate, and ſlighty curving upwards, lower one longeſt; above and beneath ſpurious fins near to the tail. *Maxillis ſubulatis ſuaſcendentibus, inferiore longiore, caudam verſus ſupra infraque pinnulis ſpuriis.* Donov. Brit. Fiſhes. *Saurus*, Rondel. *Skipper*, Ray. *The ſaury*, Penn. &c.

The obſcurity that prevailed reſpecting this curious fiſh till within a very recent period, induced us to enter on the details of its general deſcription with rather more than ordinary minuteneſs: the writer of this article has already treated at ſome length on the Eſox ſaurus in his work on Britiſh fiſhes lately publiſhed, and conceives a repetition of the following obſervations ſubmitted on that occaſion may not prove altogether unacceptable.

Our countryman Ray appears to be the firſt writer who deſcribes this rare and curious ſpecies of eſox as a native of Britain; he ſpeaks of it as a Corniſh fiſh, under the provincial name of ſkipper. Rondeletius and Geſner previouſly mention it as a ſcarce kind among the fiſhes of the Mediterranean. In 1769 the ſame fiſh was again introduced to notice by Mr. Pennant in his tour of Scotland, and afterwards in his Britiſh Zoology, wherein we are informed, that vaſt numbers of them were thrown aſhore on the ſands of Leith, near Edinburgh, after a great ſtorm in November, 17[illegible]8. In the ſummer of 1800 a ſingle ſpecimen was taken near the iſle of Portland, in Dorſetſhire, after a hard ſtorm; an account of which, accompanied with a figure of the fiſh in its natural ſize, is given by the Rev. Mr. Rackett, in the third volume of the Linnæan Tranſactions. "This fiſh (Mr. Rackett obſerves) appears to be rare on the Dorſet coaſt. Of the fiſhermen in this part, only one was acquainted with it, and called it a ſkipper, the name under which, according to Ray, it was known in his time on the coaſt of Cornwall. This writer adds that the ſpecies has not been noticed by Linnæus, Gmelin, nor Bloch; and that Pennant has given a very indifferent figure of it in his Tour in Scotland, and has made uſe of the ſame plate in his Britiſh Zoology." See Linn. Tranſ. 3. p. 60.

It is altogether ſingular that this fiſh has no place in either edition of the Linnæan Syſtema, not even that by Gmelin; it is inſerted by Dr. Turton in his tranſlation on the authority of Pennant. The length of this ſpecies is about eighteen inches: the body of a long and ſlender form; not like that of an eel, as writers deſcribe, but agreeing preciſely with that of the common gar-fiſh (Eſox belone). The ſnout is ſubulate, fine, toothleſs, and curving upwards. The jaws are of unequal length, the lower being longeſt, and bending upwards at the tip, in which reſpect it differs from the figures of Mr. Pennant and Mr. Rackett, in both which the jaws appear ſtraight and of equal length. Neither do the jaws, when cloſed, exhibit that remarkable hiatus or gaping ſhewn in thoſe two repreſentations; there is a kind of flexuoſity in the ſhape of the mouth, when open, which might excite ſuch an idea, but upon gently cloſing it the curvature in the form of one jaw will be found to correſpond with the ſuture of the other; ſo that the character "maxillis medio hiantibus," aſſigned to it, is by no means applicable. Dr. Shaw mentions in the Gen. Zool. that "in a ſpecimen figured in the work of Cepede, the jaws are repreſented upwards, contrary to what has hitherto been obſerved; the ſpecimens figured in the work of Mr. Pennant, as well as that of Rondeletius, and the drawing by Mr. Rackett, have the jaws ſtraight." This is certainly true, and it is therefore to be preſumed that the examples from whence the figures of the latter mentioned writers have been taken muſt have ſuſtained injury, or been miſrepreſented; for it is clear Cepede is right in repreſenting the jaws curving upwards: it is indeed evident, from the comparative ſhortneſs of the jaws in the figure by Pennant and others, they could not be perfect, the beak in the fiſh itſelf being nearly twice the length delineated by either. Dr. Shaw has alſo been apparently miſled to the perſuaſion that the ſkin of this fiſh is reticulated by fine fins decuſſating each other at equal diſtances, which is not by any means the natural appearance of the fiſh, and the figure in the Britiſh Zoology is ſtill more erroneous, as it appears entirely ſmooth, and deſtitute of ſcales.

Some miſunderſtanding ſeems to prevail likewiſe as to the colour of the fiſh. Mr. Pennant deſcribes it as having the back duſky, and the belly bright and ſilvery, in which particulars he is followed by Dr. Shaw, who remarks that the colour of the whole animal is duſky above, and ſilvery beneath, with duſky or blueiſh brown back. This is not, however, correct, the true colour of the back of the fiſh is a moſt lovely azure blue, changeable to green, and gloſſed with purple and yellow, and the lower parts ſilvery. The body has a ſmooth appearance, the ſcales with which it is covered being thin and glabrous: the lower part of the body from the gills to the tail is marked with a longitudinal carina or keel, which terminates at the latter part in a ſomewhat protuberant manner.

The ſpecies may be readily diſtinguiſhed by the pinnules or ſpurious fins on the body near the tail, in which particular it agrees with the ſcomber or mackarel genus; theſe have been variouſly miſrepreſented; in the fiſh itſelf they amount altogether to twelve in number, five of which are diſpoſed above and ſeven beneath; and it is alſo neceſſary to add that they are perfectly detached from each other. The fiſh, in point of flavour, reſembles that of the mackarel.

Osseus. Upper jaw longer; ſcales bony. Linn. *Eſox maxilla ſuperiore cauda quadrata*, Arted.

Native of North America and Aſia, and has been found in Europe. (Donov. Brit. Fiſhes.) The ſpecies is from two to three feet in length, and is covered with rhombic ſcales.

Cepedianus. Snout long, jaws ſpatulate; ſcales bony. *Le piſoſteus ſpatula*, Cepede. *Eſox cepedianus*, Shaw.

The principal difference between the two laſt mentioned fiſhes ſeems to conſiſt in the ſnout being ſhorter in proportion in E. cepedianus than the other. There is likewiſe another pike of the ſame bony ſcale kind, which has the jaws rather ſhorter than either, and bears the name of Leverianus. We are not entirely ſatisfied that the three laſt mentioned differ ſpecifically from each other.

No ſmall degree of uncertainty ſeems to prevail throughout this tribe of fiſhes independently of thoſe laſt adverted to; the ſpecies ſynodus, hepſetus, vulpes, and marginatus, appear to be imperfectly underſtood: barracuda, viridis, and becuna, are perhaps more doubtful, as are alſo chirocentrus, and chinenſis; and it will have been obſerved that the true characters of the ſpecies ſaurus were not till lately aſcertained.

The viper-mouthed pike (Eſox ſtomias), and vipera marina of Cateſby, is diſtinguiſhed by having four of the teeth much larger than the reſt: this is a very extraordinary fiſh, and ought, in our opinion, to conſtitute a new genus.

ESPADACINTA, in *Geography*, a town of Portugal, in the province of Tras-los-Montes, ſituated on the Duero, and borders of Spain; 34 miles S.W. of Miranda de Duero, and 28 N. of Almeida.

ESPAGNAC, John-Baptist-Joseph de Sahuguet-Damarzil, Baron d', in *Biography*, a military writer, was born in the year 1713 at Brive la-Gaillarde. At the age of nineteen he entered the army, and became celebrated for great ſkill and proweſs. In 1742 he was aid-decamp in the war of Bavaria, and was afterwards employed by marſhal Saxe as aid-major general and colonel of a regiment of grenadiers. In 1780 he was raiſed to the rank of lieutenant-general, and died at Paris in 1783. As an author he attained a good ſhare of celebrity by his "Campaigns of the King in 1745—48," which were publiſhed in four octavo volumes. He publiſhed alſo "Eſſays on the Science of War," 3 vols. 8vo. "An Eſſay on the great Operations in War," in 4 vols. 8vo; "A Supplement to the Reveries of Marſhal Saxe," in 2 vols. 8vo. 1773. He likewiſe drew up "The Hiſtory of Marſhal Saxe," in 3 vols. 4to. in which are detailed plans of his battles and marches, together with thoſe particulars of the life of that general, as render it a work of conſiderable intereſt to literary as well as to military men." Nouv. Dict. Hiſt.

Espagnac, in *Geography*, a ſmall town of France, in the department of the Lozere; 12 miles S. of Mende.

ESPAGNE, John d', in *Biography*, a French proteſtant divine in the ſeventeenth century, was born at Dauphiné, and became miniſter of the French church in London, an office which he ſuſtained during the reigns of James I. and Charles I. He publiſhed ſeveral ſmall tracts, which were afterwards collected and publiſhed at Geneva and the Hague, in three and in two volumes 12mo. about the year 1670. He alſo publiſhed a work, which he dedicated to Charles I., entitled "Erreurs Populaires en points Generaux qui concernent l'Intelligence de la Religion." Of this and of ſome other of his pieces Bayle ſpeaks in terms of commendation. Moreri. Bayle.

Espagne, in *Geography*. See Epaigne.

ESPAGNET, John d', in *Biography*, who flouriſhed in the 17th century, was preſident of the parliament of Bourdeaux. As a literary character he publiſhed a work entitled "Enchiridion Phyſicæ Reſtitutæ," which was afterwards

wards tranſlated into French under the title of "La Philoſophie des Anciens retablie en ſa Pureté." This may be regarded as the firſt book that appeared in France, in which there is a complete ſyſtem of phyſics contrary to that of Ariſtotle; though the author pretended that he had merely re-eſtabliſhed the ancient philoſophy. He publiſhed alſo a work concerning the philoſoper's ſtone, entitled "Arcanum Hermeticæ Philoſophiæ Opus." Alſo an old MS. entitled "Le Rozier des Guerres," found at Nerac in the king's cloſet, and attributed, though erroneouſly, to the pen of Lewis XI. To this work he added a treatiſe of his own, upon the education of a prince. In publiſhing the "Rozier des Guerres," he followed the original with the utmoſt exactneſs, becauſe, ſays he, "this little tract ſeemed to me ſo good, that I would not embelliſh or diſguiſe it, but have left it in its native ſimplicity; and though the language of it is not in uſe in this age, yet it may be underſtood, being ſo full of good ſenſe and meaning, that with all its jargon it may ſilence the affected language of the court and bar. I have alſo carefully preſerved the ſpelling, becauſe in adding or diminiſhing a letter, a word is often changed, and of old made new." Bayle.

ESPAIN, Saint, in *Geography*, a ſmall town of France, in the department of Indre and Loire; 15 miles S.E. of Chinon.

ESPALIER Trees, in *Gardening*, are ſuch fruit trees of low growth as are trained to treillages or framed woodworks made for the purpoſe, in ranges, ſo as to conſtitute a ſort of hedge. They are uſually planted in ſingle rows along the borders, on the ſides of the principal walks, in the main diviſions of the garden, affording ſhelter to other plants as well as ornament to ſuch parts.

The ſorts of fruit trees moſtly employed in this way are thoſe of the apple, pear, and plum kinds; but many others may be managed in this method where variety is wanted; as the quince, cherry, almond, apricot, mulberry, and filbert. And it is neceſſary, with a view to beauty and uniformity, to manage them in ſuch a manner as to have them that are nearly of the ſame growth in the ſame range or line of planting.

The ſorts of apples moſt adapted to this uſe are thoſe of the golden and other pippin kinds, the nonpareil, rennet, and ruſſet; but many others may be cultivated in this way.

In the pear kind, the jargonelle, blanquette, bergamot, burre du Roy, &c: the melting pears being always better in this way than thoſe of the breaking kind. On ſtrong moiſt ſoils thoſe grafted on quince ſtocks are the beſt, but on dry ones thoſe on free ſtocks.

Trees intended for this uſe ſhould be grafted or budded within a few inches of the ſurface of the ground, that branches may be thrown out regularly from the bottom upwards, to furniſh and fill the treillage; and the more effectually to accompliſh the purpoſe, the firſt ſhoots from the grafts, &c. ſhould be cut off, or headed down within a few inches of the grafts, in the ſpring ſeaſon, when they have had one year's growth. The branches or ſhoots thus produced, whether the trees are in the nurſery, or planted out as eſpaliers, ſhould, in the latter part of the ſummer, or beginning of autumn, be trained both ways laterally in their advancing growth, to ſtakes put down for the purpoſe, or the eſpalier frames. In this way the trees acquire a proper form, thoſe in the nurſery being thus trained and kept for ſale. A ſecond heading down in the upper branches may likewiſe be practiſed when neceſſary, in order to fill up the middle, and completely cover the frames.

When theſe trees have been thus trained for three or four years in the nurſery-ground, they are generally in a proper ſituation for being planted out as eſpaliers in the borders or other parts along the ſides of the walks in the garden or pleaſure ground, a ſufficient breadth being allowed for the borders according to the ſize or extent of ſuch grounds, as ſix, eight, ten, or more feet.

Beſides this, there is another method ſometimes practiſed in forming eſpalier trees, which is that of, after heading the firſt ſhoots down as above, training the ſide-ſhoots horizontally in the direction of the frames, and the middle one upright, forming the lateral ſhoots, which it throws out horizontally on each ſide; and, if they are not thrown off ſufficiently low, heading the upright one down, by which lateral branches will be ſent off, ſo as to range with regularity at the diſtance of ſix or ſeven inches, one above another, on each ſide, from the bottom to the top. In this way the trees have a very neat appearance.

In planting the trees out, when they are of the apple or pear kind, on dwarf ſtocks, the diſtance in the rows ſhould be fifteen, eighteen, or twenty feet; and when on free ſtocks, not leſs than twenty or thirty; and for free growing trees conſiderably more. For plums, the diſtance ſhould be eighteen feet or more; and for cherries, apricots, almonds, and mulberries, it ſhould never be leſs than fifteen. Conſiderably leſs diſtance will, however, be ſufficient for filberts, eſpecially in the poorer ſorts of ſoil.

When theſe trees have been planted, it is the uſual practice to put ſticks down in a line to train them to for the two or three firſt years; but it has a much neater appearance to have the treillage fixed down to train them to at once.

Frames for this uſe are made in different ways, according to the taſte of the perſon who has them; but the moſt uſual ſorts are thoſe conſtructed of three or four inch ſquare pieces of oak timber for the poſts, with rails of deal carried from poſt to poſt, at the diſtance of every ten or twelve inches from the bottom to the top. Between theſe rails thin upright pieces are again ſometimes fixed at the ſame diſtances, for particular purpoſes. The whole ſhould be well painted over in oil ſome time before the trees are to be trained to it. This laſt is performed either by tying the branches to the trellis by oſier twigs, woollen-yarn, or other ſimilar ſubſtances, or by nailing them in the manner of wall-trees. In whichever way it is done, the greateſt exactneſs and regularity ſhould be obſerved in laying in and directing the ſhoots, that they may have a neat regular appearance. The manner of performing the future pruning and managing of theſe trees will be explained when we come to ſpeak of the nature of pruning in general. See Pruning *of Fruit Trees*.

Theſe ſorts of trees are chiefly advantageous in admitting the branches to produce fruit ſpurs on both ſides, which is not the caſe with wall-trees; in taking up but little room in the garden; in not being ſo injurious to the crops that are near them; in affording fruit of a finer flavour, from the more free admiſſion of air and ſun, and in the fruit not being ſo liable to be blown down and injured as in other caſes.

ESPALION, in *Geography*, a ſmall town of France, in the department of the Aveyron, chief place of a diſtrict of the ſame name, with a population of 2622 inhabitants. It is ſituated on the river Lot, 18 miles N.E. of Rhodez, and has ſome manufactures of coarſe woollen cloth. The canton has a territorial extent of 167½ kiliometres, 12 communes, and a population of 9139 individuals.

As chief place of a diſtrict, Eſpalion has a ſub-prefect, a court of juſtice, and a regiſter office. Corn, wine, and madders, grow in its neighbourhood, and the whole diſtrict contains 9 cantons, 101 communes, and 58,855 inhabitants, on a territorial extent of 1630 kiliometres.

ESPAMISCACK, a lake of Lower Canada; 74 leagues N.E. of Quebec. N. lat 50°. W. long. 68°.

ESPAQUE, a town of Perſia, in the province of Segeſtan; 54 miles S.W. of Kin.

ESPARCET, in *Agriculture*, a name ſometimes given to ſaintfoin. See SAINTFOIN.

ESPARRAGOSA, in *Geography*, a town of Spain, in the province of Eſtremadura; 35 miles E.S.E. of Merida.

ESPARRAGUERA, a town of Spain, in the province of Catalonia; 15 miles N.N.W. of Barcelona.

ESPARZA, a town of Spain, in Navarre; 22 miles E. of Pamplona.—Alſo, a town of North America, in Mexico, and province of Coſta-Rica.

ESPEJA, a town of Spain, in the province of Cordova; 17 miles N.N.E. of Montilla.

ESPELETTE, a ſmall town of France, in the department of the Lower Pyrenées, chief place of a canton in the diſtrict of Bayonne, with a population of 1200 individuals. Its canton has a territorial extent of 237½ kiliometres, 7 communes, and 7861 inhabitants.

ESPEN, ZEGER BERNARD VAN, in *Biography*, was born at Louvain in the year 1646. After going through the uſual courſe of ſtudies at the univerſity, with much credit to his talents and diligence, he was admitted to prieſt's orders in the year 1675, and had, within two years of this time, the degree of doctor of laws conferred upon him. From this period till the year 1702, he lived in the college of pope Adrian VI., where he performed the duties of profeſſor, and applied himſelf to the ſtudy of thoſe works which have rendered his name illuſtrious. He obtained ſo much reſpect by his various writings that he was conſulted from every quarter: by the tribunals of juſtice, by the biſhops, and by ſeveral ſovereign princes. His principal work was entitled "Jus Eccleſiaſticum Univerſum." Beſides this, he is well known for other treatiſes, "De peculiaritate et Simonia;" "De Officiis Canonicorum;" "Tractatus Hiſtorico-Canonicus in Canones;" "De promulgatione Legum Eccleſiaſticarum," and many others, all of which were collected and publiſhed in 4 vols. folio, in 1753, at Paris. When he was in his 65th year, he was deprived of ſight by a cataract, which was not removed for two years; during this time, however, he neither loſt his cheerfulneſs, nor remitted his application. His manner of living was at all times frugal, and very ſimple, his temper was benevolent, modeſt, and humble. He was eminent for piety towards God, and for his candour and good-will towards men. He nevertheleſs had made himſelf enemies, by the integrity and independence of his mind; ſome of whom, to render Eſpen obnoxious to the ruling powers, had forged a treatiſe, containing ſome things very offenſive, in a religious and political point of view, which they attributed to him; but he luckily detected the impoſture, and puniſhed the agents. On other accounts, he met with ſevere and unmerited perſecution, and in one inſtance, after a variety of proceſſes, ſentence was pronounced againſt him, without any declaration reſpecting the definitive judgment of the court. Under theſe circumſtances, believing that it was intended to put him under an arreſt, he withdrew to Maeſtricht, and afterwards to Amersfort, in the province of Utrecht, where he died in 1728, in the 83d year of his age. He left behind him, which was afterwards publiſhed, a learned treatiſe, entitled "Commentarius in Canones Juris Veteris ac Novi," and other diſſertations, which are ſaid to contain diſcuſſions on ſome of the moſt important points in moral philoſophy, as well as the canon and civil laws. Moreri.

ESPENCE, CLAUDE DE, was born at Chalons ſur Marne in the year 1511. He received his education at different colleges in Paris, to the principal of which he was choſen rector at a very early age. When he was about thirty years old, he took his doctor's degree, ſoon after which he was invited by the cardinal of Lorrain to reſide in his houſe, to manage the eccleſiaſtical concerns of which he had the care. In the year 1544 he accompanied the cardinal on an embaſſy to Flanders, to negociate a treaty of peace between Francis I. and the emperor Charles V. He was afterwards ſelected by the king to aſſiſt at the eccleſiaſtical conference, to conſider the queſtions proper to be propoſed for diſcuſſion at the council of Trent; and in 1547 he was deputed by Henry II. to attend the council of Trent, which was then transferred to Bologne. Some years afterwards he was employed in negociating at Rome in favour of the French court, where his talents, as a diplomatic miniſter, produced ſuch an impreſſion in his favour, that the pope, Paul IV. wiſhed to attach him to his intereſts by making him cardinal. He declined the intended honour, and having finiſhed the buſineſs on which he was ſent to Rome, he returned to his native country, where he appeared with high reputation at a meeting of the States at Orleans in the year 1560. In the following year he was appointed a member of the conference at Poiſſy, where he attached himſelf to the Calviniſts, which was highly diſagreeable to the Catholic divines, by whom he was likewiſe ſuſpected of being the author of a treatiſe on Image Worſhip, which occaſioned him ſome trouble with the faculty. After this, he paſſed his life in retirement, devoted to his ſtudies, till he died at Paris in the year 1571. His works are chiefly theological; the moſt important are his "Commentaries on the Epiſtles of St. Paul to Timothy and Titus;" in theſe, ſeveral queſtions relative to hierarchy and eccleſiaſtical diſcipline are diſcuſſed. Moſt of his treatiſes were written in the Latin language, in the knowledge of which he was ſuppoſed to excel his contemporaries. He was one of the moſt learned, judicious, and moderate eccleſiaſtics of his time. He was very converſant in the canons and diſcipline of the church; and not leſs celebrated for his knowledge of profane literature. He was attached to the Catholic religion, but was a decided enemy to every ſpecies of perſecution and intolerance. Moreri.

ESPER, JOHN FREDERIC, was born at Droſſenfeld, in Bayreuth, in 1732. He ſtudied very diligently at Erlangen, where he applied himſelf chiefly to theological purſuits, but at the ſame time made himſelf well acquainted with natural hiſtory and botany, of which he afterwards became a teacher. He died of a fever in July 1781, leaving behind him a conſiderable reputation as a naturaliſt, particularly in that department which relates to the zoolites in the principality of Bayreuth. In this place are a number of large ſubterranean caverns, partly inſulated, and partly connected with each other, which contain immenſe numbers of bones of various animals, thrown together in heaps to a conſiderable height, and covered with the earth ariſing from decompoſed animal bodies. The entrance to theſe caverns is highly pictureſque, but almoſt as ſoon as a perſon enters them he is ſurrounded by darkneſs, and the paſſage becomes ſtill more difficult and narrow, till the eye at laſt is ſtruck by the immenſe extent of an awful arch, which on every ſide preſents fiſſures and clefts, ſtrewed with the fragments of once living bodies, which excite the idea of a repoſitory of the dead. With the aid of an ingenious apothecary of Erlangen, Eſper undertook an examination and deſcription of theſe curioſities, and publiſhed the reſult of his labours under the following title; "An accurate Deſcription of the Zoolites of Unknown Animals, &c." This was publiſhed at Nuremberg, in the year 1774, in folio, with fourteen illuminated plates. Eſper was author likewiſe of various papers in the Tranſactions of the Friendly Society of the Searchers into Nature: and he wrote an account of "A Method of determining the Orbits of Comets, and other Celeſtial Bodies without Inſtruments, or Mathematical Calculations." Gen. Biog.

ESPERAZA, in *Geography*, a town of France, in the department of the Aude, and diſtrict of Quillan; 2½ leagues S. of Limoux.

ESPERNAY. See EPERNAY.

ESPERNON, a ſmall town of France, in the department of Eure and Loire, on the river Gueſle; 15 miles N.E. of Chartres, and 6 miles E. of Maintenon.

ESPESEL, a town of France, in the department of the Aude, and diſtrict of Quillan; 2½ leagues S.W. of Quillan.

ESPHLASIS, (from εσφλαομαι, *to recede inwards*,) in *Surgery*, a receſſion of a part of the body inwards, in conſequence of ſome violent outward force.

ESPIERRE, a town of Savoy, in the county of Maurienne, on the river Arc; 3½ miles S. of Argentina.

ESPIERS, in *Geography*, a town of Flanders; 8 miles N. of Tournay.

ESPINAL. See EPINAL.

ESPINAR, a town of Spain, in Old Caſtile; 18 miles S.S.W. of Segovia.

ESPINHAL, a town of Portugal, in the province of Beira; 18 miles S E. of Coimbra.

ESPINOSA DE LOS MONTEROS, a ſmall town of Spain, in Old Caſtile; ſituated in a pleaſant valley, watered by the river Trueva, among the mountains of Burgos, about 15 leagues N.W. of Miranda, in the north corner of the province.

ESPINOSA, a town of Spain, in New Caſtile; 44 miles S.W. of Toledo.

ESPIRITU SANTO, the largeſt and moſt weſterly of the New Hebrides iſlands, in the South Pacific ocean, about 57 miles in length, and 30 in breadth.—Alſo, a province of Braſil, which is chiefly productive of ſugar.—Alſo, a town of Braſil, ſeated in a fertile country on the ſea-coaſt, with a ſmall caſtle and harbour. S. lat. 20° 10′. W. long. 41°.—Alſo, a river of Braſil, which runs into the Atlantic.—Alſo, a town on the ſouth coaſt of the iſland of Cuba; 55 miles S. W. of Bayamo.—Alſo, a bay on the weſt coaſt of Eaſt Florida. N. lat. 27° 36′. W. long. 82° 54′. It has a good harbour and ſafe anchorage; but the land about the ſea-coaſt is very low. Several low, ſandy iſlands and marſhes, covered with Mangrove buſhes, lie before the main land. This bay abounds in the ſummer with fiſh, which may be taken with a ſeine, in quantity ſufficient to load a ſhip, if the climate would admit of curing them, in a few days.—Alſo, a lake towards the extremity of the peninſula of Eaſt Florida, ſouth from the chain of lakes which communicate with St. John's river.

ESPIRITU *Santo, Iſlas del*, iſlands ſituated on the S. W. of Providence in the Weſt Indies. See ANDROS *iſlands*.

ESPLANADE, in *Fortification*, called alſo the glacis; a part which ſerves the counterſcarp, or covert way, for a parapet; being a declivity, or ſlope of earth, commencing from the top of the counterſcarp, and loſing itſelf, inſenſibly, in the level of the champagne.

ESPLANADE alſo ſignifies the ground which has been levelled from the glacis of the counterſcarp to the firſt houſes; or the vacant ſpace between the works and the houſes of the town.

The term is alſo applied, in the general, to any piece of ground which is rendered flat, or level, and which before had ſome eminence that incommoded the place.

ESPLEES, EXPLETIÆ, from *expleo*, in *Law*, the products which ground or land, &c. yield; as the hay of the meadows, the herbage of the paſture, corn of the arable, rents, ſervices, &c. and of an advowſon, the taking of tithes in groſs by the parſon; of wood, the felling of wood; of an orchard, the fruit growing there; of a mill, the taking of toll, &c. Theſe and ſuch like iſſues are termed eſplees. And it is obſerved, that in a writ of right of land, advowſon, &c. the demandant ought to allege in his count, that he or his anceſtors took the eſplees of the thing in demand; otherwiſe the pleading will not be good.

Sometimes this word hath been applied to the farm, or land, &c. themſelves. "Dominus E. habebit omnia expletias & proficua de corona emergentia." Plac. Parl. 30 Ed. I.

ESPOSENDA, in *Geography*, a town of Spain, in the province of Galicia; 12 miles S. W. of Orenſe.

ESPOSENDE, a ſmall port town of Portugal, in the province of Entre Minho, at the mouth of the Cavado, three leagues S. of Viana. Its ſhallow harbour is ſlightly protected by a fort, 22 miles N. of Oporto.

ESPRIT, JAMES, in *Biography*, was born at Beſiers in the year 1611. Having paſſed through his initiatory ſtudies, to which he had applied himſelf with great diligence, he was introduced to the duke de la Rochefoucault, who brought him acquainted with the chancellor Seguier, who not only allowed him a penſion from his own private purſe, but procured for him a penſion of two thouſand livres, on an abbey and a brevet of counſellor of ſtate. Through ſome ſecret enemies he incurred the diſpleaſure of the chancellor, and withdrew to the ſeminary of St. Magloire, where he became acquainted with the prince of Conti, and at that time had ſerious thoughts of entering the church. This prince was ſo charmed with the converſation of M. Eſprit, that he gave him handſome apartments in his own hotel, and a penſion of a thouſand crowns. In a ſhort time afterwards Eſprit gave up all thoughts of the eccleſiaſtical life, and determined to marry. On this occaſion he received ſome handſome preſents from the prince, to whom he became ſo much attached that he followed him, in 1766, to his government of Languedoc, and became his moſt confidential friend and adviſer. After the death of his patron, he devoted the whole of his time to the education of that prince's children. He himſelf died at the place where he was born in 1678. As a literary man he left behind him "Paraphraſes on ſome of the Pſalms;" and a treatiſe, entitled "La Fauſſetè des Vertus humain," in two volumes, which was publiſhed the ſame year in which he died, and which was intended as a commentary on the maxims of his firſt patron the duke de la Rochefoucault, to ſhew the fallacy of the virtues that are merely human, and the reality of Chriſtian virtues. By the abbè Olivet and others he is ſuppoſed to have been the tranſlator of Pliny's panegyric on Trajan. Eſprit was a member of the French academy, and in its infancy was conſidered as one of its ſhining ornaments. Moreri.

ESPRIT, *Saint*, in *Geography*, a ſmall town of France, in the department of the Landes, chief place of a canton in the diſtrict of Dax, with only 589 inhabitants. Its canton has a population of 10,161 individuals, diſperſed in eight communes, on a territorial extent of 147½ kiliometres.

ESPOUSALS, SPONSALIA, in *Law*, a contract or mutual promiſe between a man and a woman to marry each other. Marriage or matrimony is ſaid to be an eſpouſal de preſenti.

ESPRONCEDA, in *Geography*, a town of Spain, in Navarre; 11 miles W.S.W. of Eſtella.

ESQUADRILLE. See QUADRILLE.

ESQUADRON. See SQUADRON.

ESQUERDES, in *Geography*, a town of France, in the department of the ſtraits of Calais, and diſtrict of St. Omer; one league S. of St. Omer.

ESQUIAVINE, in the *Manege*, an old French word ſignifying a long and ſevere chaſtiſement of a horſe in training him.

ESQUILIÆ, or ESQUILINUS MONS, in *Ancient Geography*, one of the ſeven mountains on which Rome was ſeated, where was anciently one of the gates of the city, now the gate of St. Laurence, to whoſe magnificent church it leads. This gate ſeems to have been anciently called "Libitinenſis," on account of the dead bodies that were carried through it, in order to their being interred in the "Campus Eſquilinus," which was the general burying-place of the common people. The name of Eſquilinus was varied, for facility of pronunciation, from Exquilinus, a corruption of Excubinus, *ab Excubiis*, from the watch that Romulus kept in this place. It was taken in by Servius Tullius, who had his royal ſeat upon this hill. Varro will have the Eſquiliæ to be two hills. To the eaſt, it has the city walls; to the ſouth, the via Labicana; to the weſt, the valley lying between Mons Cœlius and Mons Palatinus; to the north, Mons Viminalis; and is in compaſs between three and four miles. It is now called "Il Monte de Santa Maria Maggiore." One of the 14 regions or wards, inſtituted by Auguſtus, was denominated "Eſquilina." It contained 15 ſtreets, eight luci, ſix temples, five ædes, 75 public baths, 18 granaries, 22 mills, and 180 great houſes; and its circuit was 15,950 feet.

ESQUIMAUX, the inhabitants of the coaſts of Labrador and Hudſon's bay, who differ, in ſeveral characteriſtic marks, from the inland inhabitants of North America. That the Greenlanders and the Eſquimaux agree in every circumſtance of cuſtoms, and manners, and language, which are demonſtrations of an original identity of nation, was diſcovered near half a century ago. Crantz, in his "Hiſtory of Greenland," (vol. i. p. 262.) informs us, that the Moravian brethren, who, with the conſent and furtherance of ſir Hugh Palliſer, then governor of Newfoundland, viſited the Eſquimaux, or the Labrador coaſt, found that their language, and that of the Greenlanders, do not differ ſo much as that of the high and low Dutch. Mr. Hearne, in 1772, traced this unhappy race farther back, towards that part of the globe, from whence they had originally coaſted along in their ſkin-boats, having met with ſome of them at the mouth of the Copper-mine river, in the latitude of 72°, and near 500 leagues farther weſt than Pickerſgill's moſt weſterly ſtation in Davis's ſtrait. Their being the ſame tribe, who now actually inhabit the iſlands and coaſts on the weſt ſide of North America, oppoſite to Kamtſchatka, is a diſcovery, the completion of which was reſerved for captain Cook. The reader of his third voyage will find them at Norton ſound, and at Oonaleſhka, and Prince William's ſound; that is, near 1500 leagues diſtant from their ſtations in Greenland, and on the Labrador coaſt. And leſt ſimilitude of manners ſhould be thought to deceive us, a table exhibiting proofs of affinity of language, drawn up by captain Cook and inſerted in the appendix to the work juſt cited, will remove every doubt from the mind of the moſt ſcrupulous inquirer after truth. See *New* BRITAIN and LABRADOR.

ESQUIMAUX *Bay*. See ESKIMAUX.

ESQUINANCY, in *Medicine*, from the French *eſquinancie*; whence our more common term *quinſy*. See CYNANCHE.

ESQUIRE, a title of diſtinction, next below that of knight, and above that of a ſimple gentleman.

The origin, both of the name, and the thing, eſquire, is very obſcure. The Engliſh denomination is confeſſedly borrowed from the French, *eſcuyer*; and that from the Latin *ſcutum*, ſhield, as ſome will have it; or, as others, from *ſcutarius*, or *ſcutiger*, ſhield-bearer; or from *ſcuria*, ſtable; or from *equiſo*, groom. So many different opinions of the formation of the word have given riſe to as many about the primitive office of eſquires; unleſs, perhaps, the latter hath given occaſion to the former. Paſquier, in his Recherches, liv. ii. chap. 15. maintains the title of eſquire, *eſcuyer*, *ſcutarius*, to be very ancient. From the time of the decleſion of the Roman empire, he obſerves, there were two extraordinary kinds of ſoldiery in the Roman army: the one called *gentiles*, and the other *ſcutarii*.

Ammian. Marcellin. lib. xiv. cap. 7. and lib. xvi. cap. 4. ſpeaks of theſe *ſcutarii* as men of redoubted prowefs, and even deemed invincible: it is added, that Julian the Apoſtate ſet a mighty value on thoſe troops, when he was among the Gauls; and hence, probably, it was, that the Gauls, or perhaps only the Franks, finding the braveſt among the Roman forces were called *gentiles*, and *ſcutarii*, gave the like names to the boldeſt and braveſt among themſelves; ſuch, according to that curious antiquary, is the original of eſquires.

Eſquire, however, afterwards came to be uſed in a ſomewhat different ſenſe; *viz.* for a gentleman who attended a knight in the wars, and on other military occaſions; bearing his ſhield, *ſcutum*, before him (whence he was called *ſcutarius*, *ſcutiger*, or *ſcutifer*), as alſo his lance, and other weapons; whence his other Latin appellation, uſual among us, *armiger*, q. d. *armour-bearer*. And hence likewiſe it is, that, in all our ancient romances, the hero is conſtantly attended by a gentle and truſty *'ſquire*.

After all, the moſt probable derivation of *eſcuyer* is not from *eſcu*, *ſcutum*, as is the common opinion; but from *equus*, horſe; the primitive eſquires being no other than what the Latins call *equiſons*, who had the care and intendance of the equerries, or ſtables, only.

Be this as it will, the title eſquire, *armiger*, as now eſtabliſhed among us, is next below that of knight, *eques*. They who bear this title are all younger ſons of noblemen, and the eldeſt ſons of ſuch younger ſons; the eldeſt ſons of knights, and their eldeſt ſons ſucceſſively; both which ſpecies of eſquires ſir Henry Spelman entitles *armigeri natalitii*; the four eſquires of the king's body, now diſuſed, and eſquires created by the king, by putting about their necks a collar of SS's, and beſtowing on them a pair of ſilver ſpurs, letters patent, or other inveſtiture, and their eldeſt ſons. Laſtly, divers others, in the ſuperior public offices, are reputed eſquires, or equal to eſquires; as ſheriffs of counties, ſerjeants at law, juſtices of peace, mayors of towns, counſellors at law, lieutenant-colonels, majors, captains, &c. during the time of their commiſſion. Laſtly, the heads of ſome ancient families are likewiſe eſquires by preſcription. To theſe may be added the eſquires of knights of the Bath, each of whom conſtitutes three at his inſtallation; and all foreign, nay Iriſh peers; for not only theſe, but the eldeſt ſons of peers of Great Britain, though frequently titular lords, are only eſquires by the law, and muſt be ſo named in all legal proceedings. See GENTLEMAN.

ESQUISSE, in the French *Painting*, a term ſignifying the firſt ſlight ſketch or draught of a picture; the firſt thought of a deſign drawn haſtily with a crayon; or in colours, on paper, canvas, or the like, in order to be finiſhed, and painted, or engraven afterwards.

He had not the trouble of making a finiſhed and correct deſign, but went to work upon the eſquiſſe.

The word is formed of the Italian *ſchizzo*, a ſplaſh; becauſe an eſquiſſe of a painting only repreſents, as it were, ſplaſhes, or dabs, of colours.

ESQUIVO. See Essequibo.

ESRAKITES. See Eschrakites.

ESS, in *Agriculture*, a term made uſe of in ſome places to ſignify aſhes.

ESSA, in *Ancient Geography*, a town of Paleſtine, on the other ſide of Jordan, according to Joſephus, who ſays that it was taken by Alexander, king of the Jews.

ESSACHORDO. See Hexachord.

ESSÆANS. See Esseni.

ESSAORE, in *Geography*, a town of Egypt; three miles S.S.E. of Achmim.

ESSARS, Les, a town of France, in the department of La Vendée, and diſtrict of La Roche-ſur-Yon; 3 leagues N.E. of La Roche.

ESSART, or Assart. See Assart.

Du-Cange derives the word from ſome of the barbarous Latin words, exartus, exartum, eſſartum, aſſartum, ſartum, and ſartus; which all ſignify a foreſt cut down, or dug up; though Spelman chooſes to deduce it from the Latin *exertum*, torn up, or unrooted. Others from *ſarrire*, to weed; and others, laſtly, from *exaro*, I plow; whence *exarare*; and, by contraction, *exartum*. In our ancient law-books, "exartum facere in ſylva," is to eſſart a place in a foreſt. To eſſart, is to grub up, or extirpate buſhes, trees, old roots, ſtumps, or the like; in order to fit the ground for tillage.

Essarts, *Les*, in *Geography*, a ſmall town of France, in the department of La Vendée, chief place of a canton in the diſtrict of Montaign, with a population of 2089 individuals, 24 miles W. of Mauléon. Its canton contains 9 communes, and 9043 inhabitants, on a territorial extent of 242½ kiliometres.

ESSATUM, a word uſed by ſome of the chemical writers to expreſs the medicinal power or ſanative property reſiding in ſimple medicines.

ESSAY, a trial, or experiment, to prove whether a thing be of the requiſite quality or goodneſs.

The word is French, *eſſai*; which ſome authors derive farther from the Latin *examen*.

Essay is alſo uſed for an attempt, or tentative, to learn whether or not a thing will ſucceed.

Eſſays of machines ſhould be made in large; it is not enough that they ſucceed in little.

Essay, in *Monaſteries*, is particularly uſed for a trial which a perſon makes of the monaſtic life, in a ſecular habit.

This eſſay is of one, two, and, in ſome monaſteries, of three months. The eſſay is not reckoned in the noviciate. See Probation.

Essay, or *Aſſay*, or ſimply *Say*, in *Coinage*. See Assay.

Essay, in matters of learning, is a peculiar kind of compoſition; whoſe character is to be free, eaſy, and natural; not tied to ſtrict order, or method, nor worked up, and finiſhed like a formal ſyſtem.

The matter of an eſſay is ſuppoſed to conſiſt principally of ſudden and occaſional reflections, which are to be wrote much at the rate, and in the manner, a man thinks; ſometimes leaving the ſubject, and then returning again, as the thoughts happen to ariſe in the mind.

At leaſt, this has hitherto been the practice; and Montagne, who has acquired no ſmall reputation by this way of writing, ſeldom keeps many lines to the ſubject he propoſes; though it is our opinion, that lord Bacon, in many of his works, is a better pattern in the eſſay kind. Mr. Locke, however, and a few other authors, uſe eſſay in a ſtricter ſenſe: the Eſſay of Human Underſtanding, every body knows, is a regular, artful, and laboured work; though perhaps ſo called to guard againſt too ſevere ſtrictures, by pleading the title.

Essay-*hatch*, is the miners term for a little trench or hole, which they dig to ſearch for ſhoad, or ore. See Tin.

Essay-*maſter*. See Mint, and Assay.

ESSE, in the *School Philoſophy*, is uſed in the ſame ſenſe with eſſence; principally for that which is actual, or actually exiſting.

The word is pure Latin; being the infinitive of the verb *ſum*, I am; whence *eſſe*, to be.

From eſſe ariſes *eſſatum*, a barbarous term, now almoſt obſolete, ſignifying that which is ended with eſſence, or nature; or affected with the virtue, or efficacy, of another. Some diſtinguiſh eſſe into *real* and *intentional*; and, again, into *eſſatum* and *volitum*.

ESSEDARIUS, among the Romans, a gladiator, who fought in a car or chariot. See Hiſt. Acad. Inſcrip. vol. ii. p. 376. ſeq.

ESSEL, or Ebstel, in *Geography*, a town of Germany, in the circle of Weſtphalia, and county of Verden; 2 miles N. of Verden.

ESSEN, a ſmall town of Germany, in the circle of Weſtphalia, remarkable for its manufactures, chiefly of ſwords and fire arms; but more particularly for a rich abbey, which, until the peace of Luneville in 1801, was a free imperial abbey. It was ſecularized, and its poſſeſſions, together with the town and its territory, were given to Pruſſia as an indemnity for her loſſes on the right ſhore of the Rhine. After the peace of Tilſit in 1807, when Pruſſia loſt all her dominions beyond the Elbe, Eſſen was added to the grand duchy of Berg and Cleves, which now belongs to the eldeſt ſon of the king of Holland. There are other towns of this name in the circle of Weſtphalia.

ESSENBACK, a town of Denmark, in Jutland; 4 miles from Randers.

ESSENBERG, a town of Germany, in the circle of Weſtphalia, and county of Meurs, near the Rhine; 3 miles E. of Meurs.

ESSENCE, a term much uſed among the ſchoolmen; and denoting what the Platoniſts called the idea of a ſpecies. The word *eſſentia* is ſaid to have been made by Cicero; but his authority could not give it currency, until long after his time. It came at laſt to be uſed, and the ſchoolmen fell into much the ſame opinions concerning eſſences, as the Platoniſts held concerning ideas. The eſſences of things were held by many to be uncreated, eternal, and immutable. Mr. Locke diſtinguiſhes two kinds of eſſence, the real and the nominal. By the former he means the conſtitution of an individual, which makes it to be what it is. This eſſence moſt begin and end with the individual to which it belongs. It is not therefore a Platonic idea. But the latter or nominal eſſence, ſo called by Mr. Locke, is the conſtitution of a ſpecies, or that which makes an individual to be of ſuch a ſpecies; and this is nothing but that combination of attributes which is ſignified by the name of the ſpecies, and which we conceive without regard to exiſtence. The eſſence of a ſpecies is, therefore, what the Platoniſts called the idea of the ſpecies. The nominal eſſence depends on the real eſſence; thus, the nominal eſſence of gold, is that complex idea which the word gold repreſents; *e. gr.* a body, yellow, heavy, malleable, fuſible, and fixed; but its real eſſence is the conſtitution of its inſenſible parts, on which thoſe qualities, and all its other properties depend; which is wholly unknown to us.

In philoſophy, the eſſence of a thing is defined to be, that whereby a thing is diſtinguiſhed from every other thing. The Carteſians hold the eſſence of matter to conſiſt in extenſion; and, on that principle, deny that there is any ſuch thing as mere ſpace, or vacuity; but the hypotheſis is falſe, as will be ſhewn under the articles MATTER, SPACE, VACUITY, PLENUM, &c.

Gaſſendus, and moſt of the corpuſcular philoſophers, hold the eſſence of matter to conſiſt in ſolidity, or impenetrability, reſiſtance, or, more adequately, in a ſolid impenetrability reſiſting the touch; which it muſt be allowed, of all the properties of matter, ſeems to have the faireſt title to it.

The ſchool philoſophers give us two ſignifications of the word eſſence; the firſt denotes the whole eſſential perfection of a being, and, conſequently, its entity, with all its intrinſic, or eſſential, and neceſſary attributes, taken together; in which ſenſe, eſſence may be defined to be, all that whereby a thing is, and what it is. In which caſe the eſſence of a thing is to the thing itſelf, what humanity, *e. gr.* is to man.

The ſecond ſignification of eſſence is, that whereby it denotes the principal, and moſt intimate, of all the attributes of a thing; or that which agrees to every ſuch thing, and ſuch alone, and that always, and in ſuch manner, as that the mind, with all its attention, cannot perceive any thing prior thereto; by which, eſſence is diſtinguiſhed from the eſſential attributes, *i. e.* from ſuch as flow from its eſſence, or firſt attribute. Thus, the eſſence of the human mind is commonly ſuppoſed to conſiſt in the power of thinking; becauſe all its other perfections ſeem to pre-ſuppoſe this; but this pre-ſuppoſes none. And thus the powers of underſtanding, doubting, aſſenting, willing, &c. do all flow from the power of thinking; and cannot exiſt without it, though this may without any of them.

It muſt be allowed, however, that the eſſential properties of a thing do ſo cloſely cohere, nay, and inhere, in the eſſence itſelf, that it is ſcarcely poſſible to diſtinguiſh the one from the other. Hence, what ſome urge, that, ſetting aſide all the attributes and properties of a thing, and what remains is its eſſence, is a mere chimera. For ſet aſide, *e. gr.* from the mind, the powers of underſtanding and willing, with the reſt of its attributes, and what will there remain to call its eſſence?

It is greatly diſputed, in the ſchools, whether the eſſences of created things be eternal? or whether the eſſences, as well as their exiſtence, had their origin in time? The Carteſians hold, that the eſſences of things depend abſolutely on the free concurring will of God.

ESSENCE, *Eſſential oil, Eſſential ſalt.* The eſſence of a vegetable, according to the old chemiſts, was, that one of its proximate elements, in which reſided the quality of taſte or odour, which peculiarly diſtinguiſhed it from other vegetables, and rendered it eſpecially applicable to pharmaceutical purpoſes. Thus the fragrance of orange peel, of pepper-mint, of cinnamon, was found by experience to be ſeparable from the other parts of the vegetable, by means of diſtillation, &c.; the reſult of this proceſs was a ſmall portion of highly fragrant oil, in which was contained the entire odour that had been naturally diſperſed through the whole maſs: hence the oil thus procured obtained the name of "eſſential oil." Again, moſt ſour vegetables, as ſorrel, lemons, &c. owe this quality to the preſence of an acid, which, when ſeparated from the other vegetable principles, aſſumes a cryſtalline appearance, and was known by the name of their eſſential ſalt. The ſame appellation was alſo given to all thoſe vegetable principles which, when pure, are capable of cryſtallizing, whether they were acid to the taſte or not. Thus ſugar was ranked among the eſſential ſalts. The term, however, is at preſent obſolete. Eſſential oil ſtill retains its place in chemical nomenclature, and we refer the reader to the article OILS, *eſſential*, for a particular account of their ſpecies and properties.

ESSENCE *of Roſes.* See ROSES.

ESSENCE, *Ward's.* See WARD'S *Medicines.*

ESSENCE *of Wine*, a term uſed by Paracelſus, and ſome of the German chemiſts ſince his time, to expreſs what is called ſometimes the philoſophical ſpirit of wine, or the ſpirit of wine of the ancients. It is not a diſtilled ſpirit like what we call ſpirit of wine, but approaches more to what Stahl has greatly recommended to the world, under the name of concentrated wine, or wine whoſe ſtrength has been reduced to a ſmaller compaſs, by ſeparating its aqueous parts only by freezing. Stahl recommends the immediately expoſing of wine to the froſty air on this occaſion; but the proceſs ordered by Paracelſus for the preparation of this liquor is more tedious. He orders that the fineſt and beſt flavoured wine be choſen; that it be put into a glaſs, filling it up three parts in four: and the neck being then ſealed hermetically, it is to be put into horſe-dung for three months, and then expoſed to the froſty air for a month, after which the ice is to be thrown away, and the liquid part, which is the eſſence, preſerved. Shaw's Chemical Eſſays.

ESSENDO *Quietum de Tollonio*, in *Law*, a writ to be quit of toll, and lies for citizens and burgeſſes of any city or town that by charter or preſcription ought to be exempted from toll, where the ſame is exempted of them. Reg. Orig. 258.

ESSENEUX, in *Geography*, a town of the Netherlands, in the duchy of Limburg, ſituated on the Ourt; 9 miles S. E. of Liege.

ESSENI, ESSENES, or *Eſſæans*, an ancient ſect among the Jews.

As to the etymology of the name, critics have been much divided. Philo derives it from οσιος, *holy*; Epiphanius from ישי, *Jiſhai, Jeſſe*, the father of David; Salmaſius from a city called *Eſſa*, mentioned by Joſephus; whence he apprehends the ſect firſt ſprung; Godwin derives it from the Syriac word אסא, *aſa*, which ſignifies *to heal*; becauſe Philo calls one branch of the Eſſenes Therapeutæ; and Serrarius enumerates at leaſt a dozen different etymologies. Philo in Tract. Omnis probus Liber. Oper. p. 678. Colon. Allobr. 1613. Epiphan. Hæreſ. xix. lib. i. Salmaſ. Plin. exercit. in Solin. cap. 35. Serrar. Trihæres. Jud. lib. iii. cap. 1. p. 106. 110. edit. Trigland. 1703. The principal ancient writers, who give any conſiderable account of the Eſſenes, are Joſephus, Philo, and Pliny. Joſ. de Bell. Jud. lib. ii. cap. i. cap. 8. & 12. and Antiq. lib. cxiii. cap. 9. 13. 19. lib. xviii. cap. 1. & cap. 2. & alibi. Philo, ubi ſupra, & De Vita contemplativa, p. 688. ed. col. Allobr.

As to the origin of this ſect, Pliny aſſerts, without mentioning his authority, that it had ſubſiſted for ſeveral thouſand years. The moſt probable opinion is, that this ſect was formed by Jewiſh exiles, a little before the time of the Maccabees, who were forced to fly from the perſecution of their enemies into caves and deſerts. The firſt Eſſenes we read of are mentioned in the fourth book of Maccabees, under the name of Haſdanim, and by Joſephus; both which accounts agree that they were already ſettled in Judæa, in the time of Jonathan, the brother and ſucceſſor of Judas Maccabæus, about a hundred and fifty years before Chriſt. Joſephus ſtates that their number in Judæa was about four thouſand, meaning, as Dr. Lardner (Works, v. i. p. 128.) ſuggeſts, thoſe of them, that entirely rejected marriage. Philo ſays, that in Syria and Paleſtine there were about 4000 of them, but he makes the number in Egypt much greater. Philo ſays, that they ſacrificed no living creatures, and that they ſhunned cities. Joſephus ſays that they ſent preſents to the temple, but offered no ſacrifice there. They ſeem therefore not to have expoſed themſelves much to public view, nor would they admit a man of another ſect into the apartments in which they lived. Some have expreſſed their ſurpriſe, that no mention ſhould be made of this ſect in the New Teſtament. This proceeded, as ſome imagine, from their retired mode of living, by reaſon of which they never came under our Saviour's obſervation, as the Phariſees and Sadducees often did. Others ſuppoſe, that, being very honeſt and ſincere, without guile or hypocriſy, they gave no reaſon for that reproof and cenſure, which the others very juſtly merited. It ſhould be conſidered that it was the deſign of the evangeliſts to write the hiſtory of our Saviour's miniſtry, and not that of the Jewiſh ſects. Prideaux obſerves, that almoſt all that is peculiar in this ſect is condemned by Chriſt and his apoſtles. Prid. Conn. vol. iii. p. 384. However, it has been ſuppoſed, that they are referred to by the apoſtle Paul in his epiſtle to the Coloſſians, ch. ii. 18. 21. 23.

Joſephus, making mention of the ſeveral ſects among his countrymen, diſtinguiſhes three; *viz.* the Phariſees, Sadducees, and Eſſeni; which laſt he prefers to the two former, as to their manner of life. He aſſures us, farther, that they were Jews, by original; from which it ſhould appear, that St. Epiphanius was miſtaken in ranking them among the Samaritans.

In effect, the Eſſeni appear to have been true Pythagorean philoſophers, in every thing that related to their manner of living; for they greatly affected ſolitude and retirement; and avoided all converſation with women, to devote themſelves more entirely to the contemplative life. Grotius will have the Eſſeni the ſame with the ancient חסדים, *Haſidim*, or *Haſidæi*; thus called, according to Philo, from their ſingular piety, humility, and devotion. Among theſe, Gale obſerves, it was, that the Hebrew philoſophers chiefly flouriſhed. Porphyry is very prolix in his praiſes of the Eſſeni: *Εισι τοινυν οι Εσσαιοι Ιȣδαιοι μεν το γενος φιλαλληλον*, &c. He repreſents them as deſpiſers of pleaſures, riches, glory, and delicacy; and ſtrenuous retainers to continency, auſterity, ſtudy, &c. He adds, they decline marriages, and adopt and educate other people's children in the principles of religion and philoſophy; they are all on a level, hold every thing in common, neither buy nor ſell, &c. By long habit, they arrived at ſuch a degree of patience, that Porphyry aſſures us, flames and tortures had not the leaſt effect on them. They ſcorned to intreat their tormentors; nor ever ſhed a tear; but would ſmile under all their agonies, &c. As to their learning, Philo Judæus, in his treatiſe, That every good Man is free, tells us, that they deſpiſed logic, as uſeleſs to the acquiring of virtue; phyſics they left to the ſophiſts and diſputants, as judging it to tranſcend the human faculties; and applied themſelves wholly to morality. Porph. de Abſtin. lib. iv. § 11. ſeq. Gale Philoſ. Gener. lib. i. cap. 1. § 11.

Both Joſephus and Philo give a ſurpriſing account of their auſtere way of life, which the curious reader may ſee at large in Prideaux's Conn. ubi ſupra. Their houſes were mean; their cloaths made of wool, without any dye; they never changed their cloaths or ſhoes till they were quite worn out; their food was plain and coarſe, and their drink water; they neglected all bodily ornaments, and would by no means anoint themſelves with oil, according to the faſhion of thoſe times. They lived in ſodalities, and had all their goods in common; their morals were very exact and pure, and they kept the Sabbath more ſtrictly than any of the Jews. Before any of them were admitted to the common table, they bound themſelves by a ſolemn oath to obſerve the rules of the ſociety, which were very ſtrict and exemplary.

Some have ſaid that the Eſſenes, as well as the Pythagoreans, prohibited oaths; that they uſed only inanimate ſacrifices, and that they not only worſhipped towards the riſing ſun, but worſhipped the ſun itſelf. But it has been urged, that neither of theſe charges ſeem to be well founded; or at leaſt, that it is difficult to reconcile them with their known veneration for the writings of Moſes, and other inſtances of their conduct. Pliny, and others on his authority, have aſſerted, that they wholly declined marriage; and Pliny (lib. v. cap. 17.) with more wit than juſtice, ſays, that for ſeveral thouſand of years, this people is perpetually propagated without any being born among them, ſo fruitful and prolific unto them is the repentance of others. But Joſephus informs us (De Bell. Jud. lib. ii. cap. 1.) that there is one ſort of Eſſenes, who agreed with the others, except in the article of marriage. For they reckoned, that thoſe that do not marry cut off a great part from the number of the living, and that thus the whole race of mankind would ſoon be extinguiſhed. Accordingly they made choice of thoſe women, who, after three years trial, were found fit to bear children, and never cohabited with them after they were known to be with child; conſulting the propagation of their ſpecies, and not their own gratification in this buſineſs.

With reſpect to the religious opinions of the Eſſenes, they believed the exiſtence of angels, the immortality of the ſoul, and a future ſtate of rewards and puniſhments, but denied the reſurrection of the body. They maintained, that fate governs all things, and that nothing happens to man but by its appointment.

The Eſſeni ſeem to have been, among the Jews, what the moſt retired and auſtere monks are, or were, among the Chriſtians: which was what gave them their denomination of *Ιȣδαικοι ασκηται*, *Jewiſh aſcetics*.

Many Catholic writers have even deduced the origin of monks from them; building, principally, on what Philo relates of them, who divides them into two branches, or ſects; the one who married, and the other who lived in celibacy.

Joſephus ſeems likewiſe to have had an eye to theſe two ſorts of Eſſeni. Serrarius, who has wrote very amply on the ſubject, follows Philo in making two claſſes of Eſſeni. The firſt are thoſe whom he calls *Practici*, and who lived in community; the ſecond, thoſe called *Theoretici*, who lived in ſolitude, and led a life of pure contemplation. He adds, that Joſephus only makes mention of the firſt; omitting the contemplative kind, whom Philo calls *Therapeutæ*, and who were principally found in Egypt. See THERAPEUTÆ.

Euſebius holds, that the Eſſeni, called *Therapeutæ*, were real Chriſtians, or Jews converted by St. Mark, who had embraced this kind of life. Scaliger, on the contrary, maintains, that theſe Therapeutæ were no Chriſtians, but real Eſſeni, who made profeſſion of Judaiſm; however, he allows of the two kinds of Eſſeni above-mentioned. But Valeſius, in his notes on Euſebius, abſolutely rejects any ſuch diſtinction: he denies that the Therapeutæ were any real Eſſeni; and that chiefly on the authority of Philo himſelf, who never calls them Eſſeni, and who places the Eſſeni in Judæa and Paleſtine; whereas the Therapeutæ were ſpread throughout Greece, Egypt, and other countries.

Some traces of the Eſſenes are found under the emperor Trajan, and under Juſtinian; but they were much degenerated from their primitive purity both of doctrine and manners; and the ſect about that time became extinct. Though the Therapeutæ, as well as the Eſſenes, were ſtrictly Jews, and not Chriſtians, it is not impoſſible, that ſome of them, becoming Chriſtians, might ſtill affect their former recluſe way of living; and being imitated by others, laid the foundation of monkery among Chriſtians.

ESSENIAS, Andrew, in *Biography*, a learned Dutch divine, was born at Bommel in the year 1618. He was educated chiefly at Utrecht, was admitted to the exerciſe of the miniſtry in the year 1639, and in the following year took the degree of M. A. He obtained ſome preferment, and took his doctor's degree in the year 1645. Soon after this, he was choſen paſtor of the principal church at Utrecht, and in 1653 was appointed profeſſor of theology at that univerſity. He died in 1677, leaving behind him many works, that were very highly eſteemed by his contemporaries. He was what the world has uſually denominated an orthodox divine, and wrote againſt Crellius, and others among the Unitarians. One of his largeſt publications was "A Syſtem of Divinity," in 2 vols. His moſt popular piece was entitled "A ſhort View of Theological Controverſies, with an Index to Scripture Paſſages." This has gone through many editions. Moreri.

ESSENTIA Dulcis, in *Chemiſtry*, a name given by Kunkel, and ſome others of the German authors, to a menſtruum, of which they relate wonderful effects; but the preparation of which ſeems hitherto a ſecret. They ſay this menſtruum has nothing acid or corroſive in it, but that it approaches to the nature of ſpirit of wine, yet that it is capable of diſſolving the moſt denſe metals, and of converting any of them into a pure white ſalt, which has all their virtues, but nothing of that vitrolic acrimony, which they have when prepared in the common way. The ſalts of mercury and of gold thus prepared have great praiſes beſtowed on them, and are ſaid to cure epilepſies, the venereal diſeaſe, and many other diſtempers, without any violence or danger. Kunkel, De Salis Metal. See Metal.

ESSENTIAL, ſomething that is neceſſary to conſtitute a thing, or that has ſuch a connection with the nature and reaſon of a thing, that it is found, or ſuppoſed, wherever the thing itſelf is.

Thus, it is eſſential to God to be juſt. Mr. Locke has laboured to overturn that great principle of the Carteſians, that thinking is eſſential to the ſoul.

The heart, brain, and ſpinal marrow, are parts ordinarily ſuppoſed eſſential to life, or without which life cannot be; yet we have inſtances, in hiſtory, of children being found, and alive, without almoſt any of thoſe parts. See Brain, &c.

Essential *characters*, in *Natural Hiſtory*, or *Diagnoſtics*, are ſuch particulars as mark or diſtinguiſh a plant or animal from all others in the ſame genus or order. Mr. William Martin, in his "Outlines of the Knowledge of Extraneous Foſſils," p. 189, ſtates the principles under five heads, which ſhould direct the choice of parts of a foſſil animal or plant, to be conſidered as its diagnoſtic or eſſential characters. See Reliquia.

Essential *oils*. See Oils.

Essential *properties*, are ſuch as neceſſarily depend on and are connected with, the nature and eſſence of any thing, ſo as to be inſeparable from it; in diſtinction from *accidental*.

Essential *ſalts*, are thoſe prepared from decoctions, or thoſe which are found cryſtallized in the juices and infuſions of plants; in contradiſtinction to thoſe made by incineration. See Salt.

Essential *Fever*, *Form*, *Mode*, *Part*, *Perfection*. See the ſubſtantives.

ESSEQUEBO, or Esquivo, in *Geography*, one of the four provinces into which the Dutch poſſeſſions in Guiana are divided; the other three being Surinam, which is the chief ſettlement, Berbiſche or Berbiz, and Demerara. This ſettlement derives its name from that of the large river on which it is ſituated, and which at its diſcharge into the Atlantic is 3 leagues wide. The productions of this country are ſugar, coffee, and cotton. See Guiana, Surinam, Berbische, and Demerara.

ESSERA, a river of Spain, which runs into the Cinca, in Arragon.

ESSERA, Essere, or *Sere*, in *Medicine*, a generic denomination, uſed by the Arabian phyſicians, and compriſing ſeveral popular eruptions, and raſhes, which appear on the ſkin; eſpecially the eruption of the ſummer ſeaſon, in warm climates, which has been termed the Prickly-*heat*, the Nettle-*raſh*, the Prurigo of Dr. Willan's claſſification; &c. See theſe articles. See alſo Willan on Cutaneous Diſeaſes, genus Lichen.

ESSERUM, in *Geography*, a ſmall town of Denmark, in the iſland of Zealand, in the diſtrict of Cronburg, and the herred of Holboe. Before the Reformation it was remarkable for a rich monaſtery of Bernardines, founded in 1150, in an extremely pleaſant country, watered by lakes abounding in fiſh. But Eſſerum is now much more intereſting for a royal ſtud of horſes, and for having conſtantly flocks of the moſt renowned foreign ſheep, Spaniſh and others, which are diſtributed among the farmers to improve the Daniſh breed. In the beginning of the year 1800, there were at Eſſerum 652 choice ſheep, of which 223 ewes, and 33 rams, were Spaniſh of the beſt Merino breed. Catteau Tableau des Etats Danois, vol. ii. p. 147.

ESSES, in *Military Language*, are fixed to draught chains, made in the form of an S; one end of which is faſtened to the chain, and the other to hook to the horſe's harneſſes, or to a ſtaple; they ſerve likewiſe to lengthen and piece chains together.

ESSEX, in *Geography*, the name of one of the Engliſh counties, which has for its boundaries the German ocean and river Thames to the eaſt and ſouth; the counties of Suffolk and Cambridge to the north; and thoſe of Middleſex and Hertfordſhire on the weſt. The area of land thus encompaſſed meaſures about ſixty miles in length from eaſt to weſt, by fifty from north to ſouth: its circumference being about 225 miles. It is divided into 20 parts, of which fourteen are hundreds, five half hundreds, and one a royal liberty. Theſe are ſubdivided into about 400 pariſhes and townſhips, and twenty-five towns; containing, according to the late official report, 39,398 houſes, and 226,437 inhabitants. When the Romans invaded Britain, this diſtrict, with that now denominated Middleſex, were inhabited by a claſs or tribe of the Britons, called Trinobantes, or Trinovantes, who poſſeſſed, according to Cæſar, and ſome other ancient writers,

ters, two conſiderable cities or fortified towns; one, the ſite of modern London; and the other, that of Colcheſter in this county. This tribe was the firſt to ſubmit to and become vaſſals to the Romans, who, to keep them in ſubordination, eſtabliſhed five military ſtations within this diſtrict. Theſe were Durolitum, Cæſaromagus, Canonium, Camalodunum, and Ad Anſam. Theſe ſtations were all ſeated on the road which formed the fifth Iter from Londinium to Venta Icenorum, Caſtor in Norfolk. Camalodunum was unqueſtionably the principal ſtation in Eſſex, and though its ſite has been much conteſted by different writers, an attentive examination of the ſeveral places aſſigned, combined with a knowledge of the antiquities diſcovered in the vicinity of each, will admit little doubt of Colcheſter being the real ſituation. Eſſex formed a ſeparate and diſtinct kingdom during a certain period of the Saxon Heptarchy, and was called Eaſt-Seaxa; but the times of its eſtabliſhment and termination are not preciſely authenticated. Turner ſtates that this diſtrict, and Eaſt Anglia, were originally occupied by the Saxons at nearly the ſame period; and that Erkenwin was the firſt king of the former; commencing his reign in 527, and dying in 587.

By the Domeſday-book it appears, that ninety land-owners of this county were deprived of their lands by the Conqueror, during whoſe reign the whole civil and eccleſiaſtical eſtabliſhment of the kingdom, and of each county, underwent very conſiderable changes. Eſſex was now governed and tyrannized over by Norman barons, who conſtructed caſtles on their eſtates to ſecure themſelves, and to awe their dependant vaſſals. In the civil wars between the houſes of York and Lancaſter, and in thoſe of Charles's time, this county ſuffered greatly from the interference of the De Vere's in the former, and during the long ſiege of Colcheſter in the latter. Formerly there were twelve caſtles, or fortified buildings in this county; two of which, Landguard fort, and Tilbury fort, were denominated royal caſtles, as built for national ſecurity: the others were baronial reſidences, *viz.* Colcheſter, Hadleigh, Canfield, Hedingham, Clavering, Raleigh, Ongar, Pleſhy, Stanſtead-Montfichet, and Walden. Theſe formidable fortreſſes, though once the pride of the nobility, and the terror of the peaſantry, are moſtly raſed to the ground; the only parts remaining being their high keeps and wide foſſes. At Colcheſter, Hadleigh, Hedingham, and Walden, ſome parts of the walls ſtill remain. Eſſex compoſes part of that tract of country on the eaſtern ſide of England which forms the largeſt connected ſpace of level ground in the whole iſland; not one lofty eminence or rocky ridge being found in ſeveral contiguous counties. The ſurface of Eſſex is not, however, totally flat, having many gentle hills and dales; and towards the north-weſt, whence moſt of the rivers proceed, the country riſes, and preſents a continued inequality of ſurface. The moſt level tracts are thoſe of the ſouthern and eaſtern hundreds. The ſea-coaſt is broken into a ſeries of iſlets and peninſulas, deeply cut in by arms of the ſea, and exhibiting evident tokens of the force and effects of that reſtleſs element. Extenſive ſalt marſhes border moſt of the coaſt, the greater part of which is protected by embankments. The banks of the Thames, and the lower part near the ſea, are likewiſe low and marſhy. This county lies under a proverbial imputation of being particularly unhealthy; but this character can only apply to a ſmall part of it; as the middle and northern diſtricts are juſtly noted for a dry ſoil, and a wholeſome clear air. That part known by the name of the hundreds of Eſſex, bordering on the ſouth coaſt, from its low and marſhy ſituation, and expoſure to the eaſterly winds and ſea fogs, is certainly inimical to health, and many intermitting fevers proceed from theſe cauſes.

The principal productions of this county are wheat, barley, oats, beans, peas, turnips, tares, rape, muſtard, rye-graſs, and trefoil. Many diſtricts on the eaſt ſide are extremely productive: wheat is not unfrequently found to riſe to a load an acre; oats, (particularly the Poland,) to eleven or twelve quarters; beans and other corn in proportion. Among the more rare plants cultivated in Eſſex, are thoſe of coriander, teaſel, and carraway; many acres are alſo appropriated to the produce of hops, and various horticultural plants and roots. The latter are confined to the vicinity of large towns, and to the lands adjoining to the metropolis. Almoſt every ſpecies of ſoil is to be found within the limits of Eſſex, from the moſt ſtubborn to the mildeſt loam. The north-weſt ſide is characterized by a chalky ſubſtratum; but the eaſt and ſouth ſides abound with marſhy and boggy land, having abundance of gravel intermixed. Of waſte lands and foreſts, Meſſrs. Griggs (in their "General View of the Agriculture of Eſſex,") computed the county to contain fifteen thouſand acres; the greater part of which, they obſerve, is capable of producing corn. Since their report, however, many diſtricts have been incloſed and cultivated. Though Eſſex is not highly celebrated for its dairies, yet thoſe in the pariſh of Epping and its vicinity are famous for the richneſs of their cream and butter. The butter is moſtly ſent to London, where it bears a high character and price. Few counties have leſs minerals than Eſſex; which is alſo nearly exempt from quarries, or any maſs of rocks. In conſequence, the houſes are almoſt wholly built with brick; and many of them are ſingular and curious ſpecimens of brick-architecture. In conſtructing the caſtles, the monaſtic buildings, and many of the old manſion-houſes, the builders have endeavoured to render them not only durable monuments of their ſkill, but alſo examples of their taſte, diſplayed by a variety of ornaments in the cornices, doors, pilaſters, and particularly in the chimnies. Some mineral waters riſe in the county, but few have obtained much repute; that of Tilbury is occaſionally reſorted to, and found to be impregnated with ſome earthy and muriatic ſalts.

The principal rivers, properly belonging to this county, are the Colne, the Blackwater or Pant, the Chelmer, the Crouch, the Ingerbourn, the Roding, and the Cam. Beſides theſe, Eſſex partakes of other rivers, which ſerve as natural boundaries, and irrigate and fertilize its land: theſe are the Thames, the Lee, or Lea, the Stort, and the Stour.

In the early periods of our hiſtory, it is reaſonably preſumed, that the whole, or the greater part of Eſſex, was one extenſive foreſt. During the Britiſh and Roman governments, many parts muſt have been cleared for ſtations, roads, and cultivation: yet in the time of king Stephen it appears that the principal portion of the county was either foreſt, or ſubject to foreſt laws. In his reign, however, a large tract in the north-eaſt part of the county was diſafforeſted, and cultivated; and the remaining part, north of Stane-ſtreet, was diſafforeſted by king John. Henry the Third, in the twelfth year of his reign, directed perambulations to be taken of Waltham foreſt, in order to aſcertain its extent and value; and about the ſame time had large tracts cleared for the plough. This judicious plan was purſued by Edward the Firſt, in the twenty-ſixth and twenty-eighth years of his reign: yet much foreſt land ſtill remained; and Paul, viſcount Bayning, with many other gentlemen of the county, purchaſed of the crown, and diſafforeſted ſeveral parts of it. Theſe proceedings, combined with the more equitable deciſions of ſubſequent monarchs, occaſioned the foreſts to contract their boundaries, and be leſs injurious to the public. While the foreſts continued in the crown, and were under the local government of arbitrary foreſters and ſtewards, the ſubject, whoſe eſtate was contiguous, ſuffered repeated oppreſſions. The grievance was partly redreſſed in the perilous reign of king John, when the barons compulſively procured from that monarch the "Charter of Foreſts," by which many of theſe royal diſtricts were diſafforeſted, and ſtripped of their oppreſſive privileges; while more lenient regulations were adopted in the government of thoſe that remained. The foreſts of Epping and Hainault ſtill retain the name, and ſupport a few deer, &c. The office of chief foreſter for Eſſex was deemed highly honorary, and was generally beſtowed on ſome illuſtrious perſon. The ſtewardſhip was alſo an office of great conſequence, and was uſually enjoyed by ſome of the nobility. It continued in the De Veres, earls of Oxford, for many generations, but was taken from them by Edward the Fourth, on account of their adherence to the Lancaſtrian party. On the acceſſion of Henry the Seventh, it was reſtored by grant to John, earl of Oxford. The ſteward had power to ſubſtitute a lieutenant, one riding foreſter, and three yeomen-foreſters, in the three bailiwicks of the foreſt. He alſo had many lucrative privileges, and was keeper of Havering at Bower, and of the houſe and park there.

Previous to the diſſolution, Eſſex contained forty-ſeven religious houſes: of theſe, two were mitred abbies; ſix common abbies; twenty-two priories; three nunneries; three colleges; two præceptories of templars; and nine hoſpitals.

Eſſex is included in the dioceſe of London, and contains three archdeaconries and fifteen deaneries; it returns eight members to parliament, *viz.* two for the county, two for Malden, two for Harwich, and two for Colcheſter: it is in the home circuit; pays twenty-four parts of the land-tax, and ſupplies 960 men for the militia.

Essex, one of the moſt populous and beſt cultivated counties in Maſſachuſetts, in the United States of America; bounded N. by North Hampſhire, E. and S. by the ocean, and the town of Chelſea in the county of Suffolk, and W. by Middleſex county; 38 miles long and 25 broad; of a triangular ſhape, Chelſea being the acute point. It is ſubdivided into 22 townſhips, containing 7644 houſes, and 61,196 inhabitants, about 135 to each ſquare mile. The firſt ſettlement in Maſſachuſetts proper was made in Salem, the capital of this county, in 1628, and it was made a ſhire in 1643, being one of the three into which the colony was divided. Eſſex county pays about $\frac{1}{7}$th part of the ſtate-tax, elects ſix ſenators for the government of the commonwealth, and two repreſentatives in the legiſlature of the United States. The principal towns are Salem, Newbury-port, Glouceſter, Marblehead, Beverly, Newbury, and Ipſwich; and in it are two academies, one at Byefield, and another at Andover. The face of the county is agreeably variegated with hills, vales, plains, and woods; the land is generally fruitful, but more ſuited to the culture of barley than moſt other parts of the ſtate; it has quarries of marble and limeſtone, and the coaſt is indented with a number of good harbours. The north part of Eſſex county is interſected by Merrimack river; and between it and the North Hampſhire line is a ſtrip of land three miles wide, divided into the towns of Methuen, Haverhill, Almſbury, and Saliſbury, containing 1429 inhabitants. The chief iſland on the coaſt of this county is Plum iſland.

Essex, a county in Upper Canada, bounded on the E. by the county of Suffolk, on the S. by lake Erie, on the W. by the river D'Etroit to Maiſonville's mill, thence by a line running parallel to the river D'Etroit and lake St. Clair, at the diſtance of four miles, till it meets the river Thames, and thence up the ſaid river, to the N.W. boundary of the county of Suffolk. This county ſends one repreſentative to the provincial parliament.

Essex, a county in Virginia, bounded E. and N.E. by Rappahannock river, which divides it from Richmond county; about 55 miles in length and 12 in breadth, and containing 3741 free inhabitants, and 5767 ſlaves.

Essex, a county in New Jerſey, ſituated in the eaſtern part of the ſtate, and ſeparated from Staten iſland by Newark bay. It is about 25 miles in length and 16 in breadth, and has three townſhips, *viz.* Newark, Elizabeth-town, and Acquackanack, containing 22,269 inhabitants, of whom 1521 are ſlaves. The ſoil is fertile, and its productions find a ready ſale in the city of New-York. This county comprehends ſeven Preſbyterian churches, three for Epiſcopalians, one for Anabaptiſts, and two for Dutch Calviniſts.

Essex, a county of New-York, having on the north Clinton county, on the ſouth Waſhington county, and on the eaſt lake Champlain, which ſeparates it from Vermont.

Essex, a county in Vermont, bounded N. by Canada, and E. by Connecticut river, containing 1429 inhabitants.

Essex, a townſhip in Chittenden county, in Vermont, containing 729 inhabitants, and lying between Jericho on the S.E. and Colcheſter on the N.W.

Essex *Valley Mountains*, mountains of the iſland of Jamaica; 10 miles S.S.E. of Lacovia.

ESSEY, a town of France, in the department of Orne, and diſtrict of Alençon; 3 leagues N.E. of Alençon.

ESSLISORS. See Elisors.

ESSOIGN, or Essoin, in *Law*, an excuſe for him who, being ſummoned to appear and anſwer to an action real, or to perform ſuit to a court baron, &c. cannot attend, becauſe of ſome legitimate hindrance.

The word is formed of the French *eſſoine*, or *exoine*; and that from the barbarous Latin *eſſonia*, or *exonia*, which ſignifies the ſame.

The cauſes that ſerve to eſſoin, are various; yet they may be reduced to five heads. The firſt is, *eſſoin de ultra mare*, when the party is beyond ſea; by which the defendant ſhall have 40 days: the ſecond, *de Terra Sancta*, when on an expedition in the Holy Land, and the defendant ſhall have a year and a day; the third, *de malo veniendi*, when he is infirm of body, and cannot come; which is alſo called the common eſſoin; the fourth, *eſſoin de malo lecti*, when the defendant is ſick a-bed, and may by writ be viewed by four knights; the fifth, *de ſervitio regis*, when he is in the king's ſervice. Beſides theſe, there are ſeveral other excuſes to ſave a default in real actions, as conſtraint of enemies, floods of water, &c. 2 Co. Inſt. 125.

Essoign *day of term*, is the firſt day of that term when the court ſits to take eſſoigns, or excuſes, for ſuch as do not appear according to the ſummons of the writ; *e. g.* the octave of St. Hilary, or the eighth day incluſive after the feaſt of that ſaint; which falling on the 13th of January, the octave, therefore, or firſt day of Hilary term, is the 20th of January. But the perſon ſummoned hath three days grace beyond the return of the writ, in which to make his appearance; and if he appear on the fourth day incluſive, the *quarto die poſt*, it is ſufficient.

Essoign *de malo villæ*, is when the defendant is in court the firſt day, but gone without pleading; and being afterwards ſurpriſed with ſickneſs, &c. cannot attend, but ſends two eſſoigners, who openly proteſt in court that he is detained by ſickneſs in ſuch a village, that he cannot come *pro lucrari et pro perdere;* and this will be admitted: for it lieth on the plaintiff to prove, whether the eſſoign is true or not.

Essoigns, *Clerk of the.* See Clerk.

ESSOMMES, in *Geography*, a ſmall town of France, in the department of the Aiſne, on the river Marne; 3 miles S.W of Château Thierry.

ESSONE, a river of France, in the department of Seine and Oiſe, which has its ſource near Pithiviers in the foreſt of Orleans, flows by Ferté Alais, receives the Juine near Saint Vrain, 3 miles above Villeroi, and falls into the Seine near Corbeil. It has lately been rendered navigable.

ESSONNE, a ſmall town of France, in the department of Seine and Oiſe, near the river Eſſone, 24 miles S. of Paris, and 24 miles N. of Fontainbleau, remarkable for its manufactures of gunpowder and of writing paper.

ESSORANT, from the French *eſſorer*, to air, in order to dry, in *Heraldry*, a term uſed to expreſs a bird ſtanding on the ground with the wings expanded, as if it had been wet, and were drying itſelf.

ESSOYES, in *Geography*, a ſmall town of France, in the department of the Aube, chief place of a canton in the diſtrict of Bar-ſur-Seine, with a population of 1585 individuals, 15 miles S.W of Bar-ſur-Aube. Its canton contains 21 communes, and 11,655 inhabitants, on a territorial extent of 375 kiliometres.

ESTABLISHMENT *of Dower*, in *Law*, is the aſſurance or ſettlement of dower made to the wife by the huſband on marriage; and *aſſignment of dower* ſignifies the ſetting it out by the heir afterwards, according to the eſtabliſhment. See Dower.

Establishment *of Religion*. See Religion.

ESTACHE, is uſed in our *Old Writers*, for a bridge or ſtank of ſtone and timber.

ESTAFFLISCHEN, in *Geography*, a town of Poland, in the palatinate of Kaliſh; 14 miles N.E. of Kaliſh.

ESTAFORT, a town of France, in the department of the Lot and Garonne, and diſtrict of Agen; 3 leagues S. of Agen.

ESTAGEL, a town of France, in the department of the Eaſtern Pyrenées; 3½ leagues N.W. of Perpignan.

ESTAGNAC, a ſmall town of France, in the department of the Charente; 33 miles E. of Angoulême.

ESTAIN. See Etain.

ESTAING, a ſmall town of France, in the department of the Aveyron, chief place of a canton in the diſtrict of Eſpalion, with a population of 1075 individuals. It is ſituated 18 miles N. of Rhodéz. Its canton contains 12 communes and 6700 inhabitants on a territorial extent of 195 kiliometres.

ESTAIRE, a ſmall town of France, in the department of the North, on the river Lys, between Merville and Armentieres; 15 miles W. of Lille.

ESTAMBOLIC, or Istambol-Antir, a town of Arabia, in the ſheriffal of Mecca, near the coaſt of the Red ſea; 180 miles N.N.W. of Medina.

ESTAMPES. See Etampes.

ESTANDARD. See Standard.

ESTANFORDE, in *Geography*, a town of Flanders; 12 miles S.W. of Ypres.

ESTAPA, or Istapo, a town of North America, in Mexico, and province of Tabaſco, ſituated on a river of the ſame name; 10 miles S.W. of Villa Hermoſa.

ESTAPLES. See Etaples.

ESTAPO, a ſtrong town of America, in New Spain, inhabited by Spaniards and native Americans, ſituated at the mouth of the river Tlaluc. N. lat. 17° 30′. W. long. 103° 5′.

ESTARREJA, a town of Portugal, in the province of Beira; 18 miles S. of Oporto.

ESTATE, in *Law*, the title or intereſt which a man hath in lands or tenements, &c. An eſtate in lands, tenements, and hereditaments, ſignifies (ſays judge Blackſtone) ſuch intereſt as the tenant hath therein; ſo that if a man grants all *his eſtate* in Dale to A. and his heirs, every thing that he can poſſibly grant ſhall paſs thereby. (Co. Litt. 345.) It is called in Latin *ſtatus*, ſignifying the condition or circumſtance in which the owner ſtands with regard to his property. For aſcertaining this with accuracy, eſtates may be conſidered in a three-fold view: firſt, with regard to the *quantity of intereſt* which the tenant has in the tenement; ſecondly, with regard to the *time* at which that quantity of intereſt is to be enjoyed; and, thirdly, with regard to the *number* and *connexions* of the tenants.

I. The *quantity of intereſt* which the tenant has in the tenement is meaſured by its duration and extent. Thus, either his right of poſſeſſion is to ſubſiſt for an uncertain period, during his own life, or the life of another man; to determine at his own deceaſe, or to remain to his deſcendants after him; or, it is circumſcribed within a certain number of years, months, or days; or, laſtly, it is infinite and unlimited, being veſted in him and his repreſentatives for ever. This occaſions the primary diviſion of eſtates, into ſuch as are *freehold*, and ſuch as are *leſs than freehold*. See Freehold.

Eſtates of freehold, underſtood as they are defined under that article, are either eſtates *of inheritance*, or eſtates *not of inheritance*. The former are again divided into inheritances *abſolute* or fee-ſimple, and inheritances *limited*, one ſpecies of which is uſually denominated fee-tail. See Fee, Fee-simple, and Fee-tail.

Of eſtates of freehold, not of inheritance, but *for life* only, ſome are *conventional*, or expreſsly created by the acts of the parties; others are merely *legal*, or created by conſtruction and operation of law. As to eſtates for life, expreſsly created by deed or grant; ſee Life-estate. As to the eſtate of tenant in tail after poſſibility of iſſue extinct; ſee Tail and Fee-tail. As to tenant by courteſy, and tenant in dower; ſee Tenant and Dower.

Of eſtates that are leſs than freehold, there are three ſorts; *viz.* 1. Eſtates for years; 2. Eſtates at will; 3. Eſtates by ſufferance. For the two former, ſee Lease; and for the latter, ſee Sufferance.

Beſides the ſeveral diviſions of eſtates above enumerated, in point of intereſt, there is another ſpecies which is called an eſtate *upon condition*; being ſuch whoſe exiſtence depends upon the happening or not happening of ſome uncertain event, whereby the eſtate may be either originally created, or enlarged, or finally defeated. (Co. Litt. 201.) Eſtates upon condition are of two ſorts: 1. Eſtates upon condition *implied*; 2. Eſtates upon condition *expreſſed*: under which laſt may be included, 3. Eſtates held in *vadio*, *gage*, or *pledge*; 4. Eſtates by *ſtatute-merchant* or *ſtatute-ſtaple*; 5. Eſtates held by *elegit*. See theſe ſeveral articles.

II. Eſtates, with regard to the *time of their enjoyment*, when the actual receipt of the rents and profits commences, may be conſidered either in *poſſeſſion* or in *expectancy*; as to eſtates in poſſeſſion, ſometimes called eſtates *executed*, whereby a preſent intereſt paſſes to and reſides in the tenant, not depending on any ſubſequent circumſtance or contingency, as in the caſe of eſtates *executory*; all thoſe above-mentioned are of this kind; but the doctrine of eſtates in expectancy contains, ſays Blackſtone, ſome of the niceſt and moſt abſtruſe learning in the Engliſh law. Of expectancies there are two ſorts; one created by the act of the parties, called a *remainder*; the other by act of law, and called a *reverſion*. See REMAINDER and REVERSION. See alſo EXECUTORY *Deviſe* and LIMITATION.

III. Eſtates conſidered with reſpect to the *number and connexions* of their owners, or the tenants who occupy them, whatever be their quantity or length of duration, and whether they be in actual poſſeſſion or expectancy, may be held in four different ways: *viz.* in *ſeveralty*, in *joint-tenancy*, in *coparcenary*, and in *common*. See SEVERALTY, JOINT-TENANCY, COPARCENARY and PARCENERS, and TENANTS *in common*.

With regard to the title to eſtates and the different modes of tenure; ſee TITLE and TENURE.

Eſtates are acquired divers ways, *viz.* by deſcent from a father to the ſon, &c. conveyance or grant from one man to another; by gift or purchaſe, deed, or will; and a fee-ſimple is the largeſt eſtate that can be in law. 1 Litt. 541.

Eſtates are real, of lands, &c. or perſonal, of goods and chattels; otherwiſe diſtinguiſhed into freeholds that deſcend to the heir, and chattels, which go to the executors. The word eſtate, generally, in deeds, grants, and conveyances, comprehends the whole, in which the party hath an intereſt or property; and will paſs the ſame. 3 Mod. 46.

ESTATE, *additions of*. See ADDITION.

ESTATE, *baſe*. See BASE.

ESTATE, *que*. See QUE *eſtate*.

ESTATE, or ſimple *State*, denotes alſo the empire, kingdom, provinces, or extent of lands under the government of any ſovereign.

The eſtates of the grand ſeignor, of the king of Spain, &c. are very extenſive; thoſe of the king of France were before the revolution compact, and well peopled. Italy was formerly cantoned out into a great number of petty ſtates. We ſay, miniſters of eſtate, ſecretaries of ſtate, &c.

ESTATE, or *State*, is alſo generally applied in the ſame ſenſe with claſs or order; thus, the lay part of his majeſty's ſubjects, or ſuch of the people as are not comprehended under the denomination of clergy, may be divided into three diſtinct eſtates or ſtates, the civil, the maritime, and the military. See each term.

ESTATE is more particularly applied to the ſeveral ranks or claſſes of a people aſſembled together, for concerting meaſures, reforming public abuſes, or compoſing the diſturbances of a ſtate. In England, the three eſtates, *viz.* king, lords, and commons, meet ordinarily in parliament. See PARLIAMENT.

ESTATES *General*.
ESTATES *of Holland*. } See STATES *General*, &c.

ESTAVAYER, in *Geography*, a ſmall town of Switzerland, in the canton of Fribourg, pleaſantly ſituated on the eaſtern ſhore of the lake of Neufchatel. N. lat. 46° 46′.

ESTE, a town of Italy, in the Paduan; 11 miles S.S.W. of Padua.

ESTELLA, a handſome manufacturing town of Spain, in Navarre, with an univerſity in its neighbourhood, founded A.D. 1565. It contains ſeveral churches and convents, and 4500 inhabitants, defended by a caſtle, ſituated in a plain, watered by the rivers Ega and Ureder; 6 leagues S.W. of Pampeluna. The environs of this place are agreeable and fertile.

ESTELMUR, a town of Aſiatic Turkey, in the province of Caramania; 120 miles S. of Cogni.

ESTENIDE. See EKSENIDE.

ESTEPA, a town of Spain, in the province of Seville, or, according to ſome geographers, in that of Granada; celebrated for its olives and oil; 15 miles S. of Ecija.

ESTEPONA, a ſmall fiſhing town of Spain, ſituated near the coaſt in the province of Granada, between Gibraltar and Marbella. Its territory furniſhes abundance of wine.

ESTERLING, or EASTERLING. See STERLING.

ESTERNAY, in *Geography*, a ſmall town of France, in the department of the Marne, chief place of a canton in the diſtrict of Epernay, with a population of 835 individuals. Its canton has 23 communes and 6498 inhabitants, upon a territorial extent of 325 kiliometres.

ESTETÉ, in *Heraldry*, is uſed by the French to ſignify a beaſt whoſe head has been, as it were, torn off by force, and, conſequently, the neck left rough and ragged; in contradiſtinction to deffait, or decapité, where the neck is left ſmooth, as if the head had been cut off.

ESTEVE, M. in *Biography*, a writer on the theory of muſic, or rather of ſound or harmonics. He has attacked the demonſtration of the principles of harmony by Rameau, in which M. Laborde allows him to have reaſon on his ſide: however, as he does not build his ſcale by the triple progreſſion of Pythagoras, in the way which the abbé Rouſſier preſcribes, and without which ſeries of perfect fifth he thinks there never was nor ever can be any muſic fit to be heard, M. Eſteve has not been honoured with the ſeal of Meſſrs. Laborde and Rouſſier's approbation. He has, however, explained the cauſe of more and leſs perfection in concords, from the coincidences of vibration, which has been known ever ſince the time of Galileo, (ſee BASSE *fondamentale*), but never ſo clearly explained in France.

ESTHER, a canonical book of the Old Teſtament: denominated from a celebrated Jewiſh captive of that name, in Perſia, whoſe beauty preferred her to the bed of Ahaſuerus (ſuppoſed by ſome to have been Darius Hyſtaſpis, by others Xerxes, but probably Artaxerxes Longimanus, though Jacob. Capellus makes him to be Ochus, called in Perſia Achaſch-Veroſh), and the throne of Perſia; and who, in that quality, ſaved her countrymen, the Jews, from the death to which Ahaſuerus had doomed them, by the counſels of his favourite Haman; who wiſhed thus to be revenged on Mordecai for withholding from him that reſpect to which he conceived himſelf entitled. Mordecai informed the queen of the danger to which her nation was expoſed; and induced her to wait upon the king, and invite him and Haman to a ſumptuous banquet which ſhe had prepared. Haman was puffed up with this high honour, and thought himſelf ſure of accompliſhing his ample ſcheme of vengeance. During the interval, the king chanced to read the public records, which reminded him of Mordecai's having diſcovered a conſpiracy that had been formed againſt him. Determined to diſtinguiſh him by ſome ſignal token of favour, he ordered Haman to conduct Mordecai in triumph through the city. The queen having diſcovered to Ahaſuerus, that ſhe belonged to the Jewiſh nation, intreated juſtice againſt Haman on behalf of her people, for the deſtruction of whom he had obtained the king's decree. Ahaſuerus ordered Haman to be hanged on the gallows which he had erected for the execution of Mordecai; revoked the decree iſſued forth againſt the Jews, and granted another, by which he permitted them to avenge themſelves on their enemies on the day appointed. After the death of Haman, the king beſtowed his eſtates upon Mordecai, and admitting him into his confidence, as the acknowledged uncle of the queen, advanced him to a ſtation of high office and truſt in his court. The hiſtory of this tranſaction makes the ſubject of the book of Eſther. Eſther was of the tribe of Benjamin, and a deſcendant from one of thoſe families, which had been carried into captivity by Nebuchadnezzar, king of Babylon, and afterwards ſettled in the city of Shuſhan. She was the niece of Mordecai, and her Jewiſh name was "Hadaſſeh."

The critics are divided about the author of this book: St. Epiphanius, St. Auguſtine, and Iſidore, attribute it to Ezra; but Euſebius will have it to be of a later date. Some aſcribe it to Joachim, high prieſt of the Jews, and grandſon of Joſedek; others will have it compoſed by an aſſembly, or ſynagogue, of the Jews, to whom Mordecai wrote letters, informing them of what happened. Eſth. ix. 29.

But the generality of interpreters, Hebrew, Greek, Latin, &c. aſcribe the book to Mordecai himſelf; Elias Levita, in his Maſſ. Hamum. pref. 3. mentions this opinion as unqueſtionable.

It is chiefly founded on that paſſage, chap. ix. ver. 20. where it is ſaid, that "Mordecai wrote theſe things, and ſent letters unto all the Jews, that were in all the provinces, &c." It is alſo ſuppoſed that queen Eſther herſelf might have ſome ſhare therein: it being expreſſed in the ſame chapter, ver. 29. that Eſther and Mordecai wrote a ſecond letter, by the king's authority, to ordain the ſolemnizing a yearly feaſt, called *purim*, that is, *day of lots*, in commemoration of the Jews being delivered from the lots, or ſortes, whereby they had been condemned.

Some will have this book to be deuterocanonical, or apocryphal; others contend for its being canonical, as far as chap. x. ver. 3. incluſive; and all the reſt deuterocanonical. Of this ſentiment are, St. Jerome, De Lyra, Dionyſius the Carthuſian, Cajetan, and others. The council of Trent turned the ſcale for its being canonical throughout; ſo that the matter is determined for the Catholic countries.

But the Proteſtants retain the old opinion, and only admit it as far as the third verſe of the tenth chapter; the reſt, to the end of the ſixteenth chapter, is thrown among the apocryphal books. See Canon and Apocrypha.

Esther *Town*, in *Geography*, a town of America, in the county of Lancaſter, and ſtate of Pennſylvania, ſituated on the eaſt bank of the Suſquehannah river, a little N. of Harriſburg.

ESTHIO'MENOS, (from ἐσθίω, *to eat*,) in *Surgery*, the diſeaſe called herpes exedens. Alſo any obſtinate ulcer, which continues to eat away the parts.

ESTHONIA, in *Geography*, is the ancient name of the Ruſſian government of Reval, on the ſouthern coaſt of the gulf of Finland, over-againſt Finland Proper. In the year 1386 Eſthonia was ſold to the Teutonic order, and formed a part of Livonia; with which, after a ſeparation of a hundred years, when it was under the dominion of Sweden, it was united to the Ruſſian territory.

Not only the government of Reval, but alſo the greater part of Livonia, or five circles of the government of Riga, are inhabited by Eſthonians. In the former they probably amount to 180,000, in the latter to 257,000 individuals. The language, manners, complexion, dwellings, and huſbandry of the Eſthonians prove their relationſhip to the Finns, who are one of the moſt far ſpread nations of the globe, extending from the ſhores of the Baltic to the remoteſt confines of Aſia. In the Ruſſian annals, where they act a conſiderable part, as they, in common with the Novgorodian Slavi, founded the Ruſſian ſtate, the Eſthonians are called *Tſchudes*. Tooke's View of the Ruſſian Empire, vol. i.

ESTIÆA, Εςιαια, in *Antiquity*, ſolemn ſacrifices to Veſta, called in Greek εςια, of which it was unlawful to carry any away, or communicate any part to any beſide the worſhippers. Potter, Archæol. Græc. lib. ii. cap. 20. tom. i. p. 396.

ESTIATORES, Εςιατορες, among the Athenians, perſons appointed by lot to provide an entertainment for the whole tribe. Beſides thoſe appointed by lot to this office, others voluntarily undertook it to ingratiate themſelves. Potter, Archæol. Græc. lib. i. cap. 15. tom. i. p. 86.

ESTIMIONE, in *Natural Hiſtory*, a name by which ſome call the *barmeſion*.

ESTISSAC, in *Geography*, a ſmall town of France, in the department of the Aube, chief place of a canton in the diſtrict of Troyes, with a population of 1255 individuals. Its canton has 6089 inhabitants, diſperſed in 10 communes, on a territorial extent of 200 kiliometres.—Alſo, a ſmall town of France, in the department of the Dordogne, 18 miles N. E. of Bourdeaux.

ESTIVAL, a town of France, in the department of the Voſges, and diſtrict of St. Diey; 2 leagues N. of St. Diey.

Estival *occident*. See Occident.

Estival *orient*. See Orient.

Estival *ſolſtice*. See Æstival, and Solstice.

ESTIVAREILLES, in *Geography*, a town of France, in the department of the Allier, and diſtrict of Montluçon; 5 miles N. of Montluçon.

ESTIUS, William, in *Biography*, a learned Dutch divine, was born at Gorcum in Holland in the year 1542. He received the early part of his education at Utrecht, and finiſhed his ſtudies in philoſophy and theology at Louvain, where he afterwards became an inſtructor. In 1580 he was admitted to the degree of doctor in divinity, and was ſucceſſively choſen profeſſor of theology, in the univerſity of Douay; ſuperior of that ſeminary, and afterwards its chancellor. He died in 1613 at the age of 71, while he was in the diſcharge of the various duties of his laborious office at Douay, highly eſteemed on account of his modeſty, piety, and active virtues. He had ever been indefatigable in his ſtudies, and zealous in promoting the intereſts of thoſe committed to his care. As an author his principal works are, "Commentarii in omnes S. Pauli et VII. Catholicas Apoſtolorum Epiſtolas," in two volumes folio. "Annotationes in præcipua ac difficiliora S. Scripturæ Loca." Another work is mentioned with much applauſe, it is a diſcourſe "Contra Avaritiæ Scientiæ," intended to expoſe thoſe who lock up their learning in their cloſets, and refuſe to communicate it to the public by uſeful writings, or to individuals by well-timed and ſeaſonable advice. The writings of Eſtius are recommended by Du Pin as exceedingly uſeful to young theologians in their enquiries after truth. Moreri.

ESTOILE'. A croſs eſtoilé is a ſtar with only four long rays, in manner of a croſs; and accordingly broad in the centre, and terminating in ſharp points.

ESTOILLE, Peter de l', in *Biography*, who flouriſhed towards the cloſe of the ſixteenth century, was educated to the profeſſion of the law, and became grand audiencer of the chancellery of Paris. He died in 1611, and after his death was publiſhed from his manuſcripts "A Journal of the reign of Henry III." which has paſſed through many editions; of theſe the laſt was edited by the Abbè Lenglet du Freſnoi in 5 vols. 8vo. The ſame learned editor gave to the public "L'Eſtoille's Journal of the reign of Henry IV." in four volumes, 8vo. This, as well as the other work, is enriched by ſome curious pieces not to be found in the preceding editions. The ſtyle and manner of theſe journals poſſeſs much ſimplicity, exhibiting the air of truth, and affording a lively and accurate picture of the times. Moreri.

Estoille, Claude de l', ſon of the preceding, was a poet, and admitted a member of the French academy in the year 1632. He was patronized as a dramatic writer by Richlieu, but his pieces were not well received by the public, though he is allowed to have had a talent at verſification, and a thorough knowledge of the rules of the ſtage. He was a rigid cenſor of his own performances, and of thoſe of others, and is ſaid to have occaſioned the death of a young author by the ſeverity of his criticiſm on a comedy put into his hands. He died in 1652 about 50 years of age. He had obtained, and richly deſerved, the character of an honourable and truly independent man. In the earlier part of life, though ill provided for with reſpect to fortune, he choſe to quit the capital with a wife whom he loved, rather than ſubmit to the meanneſſes which men of letters are too much inclined to practiſe in courting the opulent. Moreri.

ESTOPPEL, formed of the French *eſtouper*, *oppilare*, *obſtipare*, to ſtop, or block up, in *Law*, an impediment, or bar of action, ariſing from a man's own act, or deed; againſt which a man is forbidden, by law, to ſpeak, though it be to ſay the truth. See Bar.

Goddard defines an eſtoppel to be any bar, or hindrance, to one to plead the truth; and extends it not only to the impediment given by his own act, but by another's alſo. There are three kinds of eſtoppel; *viz.* by matter of record, by matter in writing, and by matter in pais.

ESTOVERS, is uſed by Bracton, (l. iii. tr. 2. c. 18.) for that ſuſtenance which a man, committed for felony, is to have out of his lands, or goods, for himſelf and his family, during impriſonment.

In ſtat. 6 Edw. 1. it is uſed for an allowance in meat, or cloaths. In ſome manors the tenants have common of eſtovers; that is, neceſſary botes, or allowances, out of the lord's wood; in which laſt ſenſe, eſtovers comprehends houſe-bote, hay-bote, and plow-bote; ſo that if a man have in his grants theſe general words, "de rationabili eſtoverio in boſcis, &c." he may thereby claim all three.

Eſtovers is alſo uſed for alimony, which if the huſband refuſes to pay, there is, beſides the ordinary proceſs of excommunication, a writ at common law, "de eſtoveriis habendis," in order to recover it.

ESTOURMELLES, in *Geography*, a town of France, in the department of the North, and diſtrict of Cambray; 1½ league E. of Cambray.

ESTOUTEVILLE, a ſmall town of France, in the department of the Lower Seine, 12 miles N. of Caudebec.—Alſo, a ſmall town of France, in the ſame department, 15 miles N. of Rouen.

ESTRAC, in the *Manege*, ſignifies a horſe that is light bodied, lank-bellied, thin flanked, and narrow-cheſted. See Belly.

ESTRADE, a French term, literally ſignifying a public road, or highway. Hence the military phraſe, *battre l'eſtrade*, to beat the eſtrade, that is, to ſend ſcouts, or horſemen to get intelligence, to learn the diſpoſitions of the enemy, and inform the general of every thing likely to fall in the way. An army never marches without ſending batteurs d'eſtrade on every ſide.

The word is formed of the Italian *ſtrada*, ſtreet, or road; which is derived from the Latin *ſtrata*, a paved ſtreet. Some derive it from *eſtradiots*, who were cavaliers anciently employed in beating the eſtrade.

Estrade is alſo uſed for a little elevation of the floor of a room, frequently encompaſſed with an alcove, or rail, for placing a bed in; and ſometimes, as in Turkey, only covered with fine carpets, for receiving viſitors of diſtinction.

ESTRADES, Godfrey *Count of*, in *Biography*, was at an early age deſigned for the profeſſion of arms, and ſerved under prince Maurice in Holland, with whom he acted as agent of the French court, and afterwards attained the high honour of marſhal of France. He was highly eſteemed as a diplomatic character, and in the year 1661 went to England as embaſſador extraordinary, where he maintained with ſpirit the precedence of the crown of France to that of Spain. In the following year he went to Holland in the ſame character, and concluded the peace of Breda. He was intruſted with the important negociation for a general peace at Nimeguen, and acquitted himſelf to the ſatisfaction of all concerned. He ſuſtained with high reputation various other diplomatic characters, and in 1685 was nominated governor to the duke de Chartres, but died within a few months, at the age of ſeventy-nine. The count left behind him an abundance of MSS. concerning the different negociations in which he had been engaged: from theſe, which conſiſted of twenty-two volumes folio, a collection was publiſhed in 1709, entitled "Letters, Memoirs, and Negociations of the Count d' Eſtrades." An improved edition was publiſhed in 1743 at the Hague, in 9 vols. 12mo.

ESTRANGEL, Estrangelus, in the Syriac *Grammar*. Eſtrangel character, is a particular ſpecies, or form, of Syriac letter; ſerving as the majuſcule letters in that language.

Abraham Ecchellenſis takes the eſtrangel character for the true ancient Chaldee characters; and it is certain the Abyſſinians, who call themſelves Chaldeans, ſtill occaſionally uſe the eſtrangel character, if we may credit Hottinger, in his Theſaur. Philol. p. 286. Biſhop Walton, in his Prolegomena, gives us an eſtrangel alphabet.

ESTRAPADE, in the *Manege*, is the defence of a horſe that will not obey, but to get rid of his rider, riſes much before, and while his forehand is yet in the air, yerks furiouſly with his hind legs, ſtriking higher than his head was before; and during his countertime goes back rather than advances.

ESTRAY, or Stray, ſignifies any tame beaſt, or ſheep, oxen, ſwine, and horſes, or ſwans, found within a lordſhip, and not owned by any man; in which caſe being cried, according to law, in the church, and two market-towns adjoining, if it be not claimed by the owner, within a year and a day, it becomes the lord's of the ſoil where found. If the owner claims it within the year and day, he muſt pay the charges of finding, keeping, and proclaiming; and he may ſeize it, without telling the marks, or proving his property, which may be done at the trial if conteſted. If the beaſt ſtray within the year to another lordſhip, the firſt lord cannot retake it. An eſtray muſt be fed and kept, uninjured, and without labour, till it is reclaimed, or the limited time expires.

ESTREAT, Extractum, in *Law*, is uſed for the true copy, or duplicate, of ſome original writing, eſpecially of amercements, or penalties, ſet down in the rolls of a court, to be levied by the bailiff, or other officer, on every offender. Juſtices, commiſſioners, &c. are to deliver their eſtreats into the exchequer yearly, after Michaelmas; and fines to have writs, which ſhall be entered in the eſtreat, in order as they are entered in the chancery rolls, &c. ſtats. 51 Hen. III. ſtat. 5. 16 Edw. II. All forfeited recognizances are to be firſt eſtreated in the exchequer by ſheriffs of counties; on which proceſs iſſues to levy the ſame to the uſe of the king. Stat. 22 and 33 Car. II. cap. 22.

Sheriffs' eſtreats muſt be in two parts, indented and ſealed by the ſheriff, and two juſtices of peace; who are to view them, and one of them is to remain with the ſheriff, and the other with the juſtices. Stat. 11 Hen. VII. c. 15. The eſtreats of fines, at the quarter-ſeſſions, are to be made by the juſtices; and to be double, one of which is to be delivered to the ſheriff by indenture. Stat. 14 R. II. c. 2. Fines, poſt-fines, forfeitures, &c. muſt be eſtreated into the exchequer twice a year, on pain of 50*l.* And officers are to deliver in their returns of eſtreats upon oath. Stat. 22 & 23 Car. II. c. 22. 4 and 5 W. & M. c. 24. It is the courſe of the court of B. R. to ſend the eſtreats into the exchequer twice a year, *viz.* on the laſt day of the two iſſuable terms; but in extraordinary caſes there may be a rule to eſtreat them ſooner. 1 Salk. 45.

Estreats, *Clerk of the.* See Clerk.

ESTREES, Francis-Annibal D', in *Biography*, was born in 1573, and educated for the church, in which he had the biſhopric of Noyon conferred upon him by Henry IV. at a very early age. When he was only twenty-one he reſigned his eccleſiaſtical preferment, on account of the death of his elder brother, and aſſumed the profeſſion of arms, in which he became diſtinguiſhed under the title of the marquis De Coevres. He was embaſſador extraordinary to Switzerland and the princes of Italy, in 1614. He was created marſhal of France in 1626, and in 1630 ſuccoured the duke of Mantua, who was beſieged in his capital. In 1636 he was deputed embaſſador extraordinary to Rome, a character in which he well ſupported the honour and intereſts of his crown in oppoſition to pope Urban VIII., with whom, and the nephews of the haughty pontiff, he was continually involved in quarrels. He was recalled by his own ſovereign, which he conſidered as an affront, and refuſed to appear at court, to give an account of his conduct. He died at Paris in 1670, at the great age of ninety-eight years, highly reſpected by his countrymen. At the deſire of cardinal Richelieu, he drew up "Memoirs of the Regency of Mary de Medicis," which was publiſhed at Paris in 12mo. in the year 1660. "A relation of the Siege of Mantua, in 1620," and "An Account of the Conclave, in which Pope Gregory XV. was choſen in 1621," have alſo been given to the public from his papers. Moreri.

Estrees, Cæsar d', ſon of the preceding, was born in 1628, and being brought up to the church, he was raiſed to the biſhopric of Laon in 1653. He was created cardinal by Clement X. in 1671; and at the death of that pontiff entered the conclave, and managed ſo as to put off the election five weeks, till the arrival of the other French cardinals. He was ſent into Bavaria to negociate the marriage of the dauphin in 1677, and afterwards went to Rome, on other important and difficult buſineſs. He ſupported the rights of the crown, and of the Gallican church in oppoſition to pope Innocent XI., whom he prevented from publiſhing any act infringing on both. He reſided many years at Rome, the ſole reſident on the part of France, and exerted much influence at the election of ſucceeding popes. On his return to France he was rewarded with the rich abbey of St. Germain des Pres, where he died in 1714, in his eighty-ſeventh year, greatly regretted, &c. leaving behind him a high character as a politician. Moreri.

Estrees-*Saint-Denis*, in *Geography*, a ſmall town of France, in the department of the Oiſe, chief place of a canton, in the diſtrict of Compiègne, with a population of 1040 individuals. The canton has a territorial extent of 150 kiliometres, with 20 communes, and 10,325 inhabitants.

ESTREMADURA, *i. e. Extrema Durii*, a province of Portugal, bounded on the north by Beira, on the eaſt and ſouth by Beira and Alentejo, on the weſt by the ocean; lying between 38° and 40° N. lat. and obliquely between 7° 10' and 9° 30' W. long.; being 140 miles from north to ſouth, and 70 in breadth; containing 5,440 ſquare miles, 8 juriſdictions, 400 pariſhes, and 350,760 inhabitants. Several diſtricts of this province are abundantly fertile, yielding grain, wine, oil, and fruits. The whole country is covered with flowers, and the bees produce a great quantity of honey. The manufacture of ſalt affords one of the chief articles of commerce. The principal towns are Liſbon, Leiria, Abrantes, Pombal, Alcobaca, Setuval, Thomar, Santarem, Alanquer, Torres Vedras, Cintra, and Caſcaes; and the chief rivers are the Tagus, or Tajo, and the Sador or Sado, ſometimes called Cadaon and Caldas.

Estremadura, a province of Spain, bounded on the N. by Leon; on the E. by New Caſtile; on the S. by Andaluſia; and on the W. by Portugal; lying between 38° and 40° N. lat.; and between 7° 10' and 4° 40' W. long.: being 140 miles from north to ſouth, and 90 — 1[illegible]0 from weſt to eaſt. This province was formerly a part of Portugal, but being ſeparated from that country, it is ſometimes called Eſtremadura of Caſtile. It is traverſed by the rivers Guadiana and Tajo, which divide it into three equal parts. Interſected by ridges of hills, it abounds in grain, fruits, and excellent paſtures; but good water is ſcarce, and the air in ſummer is exceedingly hot, inſupportable to ſtrangers, but to the natives not inſalubrious. The principal commerce conſiſts of cattle and fine wool; and the hills are covered with oaks, the acorns of which feed large herds of ſwine, that are black. The inhabitants are in general inclined to corpulency; and are conſidered as humane, affable, ſincere, ſtout, and brave. The principal towns are Badajoz, Placentia, Coria, Albuquerque, Caceres, Truxillo, Merida, Montejo, Xeres de los Cavalleros, Ellerena, and Zafra; and the chief rivers are the Guadiana, the Tajo, and the Alagon.

ESTREMERA, a town of Spain, in New Caſtile; 27 miles S.E. of Madrid.

ESTREMOZ, a fortified ill-built town of Portugal, in the province of Alentejo, containing three churches, ſix convents, two hoſpitals, and 6500 inhabitants; pleaſantly ſituated on a riſing ground in a fertile country; 7 leagues N.E of the capital; and famous on account of a victory gained by the Portugueſe over the Caſtilians, in the year 1663. In its vicinity there is excellent marble. The country on the weſt ſide of the town is pleaſant and well cultivated, abounding in orange gardens and laurels; but at ſome diſtance no traces of cultivation appear. This town has a manufacture of beautiful earthenware.

ESTREPAGNI. See Etrepagny.

ESTREPEMENT, in *Law*, an impoveriſhing or making of land barren, by continual plowing and ſowing, without due manuring, reſt, and other huſbandry.

The word is derived from the French *eſtropier*, to maim; or the Latin *extirpare*, to extirpate, root up.

Estrepement is alſo uſed for any waſte, or ſpoil, made by the tenant for life, upon lands or woods, to the prejudice of him in reverſion; as the cutting down of trees, or lopping them farther than the law allows, &c.

Estrepement is alſo a writ which lies in two caſes: the one, by the ſtat. of Glouceſter, 6 E. I. c. 13, when a man having an action depending, as a formedon, writ of right, or the like, ſues to inhibit the tenant from making waſte during the ſuit.

The other is for the demandant, who is adjudged to recover ſeiſin of the land in queſtion; and before execution, for fear of waſte to be made till he can get poſſeſſion, ſues out his writ.

ESTRICH, or Oestrich, in *Geography*, a town of Germany, in the circle of the Lower Rhine, and electorate of Mentz on the Rhine; 14 miles W. of Mentz.

ESTUCUA, a town of Mexico, in the province of Mechoachan; 58 miles W. of Mechoachan.

ESULA, or Æsulum, in *Ancient Geography*, a town of Italy, ſituated on a mountain, near the Tiber.

Esula, or *Æſula*, in *Botany*, a word ſaid to be of Arabian origin. See Euphorbia *Eſula*, and Apocynum *Venetum*.

ESULÆ Radix, in the *Materia Medica*, the name of a root of a plant of the ſpurge kind, ſometimes uſed in medicine. The root conſiſting of a cortical part, and an inner ſticky one, the bark only is uſed; and ſuch ſhould be choſen as is new dried, and of a reddiſh colour without and within, and ſuch as, when held in the mouth, affords a very diſagreeable taſte, with great acrimony. It is a very violent purge, and has been ſaid to have performed cures in dropſical caſes, when more gentle medicines have proved ineffectual. It is a good method to macerate it a day or two in vinegar before it is uſed.

ESURIS, in *Ancient Geography*, a town of Spain, ſuppoſed to be *Xeres*.

ESUS, or Hesus, in *Mythology*, a deity among the Gauls, to which they ſacrificed after victory whatſoever came alive into their poſſeſſion. They ſometimes ſprinkled the altars of this deity with the blood of their women and children.

ESZEK, in *Geography*, a town of Sclavonia, with a wooden bridge, built by the Turks over the Drave; 48 miles W.N.W. of Peter-Waradin, and 80 N.W. of Belgrade.

ETABLES, a town of France, in the department of the North Coaſts, and diſtrict of St. Brieuc; 2½ leagues N. of St. Brieuc.

ETAIN, or Estain, a ſmall town of France, in the department of the Meuſe, chief place of a canton in the diſtrict of Verdun, 18 miles N.E. of Verdun. It has a population of 2300 individuals, and its canton compriſes 30 communes, with 7125 inhabitants, on a territorial extent of 247½ kiliometres.

ETALLE, a ſmall town of France, in the department of the Forêts, chief place of a canton in the diſtrict of Neufchâteau, with a population of 1080 individuals. Its canton has a territorial extent of 280 kiliometres, and 13 communes, with 9013 inhabitants.

ETAMPES, a ſmall town of France, in the department of Seine and Oiſe, chief place of a diſtrict of the ſame name, with a population of 7786 individuals. It is ſituated on the left bank of the river Juine, at the confluence of two other rivulets, 36 miles E. of Chartres, ; 45 miles N. by E. of Orleans; and 40 miles S. of Paris. N. lat. 48° 25′. The canton contains 14,187 inhabitants, diſperſed in 15 communes, on a territorial extent of 192½ kiliometres.

As chief place of a diſtrict, Etampes has a ſub-prefect, a court of juſtice, and a regiſter office. There are ſome manufactures of hoſiery, woollen, and cotton yarn, and leather. The ſtockings, in particular, are known in the French trade by the name of ſtockings of Beauce, or Bas de Beauce, from the village where the beſt are made.

The ſoil of the diſtrict of Etampes is ſandy: it produces, however, ſome wheat, rye, barley, oats, and hemp. There are a few vineyards and ſome artificial meadows. The diſtrict contains 6 cantons, 111 communes, 1372½ kiliometres, and 58,890 inhabitants.

ETANGS, Les, a town of France, in the department of the Moſelle, and diſtrict of Boulay; 2½ leagues E.N.E. of Metz.

ETAPLES, or Estaples, a ſmall town of France, in the department of the Pas de Calais, chief place of a canton in the diſtrict of Montreuil, with a population of 1360 individuals. It is ſituated at the mouth of the river Canche, which forms a ſmall harbour, 12 miles N.E. of Boulogne, 168 miles N. of Paris. N. lat. 50° 30′ 44″. The canton contains 19 communes, and 7807 inhabitants, on a territorial extent of 232½ kiliometres.

ETAPPE, in *War*, an allowance of proviſions and forage made to the ſoldiers upon march through a kingdom, or province, to or from winter quarters.

Hence, he that contracts with the country, or territory, for furniſhing the troops in their march, is called etappier.

ETARRY, in *Geography*, a town of Hindooſtan, in the country of Bahar; 34 miles S.W. of Arrah.

ETAULIERS, a town of France, in the department of the Gironde, and diſtrict of Bourg; ſeven miles N. of Blaye.

ETASAGGAH, a town of Hindooſtan, in Bahar; 35 miles S.E. of Bahar.

ETAVERAM, a town of Hindooſtan, in the Carnatic; 10 miles E. of Coilpetta.

ETAYA, a circar of Hindooſtan, in the Soubah of Agra, bounded on the N. by Rohilla; on the E. by the circar of Pattan, Canoge an Corah, and on the S.W. by Jumna. Etaya is the capital.

Etaya, a town of Hindooſtan, in the country of Agra, on the N.E. ſide of the Jumnah, 52 miles S.E. of Agra. N. lat. 26° 45′. E. long. 79° 17′.

ETCH, in *Agriculture*, a term ſignifying the ſame thing as erſh. See Ersh.

ETCHAUK, in *Geography*, a town of Bengal, 22 miles N. of Ramgur.

ETCHING, in the *Polite Arts*, an important branch of that ſpecies of engraving which is performed with the view of delivering impreſſions on paper, by means of the rolling-preſs, is the ſuperaddition of the chemical proceſs of corroſion, to the art of drawing through etching-varniſh, (or etching-*ground*, as it is more frequently termed,) on plates of metal; though it has ſometimes been ſucceſsfully performed on other ſubſtances, and particularly on glaſs.

Etching is moſt frequently performed on plates of copper; and (though aqua-tinta be a ſpecies of etching, for which ſee Aqua-tinta) the means commonly employed, are lines drawn with a ſtylus, or ſteel-point, termed an etching-*needle*, which are afterwards corroded by aqua-fortis.

The etching-needle reſembles the dry point (ſee the article Dry-point) in all reſpects, excepting the ſuperior ſharpneſs of the latter, and that it need not be quite ſo long as dry-points are at the firſt. Of theſe needles, the artiſt ſhould provide himſelf with three or four, for etching finer or coarſer lines, of various dimenſions and different degrees of bluntneſs; that for the fineſt or moſt delicate lines being little leſs ſharp than the dry-point. That he may with certainty etch lines of ſimilar ſtrength and depth, where ſuch are required, as in covering a ſurface of an even tint, the extreme point of his needle ſhould be very delicately and gradually rounded off on a leathern ſtrop ſupplied with crocus-martis, or putty-powder.

The practitioner in etching ſhould, moreover, provide himſelf with a ſoft and large camel's-hair bruſh, wherewith occaſionally to ſweep the duſt, and eraſed etching ground, from the ſurface of his work: and an etching-board of from three to ſix inches in breadth, bevelled to an edge on one ſide, ſupported at the ends by ſmall bars of wood about one-third of an inch in thickneſs, and of ſufficient ſpan to ſtand as a bridge over the varniſhed plate, and prevent the engraver's hand from touching and marring his work, ſhould alſo be provided, and the copper-plate, being previouſly prepared, as ſee Copper-plate, he may proceed to lay his etching-ground in the following manner.

The plate is put upon a German ſtove, or chafing-diſh, and heated over the fire; or, if ſmall, is held with a hand-vice, the poliſhed ſide being upwards, and heated with the flame of paper burning under it; when hot, it is rubbed over with etching varniſh (ſuch as is deſcribed in the ſequel of this article) wrapped up in taffety, which ſhould be gently paſſed from one ſide to the other in a right line, ſo as to form ſeveral rows, till the plate is every where moderately covered; then with a *dabber*, formed of cotton, tied up in Perſian ſilk, let every part of the plate be beat gently, while the varniſh is in a fluid ſtate; and in order to give it a fine grain, and that the varniſh may be equally ſpread over the ſurface of the plate, continue to beat it with the dabber, after the plate is taken from the fire, till it attains a ſomewhat harder conſiſtence in cooling; but the uſe of the dabber ſhould be diſcontinued long before the varniſh is cold, leſt it ſhould be made to riſe from the plate.

When the plate is thus uniformly and thinly covered with the varniſh, it muſt be blackened whilſt it is yet warm by a piece of flambeau, or of a large wax-candle, or taper, twiſted together, till ſix or more flames unite in one, which affords a copious ſmoke; diſpatch is of importance, that the varniſh may not grow cold during the operation, which ſhould be performed, if poſſible, at one heating of the plate, for repeated melting of the varniſh does it much damage. Large plates may be ſuſpended from the ceiling of a room by four cords and iron rings, with the varniſhed ſide downwards, for the greater convenience of being blackened. Care ſhould be taken that the flambeau or candles be kept at a proper diſtance from the plate, that the wick may not touch and burn, or otherwiſe impair the varniſh. The varniſh may be made white, if that colour is preferred to black, by grinding white lead in water, and putting it into a glazed earthen diſh, with a little good glue diſſolved, and melting the whole together. This mixture is ſpread with a bruſh or pencil of hog's hairs thinly and evenly on the varniſh laid on the plate and ſmoothed. The colour is then left to dry; if it fixes with difficulty on the varniſh, the compoſition ſhould be mixed with a drop or two of ox-gall.

When the copper-plate is thus varniſhed, and is quite cold, it remains to transfer from paper to the varniſhed plate, the tracing, or outline of the deſign. If the outline be reduced from an oil or water-colour picture or other original of larger dimenſions than the intended etching, and be executed with lead pencil or red chalk upon drawing or writing paper, the method moſt in uſe among Engliſh engravers, is, to take the varniſhed plate and outline to the rolling-preſs printers, and (ſuffering the latter to lie between wetted paper for a quarter of an hour or ſo, that it may become ſufficiently damp for the lead or chalk to be in a certain degree liquified, while the paper is ſufficiently ſoftened to do no injury to the etching ground,) to paſs it through the preſs, the upper roller thereof being ſupplied with blankets in the ſame quantity, and the preſs adjuſted to about the ſame degree of preſſure, as for printing. If this be carefully performed, the outline will appear at once transferred, and reverſed on to, the ſurface of the etching-ground, and the artiſt have nothing to do but to proceed with his etching, By theſe means the trouble both of retracing and *reverſing* (*i. e.* of changing the right hand view of his picture round to the left, and *vice verſâ*, the left to the right, as it would appear if reflected in a looking-glaſs,) is ſaved to the engraver. The method formerly uſed,—which muſt ever be uſed where no rolling preſs is at hand, and which is ſtill believed to be generally practiſed in the other countries of Europe—is, either to trace the outline of the deſign on tranſparent paper, that by ſimply turning the paper it may be ſeen in reverſe, or uſing thin drawing paper for the purpoſe, to render it tranſparent afterwards by means of oil or varniſh. When this is thoroughly dry, a piece of fan, or other very thin, paper, of the ſize of the outline to be traced, muſt be evenly rubbed over on one ſide with powdered red chalk or black lead, and interpoſed between the outline and varniſhed plate, with the chalked or leaded ſide downward, and both outline and tracing paper being ſtretched tight over the varniſhed plate, and faſtened by means of ſmall bits of wax placed along the margin, a blunt etching-needle muſt be carefully paſſed over the ſeveral outlines with a moderate degree of preſſure, which will occaſion ſo much of the powdered lead or chalk to adhere to the ſmoked etching ground, as, when the papers are removed, will exhibit the outline or tracing of the whole deſign in all its correctneſs.

Having proceeded through theſe introductory mechanical preparations, which require care and ſome knowledge of drawing, the engraver's taſk as an artiſt, or man of taſte or genius, properly begins. Who ſhall preſcribe laws to genius?—He may now exerciſe the knowledge he has previouſly ſtored, and call forth his inventive powers. The forms of his objects muſt now be ſeverally drawn, with ſuch taſte and feeling as he may poſſeſs; and his ſhadows, demi-tints, and lights, excepting ſuch as he may prefer to leave to be executed by the graver or dry point, be hatched, by employing lines more cloſe or more open, and preſſing on his needles more lightly or more ſtrongly, as a ſkilful muſician preſſes on the keys of his harpſichord, and as the ſeveral parts of his work may demand, varying his line with the nature of his object.

The characteriſtic, or local advantage of etching, for certain purpoſes, over lines cut with the graver, conſiſts in the unlimited freedom of which this mode of art is ſuſceptible. The etching-needle, meeting little reſiſtance from the varniſh, glides along the ſurface of the plate, and eaſily takes any turn that the taſte of the artiſt may direct, or his hand accompliſh; and hence its peculiar adaptation to the expreſſion of that claſs of objects which artiſts term pictureſque, ſuch as trees, rocks, ruins, cottages, the ſhaggy hair of animals, broken ground, or other rough and irregular ſurfaces.

It has formerly been much diſputed among the curious, whether Germany or Italy had the honour of giving birth to the invention of etching, and with the view of aſcertaining this point, the dates of the impreſſions from the earlieſt etchings by Albert Durer and Parmegiano have been aſſiduouſly ſought for and compared. The writer of the preſent article conceives that ſome portion, at leaſt, of this diſcuſſion and reſearch, might have been ſpared, had the diſputants reflected that etching, originally **Etzen**, is not an Italian but a German word, and how very unlikely it is that an Italian invention ſhould have been denominated by a German word.

Although this art afforded means analogous to the objects themſelves, of drawing and characteriſing all thoſe objects, of which wildneſs and freedom, communicated by ſpontaneous perception and feeling, is the ſoul, yet engraving with the graver had been previouſly invented, and in the beginning of the ſixteenth century impreſſions from ſuch engravings had called forth the admiration of the taſteful. For theſe reaſons, and from the prevalence of thoſe habits, and prejudices of taſte and education, which hang like dark veils about the faculties of man, the extent and variety of energy of which etching was capable were not perceived, and probably are not even yet perceived; the means of engraving, or manual operation of the graver, was miſtaken for the end; and hence a falſe criterion of merit obtained conſiderable influence; connoiſſeurs gravely put on their critical ſpectacles in order to ſee in what degree, and how dexterouſly, the etcher had imitated the clear and clean-cut lines of the graver; juſt as the early printers with the letter preſs, merely endeavoured to imitate M.S. miſſals and bibles, without perceiving the ſuperior degree of perfection of which printing was ſuſceptible. The Sadelers, Le Boſſe, and others run into this egregrious miſtake, and the latter, who wrote a treatiſe on the art of engraving, lays it down as a principle, that the perfection of this mode of engraving conſiſts in the cloſe ſimilitude of etching to the work done by the graving-tool.

That the efforts of the moſt taſteful, bold, and inventive among the engravers of our own country, have largely contributed to diſpel theſe prejudices, will be ſeen towards the cloſe of this article. At preſent we proceed with our account of the proceſs of etching.

The forms of the ſeveral objects of which any given etching may conſiſt, being drawn with requiſite knowledge and care, and the chiaroſcuro, and expreſſion of the textures of the ſeveral ſubſtances introduced into the compoſition, hatched with the degrees of taſte and truth, which the ability of the artiſt may enable him to diſplay, the buſineſs of corroſion, which is technically called *Biting-in*, begins. For this purpoſe a border of ſuch wax as is of a moderate degree of hardneſs when cold, and of a moderate degree of tenacity whilſt warm, muſt be applied round the margin of the plate, in the form of a little wall or rampart, about an inch, or three quarters of an inch in height. This wax may be compoſed of bees' wax, either tempered with common pitch, or with Venice turpentine and tallow, and at one of the corners a gutter, or ſpout, ſhould be formed for pouring the aquafortis conveniently off the plate. The plate being thus bordered, it is uſual further to fortify or ſecure the work againſt the egreſs of the aquafortis whilſt biting, by turpentine-varniſh thickened with lamp-black, and applied with a hair pencil on the margin of the plate, and under the inſide edge of the rampart of wax. This varniſh or compoſition (which is called *ſtop-ground*) being ſufficiently dry, the aquafortis may be poured on the plate.

We are now arrived at a part of the proceſs where experience, combined with chemical knowledge, is the only practical guide on which any thing like ſound reliance may be placed. Yet a few general rules may not be diſpenſed with. The aquafortis may either be pure nitrous acid, diluted with pure water in the proportions of four or five parts water to one of nitrous acid for the more delicate parts of the etching, or it may be the double aquafortis of the ſhops diluted with pure water in the proportions of two to one, or ſometimes of equal parts, according to the degree of ſtrength or delicacy of the fainteſt parts of the work. Of aquafortis thus diluted, but which muſt be gradually ſtrengthened as the work proceeds, let a ſufficient quantity be employed to riſe, when poured on the plate, about half an inch above its ſurface. If all things have been rightly conducted, it will now be ſeen that the menſtruum will ſoon exert its action in thoſe lines or hatches where the artiſt has preſſed hardeſt on his etching-needle, and will gradually begin to corrode the more delicate lines. It may here be proper to obſerve that a feather, or camel's hair bruſh, ſhould be uſed during the biting, to burſt the ſmall bubbles of fixed air which are liberated from the copper, and cleanſe away from the lines the verdigreaſe which is generated during the operation of the aquafortis: by thus moving the aquafortis to and fro on the plate, it will exert its action uniformly over the whole etching.

In about a quarter of an hour, or when the effects of the aquafortis have become viſible in the more tender parts, it may be poured off, the plate waſhed with clean water, and dried by expoſure to the air, ſunſhine, or (which is now more common, becauſe more expeditious) by the operation of a pair of bellows. After trial made by taking off a ſmall portion of the etching-ground with the ſcraper, or a ſmall piece of pointed charcoal, ſuch parts of the etching as are believed to be ſufficiently corroded, muſt be painted over carefully, or *ſtopped-out*, with the compoſition of lamp-black and turpentine varniſh which is mentioned above; and when this is dry, the aquafortis muſt be re-applied, and the biting proceeded with in the ſame manner, till the ſtronger parts are judged to be ſufficiently corroded, the aquafortis being ſtrengthened from time to time according to the judgment of the operator.

To bite-in a large plate will ſometimes occupy ſeveral days, for great judgment and nicety of obſervation are required in gradating the chiaroſcuro, and conſiderable care muſt be exerted in the ſtopping-out. It need ſcarcely be mentioned, that the operator ſhould be as cautious as the neceſſary degree of attention to his work will allow, not to inhale the fumes which ariſe from the mingled copper and aquafortis, which become more and more deleterious, as the biting advances.

When the ſtrongeſt parts are believed to be ſufficiently corroded, and the plate is thoroughly waſhed with water, it may be again placed on the chafing diſh, or German ſtove, till it be ſufficiently warm for the border of wax to be removed, after which, and while it is yet warm, the varniſh may be diluted by the application of a ſmall quantity of oil of turpentine or of olives, and wiped off with a rag; when, if the biting-in hath been ſucceſsfully accompliſhed, the etching is complete, and in ſome caſes the plate is finiſhed; though in moſt caſes it happens that the engraver's taſte and judgment direct him purpoſely to leave certain parts to be finiſhed with the dry point and graver.

For an account of the early progreſs of the art of etching, the reader is referred to our account of the GERMAN and ITALIAN *ſchools* of engraving. Its more recent improvements have taken place in England. In etching trees, which no other mode of engraving can adequately expreſs, Vivares and Pouncy have diſplayed an art of characterizing the ſpecies of tree which it was their object to repreſent, and at the ſame time of ſuggeſting in the varying ſtyles of their foliage, thoſe maſſes or countleſs numbers of leaves which are ſeen in nature itſelf. Their etchings of trees are decidedly ſuperior to thoſe which have been produced on the continent, unleſs we might except the trees of Waterlo and Kobell, and have rarely been equalled by thoſe of the engravers of our own iſland.

He who would ſee the moſt perfect ſpecimens which have been produced of this ſpecies of art, ſhould look at aquafortis proofs (not the finiſhed engravings) which Vivares has produced after Claude, Patel, and Gainſborough; and thoſe which Pouncy has etched after Wilſon, Hearne, and Farington. In looking at the former, he will ſee with ſurpriſe how much Vivares has attained of the peculiar beauty, feeling, and delicacy of Claude's pencil, although he could only have been acquainted with certain pictures:—the larger Colonna Claude for example, from which he has produced a moſt exquiſite etching—through the medium of chalk drawings, and thoſe not very good. It is not leſs worthy of admiration, at leaſt of high approbation, to obſerve how truly Pouncy has characterized the painting of Wilſon, in his etchings of "Athens in Proſperity," and "Athens in Ruin," which are alſo executed from chalk drawings copied from the originals of Wilſon in the library of the late Mr. Willett.

In rocks and cottage ſubjects Browne has ſcarcely been leſs ſucceſsful, as may be ſeen in the aquafortis proofs of the beſt of his large plates after Both, Salvator Roſa, and Du Sart. In the rocks of his "St. John preaching," after Salvator Roſa, he is perhaps ſomewhat extravagant, and out of harmony with his own figures and foliage, though vigorous and characteriſtically rugged; but in "the Cottagers," and "the Jocund Peaſants," after Du Sart, he is unrivalled; the ſeveral textures of the old plaſter walls, old planks, thatch, broken ground, rough coated animals, (though theſe are probably etched by Woollett,) and even the ſluſh which trickles down the hog-trough, are etched with the trueſt feeling of nature and Du Sart.

In etching ruins, as well as more perfect architectural ſubjects, Piraneſi the Roman led the way, and Rooker the elder ſucceſsfully followed. Theſe artiſts more than perhaps any other, except Mr. Lowry, ſhewed the affinity, or ſuſceptibility of pictureſque union, which ſubſiſts in fine art, between freedom of handling and geometrical preciſion; as may be ſeen with pleaſure in the antiquities of Rome and Pæſtum, which Piraneſi etched from his own drawings; (the original and very maſterly drawings of the temples at Pæſtum being preſerved in the collection of Mr. C. Lambert of the Temple F. A. S.) in the ſix large views of London, which Rooker etched after the drawings of P. Sandby and himſelf; and among numerous other works from the hand of Mr. Lowry, in the plate of the weſt door of the cathedral of Carrara from the drawing of Flaxman, as well as in various other plates of architectural and mechanical ſubjects, by which this work is illuſtrated and adorned, and which conſiſt almoſt entirely of etching.

With the view of etching ſubjects of this kind with ſuperior accuracy and facility, Mr. Lowry, about twenty years ſince, invented and began to conſtruct ſeveral inſtruments or machines, which it is within the knowledge of the writer of this article have been much employed on the engravings which are ſpoken of above. The firſt was "for etching ſucceſſive lines either equidiſtant, or in juſt graduation from being wide apart to the neareſt approximation, *ad infinitum;* the compaſs of the inſtrument being commenſurate with the poſſible demands of the art. The ſecond, which is more recently conſtructed, is for ſtriking elliptical, parabolical, and hyperbolical curves, and, in general, all thoſe lines which geometricians call mechanical curves, from the dimenſions of the point of a needle, to an extent of five feet."

Within the laſt ſeven years he has conſtructed other machinery for facilitating particular operations in etching, and enſuring preciſion in deſcribing arches of circles of every poſſible radius; lines converging to points at all diſtances; various kinds of ſpiral lines, and the cogs and ſmaller teeth of wheel work; of the ſeveral uſes and ſuperior powers of which machinery, numerous examples may be ſeen in what has already appeared of this Cyclopædia.

Of theſe inventions it may be truly ſaid that they combine elegance with utility, and are of high value if only conſidered as auxiliaries of the imitative part of this branch of engraving; but as the auxiliaries of chemical, agricultural, and mechanical ſcience, they are of incalculable advantage. The accuracy of their operation, as far as human ſenſe, aided by the magnifying powers of glaſſes, enables us to ſay ſo, is perfect; and it is not neceſſary here to inſiſt on the advantages that muſt reſult to the whole cycle of ſcience, from mathematical accuracy. A hope may be indulged that before the completion of theſe volumes, Mr. Lowry may be induced to favour the public with plates, and particular deſcriptions of his various apparatus.

It now remains to deſcribe the compoſition of the ſeveral kinds of etching-ground, which have been uſed by different engravers from time to time.

Of etching grounds there are three principal kinds, *viz.* common etching ground, hard ground, and ſoft ground.

The hard ground was formerly much uſed, being better accommodated to the intention of imitating the engraving with the tool; but the former has now wholly ſuperſeded the uſe of the other, as it gives a power of expreſſion incompatible with the greater inflexibility of the hard varniſh, which confines the lines and hatches to ſuch a ſameneſs and regularity as give a ſtiffneſs of manner, and coldneſs of effect to the work.

There are various directions for preparing the *common* etching-varniſh, which is by far the moſt in uſe and the moſt worthy of being ſo. Le Boſſe recommends the following: take of virgin wax, very white and clean, and of grains of maſtic very clear and pure, each one ounce; and of calcined aſphaltum, half an ounce: grind the maſtic and aſphaltum ſeparately, very ſmall, and melt the wax over the fire in an earthen pot well glazed. When the wax is thoroughly melted, and very hot, ſprinkle the maſtic into it gradually that it may melt, and ſtir the mixture that the ingredients may incorporate. Then ſprinkle the aſphaltum into the mixture, ſtirring the whole compoſition over the fire till the aſphaltum be entirely melted: take the pot from the fire, and let the mixture cool; and pour the varniſh into clean warm water, and by working it with the hand, form it into a roll of about an inch in diameter, or into ſmall balls, which may be wrapt up in taffety and kept for uſe. The quantity of wax ſhould be increaſed in winter, in order to attemper the varniſh to the exiſting ſtate of the atmoſphere.

The following varniſh is uſed by many of the engravers at Paris: take of virgin wax, and aſphaltum, of each one ounce; half an ounce of black pitch; and a quarter of an ounce of Burgundy pitch: the aſphaltum muſt be pounded in a mortar, and the wax melted over a ſlow fire in a pot of glazed earthen-ware, and the reſt of the ingredients added by little and little, ſtirring the mixture till the whole be well melted and incorporated. Then throw the whole maſs into a veſſel of clean warm water, and proceed as before.

Mr. Lowry's recipe for common etching ground is as follows:—To two ounces of aſphaltum add one of Burgundy-pitch, and an ounce and a half of white virgin wax. The aſphaltum muſt firſt be finely powdered, and then melted in the glazed earthen veſſel over a moderate fire, before the Burgundy pitch is put in: the wax muſt be added laſt, when the whole compoſition muſt be well ſtirred, and then poured into warm water, to be further incorporated by means of the hands, and made up into balls for uſe.

The *hard* varniſh, which was uſed by Callott and other engravers of the continent, and which was commonly called the Florence varniſh, was prepared in the following manner. Take four ounces of fat oil, very clear, and made of good linſeed oil, like that uſed by painters. Heat it in a new pot of glazed earthen ware, and afterward put to it four ounces of grains of maſtic well powdered, and ſtir the mixture briſkly till the whole be well melted together, then filter the whole through a piece of fine linen into a glaſs bottle with a long neck, that can be ſtopt very ſecurely, and keep it for uſe.

In laying this varniſh on the plate, it may be ſpread evenly with the dabber and ſmoked, as before directed, but after it is ſo ſpread, there remains to dry or harden it over the fire, for which purpoſe it will be proper to prepare a charcoal fire which ſhall emit no ſparks; it ſhould be contained in a coal-pan or chafing-diſh, ſomewhat larger than the plate, which ſhould be placed over it for the ſpace of from eight to twelve minutes, every precaution being uſed to prevent duſt from approaching the plate. Whilſt in this ſituation the varniſh will ſoon begin to ſmoke, and when this ſmoking is obſerved to decreaſe, the plate muſt be removed from the fire, and touched at the ſide or on the margin with a little piece of hard wood. If the varniſh be eaſily raiſed by the touch, it is yet too ſoft, and the plate muſt be again placed over the fire as before: after a ſhort time it muſt again be tried with the ſtick, and if the ſtick adhere to the varniſh ſo as to require ſome ſlight effort to draw it away, the plate muſt from that inſtant be left to cool. If on the firſt trial the ſtick adhere ſtrongly to the varniſh, water muſt be immediately thrown on the back of the plate, to cool it as quickly as poſſible, leſt a longer continuance of the heat render it too hard, or burn the varniſh. When the plate is cold, the artiſt may proceed with the tracing and etching, as before directed.

The *ſoft* ground or varniſh is prepared ſimply by mixing common etching ground with animal oil, in proportion of more or leſs according to the exiſting ſtate of the atmoſphere; a much ſmaller portion of the oleaginous ingredient being admiſſible in ſummer than in winter. If common tallow be uſed for the purpoſe, the ſalt which it may contain ſhould firſt be precipitated, by dropping the melted tallow into water, and afterward ſkimming it from the top; but Mr. Gilpin recommends veal ſuet, and it is probably to be preferred.

The method of uſing ſoft ground is as follows. Over a plate thinly covered with this ſort of varniſh, and ſmoked as in the caſe of the common etching ground, the artiſt cautiouſly ſpreads a ſheet of very thin paper, which it is beſt to ſpread in a damp ſtate, and to faſten with ſtrong paſte by the edges, which ſhould be folded over for the purpoſe on the back of the plate: the paper will thus, when dry, be ſtretched tight and flat over the ſurface of the varniſh.

All is now ready for the reception of the etching, which is performed ſimply by making a hatched drawing of the intended ſubject with a black lead pencil on this paper. Great care muſt be taken during the etching that nothing but the pencil touch the paper, and for this purpoſe ſuch a bridge muſt be employed on which to reſt the hand of the artiſt, as is before recommended. When the drawing is complete, the paper muſt be carefully removed from the ſurface of the plate, which muſt be ſurrounded with a rampart of wax, and the aquafortis applied as before directed. This is the whole of the proceſs of etching in ſoft ground. As much of the varniſh as it was neceſſary to remove, in order to admit the aquafortis to the copper, will be found to have adhered to the back of the paper on which the artiſt has been drawing, which, preſuming the plate to be judiciouſly *bit-in*, will exhibit the exact archetype of the impreſſions which the etchings will produce.

It remains to be ſaid of etching in ſoft ground, that the ſtippling with the graver, which it is ſometimes found neceſſary to add in certain parts, after the plate is bit-in, does not incorporate ſo thoroughly with the ſketchy looſeneſs and chalky texture of the etching, but that a judicious eye will always diſcover the junction, and a delicate taſte will dwell on it with the ſame kind of diſſatisfaction that we regard a modern repair of a fine old picture that has been damaged; and further, that though it be a mode of art extremely well calculated to imitate a painter's ſketch or drawing in black-lead or chalk, it is by no means capable of producing a complete abſtract of a finiſhed picture.

There are certain local energies peculiar to every branch of engraving. He who ſhould endeavour in mezzotinto or the chalk manner to rival the playful freedom and characteriſtic taſte which is diſplayed by Vivares in his etchings of trees, would find himſelf as much miſtaken in his aims as he who by etching through ſoft ground, or on *ſtone* (for which ſee ETCHING *on Stone*,) ſhould attempt to render the delicate blandiſhments, ſo as to produce a complete abſtract of the full harmony, of the finiſhed works of Correggio or Claude. On the other hand, either of theſe modes of etching is far more capable of producing a faithful tranſcript of a drawing hatched with chalk or lead-pencil, than the powers of the graver and aquafortis united on copper, and of multiplying ſuch drawings, certainly affords the moſt efficient means.

It may not be ſuperfluous to add that it is not the painter's ſketches that it is moſt deſirable to multiply, but his finiſhed performances; we wiſh moſt to ſee the mercury of his active imagination amalgamated with the ſterling gold of his cultivated underſtanding; and we juſtly value an art of engraving as it is capable of rendering or reproducing the pure forms into which this rich maſs may be moulded.

ETCHING *on Stone*. A method of etching on calcareous ſubſtances, which may be termed a chemical art of multiplying hatched drawings, has alſo been recently diſcovered in England, or recently imported from Germany; and ſome very ſpirited ſketchy etchings have been executed in this way by the preſident Weſt, and Meſſrs Fuſeli, Coſway, Barry, and ſome other members of the Royal Academy. Meſſrs. Corbould, Stubbs, and C. Heath are alſo among thoſe who have ſucceſsfully practiſed this new art.

The materials were ſupplied by a gentleman not now in England: the knowledge of the exact proportions of the ingredients of which they conſiſted, was not imparted to thoſe who made uſe of them, neither is it believed to have been imparted to any one elſe; but the materials themſelves being known, the proportions may preſumptively be aſcertained by a little experience.

The ſtone was of a ſpecies reſembling that fine-grained ſtone of a yellowiſh colour, which is found in large quantities in the neighbourhood of Bath, and is called Bath ſtone. The etchings were of two kinds; thoſe performed with a crayon, and thoſe performed with pen and ink. The crayon was a mixture of white wax and lamp-black, with a ſmall quantity of ſhell-lac. The ink conſiſted of ſhell-lac, borax, and water, and the ſtones which received the crayons were ground to a ſurface ſomewhat leſs ſmooth than thoſe which were prepared for the reception of the ink.

The method of etching is merely *drawing* on the ſtone with theſe materials. The myſtery, or ſecret—which any chemiſt would eaſily develope—reſides in the manner of printing theſe drawings, and is ſimply as follows.

The ink is to be prepared as printer's ink is commonly prepared, namely, ground up with oil, and the paper which is to receive the impreſſion muſt be damped in the uſual manner. The etched ſtone is then to be wetted by immerſion in water; when it is taken out, and while it is ſtill wet, the ink being carefully applied on its ſurface, without violent friction, by means of a printer's ball (ſuch as is uſed in letter-preſs printing) will be found to adhere only where the ſtone has been hatched by the artiſt, with the crayon or ink, the antipathy of oil to water effectually preventing it from ſticking any where elſe. The paper is now to be placed as in letter-preſs printing, and a preſſure, which need not be very violent, applied either by means of a roller paſſed over the back of the paper or otherwiſe: a blanket or finer woollen cloth, being interpoſed between the roller and paper.

Etching *on Glaſs*, is performed in the following manner: Lay a thin coat of white wax (as etching ground is laid) on the plate of glaſs. On this the drawing muſt be traced in the uſual way. When the ſubject is etched, a border or wall of wax of a very even height muſt be put around: take then ſome fluor ſpar powdered to about the fineneſs of oatmeal, and ſtrew it *evenly* over the etching, and on this pour a mixture of equal quantities of ſulphuric acid and water, till the whole is about the conſiſtence of thick cream: a cover of metal or wood muſt then be laid over, and fitted cloſe on the border of wax, to keep in the fumes of the acid, the eſcape of which would ſo weaken the liquor that it would not act on the glaſs, and would beſides be very hurtful to the lungs.

If the ſubject be to be etched with care, and high finiſhing be required, the acid mixture muſt be taken off occaſionally, and the plate, after being well waſhed and dried, muſt have the parts that are bit-in enough, ſtopped-out, as in common etchings, when the mixture muſt be again put on, and cloſed down as before; and this muſt be repeated till the ſeveral gradations of ſhade are believed to be ſufficiently corroded.

Etchings on glaſs are printed by means of the rolling preſs, and it need ſcarcely be added that much care is requiſite on the part of the printer, leſt the plates of glaſs ſhould ſplit in paſſing through the preſs.

ETEA, or **Etia**, in *Ancient Geography*, a ſmall town of the iſle of Crete.

ETELENT, in *Geography*, a town of Aſiatic Turkey, in the Arabian Irak, ſituated on the Tigris; 66 miles N.N.W. of Baſſora.

ETENDUE, *Fr.* in *Muſic*. See Compass.

ETEON, in *Ancient Geography*, a town of Greece, in Bœotia.

ETEONOS, a town of Greece, in Eubœa.

ETERNAL Flower, in *Botany*. See Xeranthemum.

ETERNITY, duration which is conceived incommenſurable with time, and excluſive of beginning, progreſs, ending, &c. See God.

Authors are much at a loſs for a proper and juſt definition of eternity: that of Boethius, De Conſol. Philoſ. lib. v. part 6. *viz.* "Interminabilis vitæ tota ſimul et perfecta poſſeſſio, *i. e.* a perfect poſſeſſion of a whole endleſs exiſtence altogether," though retained by S. Thomas and others, is faulty in divers reſpects.

Cenſorinus, De Die Natal. defines eternity by infinite duration, that is, duration which has always been, and always will be. Others more fully deſcribe it by a duration that exiſts altogether without any flux or ſucceſſion of parts prior or poſterior to each other: where the word duration, taken abſtractedly, imports no more than the perſeverance of a thing in its exiſtence, the τȣ *durare* being here oppoſed to the τȣ *ceſſare, in exiſtendo.*

But ſoften the word duration how you will, it is ſcarcely conceivable but by conceiving a quantity thereof, nor a quantity without conceiving a ſucceſſion. Others, therefore, define eternity by a *perpetuum nunc*, a perpetual now, or a *nunc ſemper ſtans*, an everſtanding now; but neither are theſe unexceptionable, the words *perpetuum* and *ſemper ſtans* importing an obſcure ſort of duration. See Duration.

Eternity, in *Mythology*, a divinity among the Romans, who had neither temples nor altars. They repreſented it under the figure of a woman, who held the ſun in one hand and the moon in the other: her ſymbols were a phœnix, globe, and elephant.

ETERNOZ, in *Geography*, a town of France, in the department of Doubs, and diſtrict of Quingey; 2½ leagues S.E. of Quingey.

ETESIÆ, or **Etesian** *Winds*, are ſuch as blow at ſtated times of the year, from what part ſoever of the compaſs they come. They are ſo called from the Greek word ετος, *year*, being yearly or anniverſary winds, ſuch as our ſeamen call monſoons and trade-winds, which, in ſome parts of the world, continue conſtantly blowing for certain ſtated ſeaſons of the year. Thus the north winds, which, during the dog-days, conſtantly blow upon the coaſts of Egypt, and hinder all ſhips from ſailing out of Alexandria for that ſeaſon, are called eteſiæ in Cæſar's Commentaries. In other authors, the weſt and eaſt winds are called eteſiæ, when they continue blowing for certain ſeaſons of the year. Vide Salmaſ. Exercit. in Solin. p. 421.

Cellarius endeavours to prove that thoſe winds are properly eteſian which blow from that part of the horizon which is between the north and weſt about the time of the ſolſtice. Geog. Antiq. lib. i. cap. 8. See Monsoon and Wind.

ETETA, in *Ancient Geography*, a town of Upper Myſia, according to Ptolemy; called Ægeta in the Itinerary of Antonine.

ETFU, or **Edfou**, in *Geography*, a village of Upper Egypt, ſituated near the Nile, above Eſneh, built on the ruins of the great city of Apollo, or Apollinopolis Magna, and now governed by an Arab ſcheik. It poſſeſſes an ancient temple, covered with hieroglyphics, among which, ſays Savary, we diſtinguiſh men with falcons' heads. Its inhabitants were enemies of the crocodile. The extent, majeſty, and preſervation of this edifice, ſays Denon, who has given a view of it, "ſurpaſſed all that I had ſeen in Egypt, or elſewhere; it made an impreſſion on me as vaſt as its own gigantic dimenſions. This building is a long ſuite of pyramidal gates, of courts decorated with galleries, of porticoes, and of covered naves, conſtructed, not with common ſtones, but entire rocks." "The excellent preſervation of this ancient edifice forms a wonderful contraſt with the grey ruins of modern habitations built within its vaſt incloſure; a part of the population of this village is contained in huts built in the courts, and around the fragments of the temple; which, like ſwallows' neſts in our houſes, defile them without concealing or injuring their general appearance." Below Etfu, the cultivated country becomes very narrow, ſo that there is only a quarter of a league in breadth between the deſert and the river.

ETHAM, in *Ancient Geography*, a town of Egypt, ſituated in the deſert, which gave name to the lower part of the Red ſea, oppoſite to Magdalum. It was the third ſtation of the Iſraelites in their eſcape from Egypt.

ETHELBERT, in *Biography*, king of Kent, ſucceeded to the throne about the year 560. He began his reign with a reſolution to revive the reputation of his family, which had been ſinking in the ſcale of monarchy; with this view he made war upon the king of Weſſex, by whom he was twice defeated, though he was afterwards triumphant, and acquired the complete aſcendancy over Weſſex and the other ſtates, except Northumberland, and reduced them to the condition of his tributaries or dependants. In the reign of Ethelbert, Chriſtianity was introduced into England. The king had married Bertha, daughter of the king of Paris, who being a Chriſtian, had ſtipulated for the free exerciſe of her religion, and had carried over in her train a French biſhop. So exemplary in every reſpect were her life and conduct, that ſhe inſpired the king and his court with a high reſpect for her perſon, and for the religion by which ſhe appeared to be influenced. The pope, taking advantage of this circumſtance, ſent a miſſion of forty monks, at the head of whom was Auguſtine, to preach the goſpel in the iſland. They landed in Kent in 597, and were well and hoſpitably received by Ethelbert, who aſſigned them habitations in the iſle of Thanet. A conference was held, and the king took time to conſider of the new doctrines propounded to him; and in the mean while gave them full liberty to preach to his ſubjects. Numbers were converted, and at length the king ſubmitted to a public baptiſm, Chriſtianity proved the means of promoting knowledge and civilization in this iſland; and the king, with the conſent of his ſtates, enacted a body of laws, which was the firſt written code promulgated by the northern conquerors. Ethelbert died in the year 616, and left his crown, after a reign of 50 years, to his ſon Edbald. Hume's Hiſt of Eng.

ETHELBERT, king of England, was ſon of Ethelwolf, and ſucceeded to the government of the eaſtern part of the kingdom in 857, and in three years afterwards he became ſole king. He died in 866, but had, in the courſe of his reign, ſhewn a conſiderable ſhare of vigour in defending his dominions from the inroads of the Danes, who at that period were cruel enemies to this country, and continued to ravage one part as they were repulſed from another. Hume.

ETHELEUM, in *Geography*, a river of Aſia, which ſeparated between the Troade and Myſia.

ETHELING, or ÆTHELING. See ATHELING.

ETHELRED I., in *Biography*, king of England, ſon of Ethelwolf, ſucceeded his brother in the year 866. The reign of this monarch was ſhort but full of troubles. The Danes had already gained an aſcendancy over the kingdom, and ſeemed now to threaten it with entire conqueſt. The enterpriſing Alfred united his ſkill to the power which his brother the king was able to call forth; they purſued the invaders from place to place, and drove them from the centre of Mercia. The Mercians, careleſs of their liberties, or jealous of the ſuperiority which victory was likely to give to the monarch, refuſed to co-operate with him, and Ethelred was under the neceſſity of oppoſing the Danes with his Weſt Saxons alone. With theſe he was generally ſucceſsful, till large reinforcements were ſent to ſupport the invaders, which enabled them to make a ſtand againſt the natives. The actions fought were frequently very bloody, and in one of them Ethelred was wounded. He died in 871, leaving his crown to the immortal Alfred; of whom we have already ſpoken. Hume's Hiſt.

ETHELRED II. king of England, was ſon of Edgar, and brother to Edward the Martyr, whom he ſucceeded to the crown in the year 978. He was at this period a minor, and from his want of capacity and vigour in the affairs of government he was, in his riper years, characterized by the epithet of "The Unready." No man, however, ſtood more in need of exertion and enterpriſe, for the Danes, who had for ſeveral years forborne all depredations, renewed their attacks with the utmoſt fury; and meeting with little oppoſition, they became more bold, till, at length, in the year 993, under Sweyn king of Denmark, and Olave king of Norway, they made a formal invaſion of the country. At firſt nothing ſeemed to oppoſe the rapidity of their progreſs: and they laid ſiege to London, which was valiantly and ſucceſsfully defended by the citizens. A miſtaken policy in behalf of the Engliſh induced them to purchaſe the departure of the invaders, who, in 997 and 998, returned in large bodies, laid waſte the ſouthern parts of the kingdom, and demanded a ſtill larger bribe than they had before received. To ſtrengthen himſelf by a foreign connection, Ethelred married, in 1001, Emma, ſiſter to Richard II. duke of Normandy. In the following year a dreadful maſſacre took place, on the ſame day throughout England, of all the Danes ſettled in the kingdom. The Engliſh in this inſtance were the willing inſtruments in the hands of the king to execute his bloody orders. They ſpared neither age nor ſex; even a ſiſter of the Daniſh ſovereign, who had married an earl, and had conformed to the Chriſtian profeſſion, was barbarouſly murdered, having already witneſſed the death of her huſband and infant children. Such revenge, ſays the hiſtorian, added nothing to the ſtrength of the nation, but rendered its enemies more implacable. In 1003, Sweyn again invaded the iſland, and carried deſolation all along the Weſtern coaſt. On a ſubſequent occaſion the bold invader obliged the nobles to ſwear allegiance to him as king of England, while Ethelred, in 1013, fled into Normandy with his family. Sweyn maintained his power only a year, when death put an end to his reign, and Ethelred was recalled by his loyal ſubjects. He reſumed the government, but had not learned that wiſdom which his misfortunes were calculated to teach; he ſubmitted to Canute the ſon of Sweyn, whoſe valour and activity he was unable to reſiſt. Ethelred died in 1016, after an inglorious reign of thirty-five years. Hume.

ETHELWOLF, king of England, ſucceeded his father Egbert in the year 838. Little ambitious of government, one of his firſt acts was to give his eldeſt ſon, Athelſtan, the ſovereignty over Eſſex, Kent, and Suſſex. His whole reign was moleſted by the incurſions of the Danes, and about the year 851 they became ſo formidable as to threaten the total ſubverſion of the government. The natives were not inactive, but oppoſed the enemy with the utmoſt vigour; nevertheleſs they took up their winter-quarters in England, and before they returned, burnt Canterbury and London. In the midſt of theſe dangers the king, excited by a ſpirit of devotion, made a pilgrimage to Rome, where he remained about a year, being accompanied by Alfred, who was afterwards king. During his abſence he left his eldeſt ſon Athelſtan as regent, who ſoon after died, and thus afforded an opportunity to his ambitious brother of ſeizing the reins of government with an intention of dethroning his father. To avoid the evil conſequences of civil war the king, without heſitation, ceded the weſtern part of his dominions to his ſon. After this, influenced, in all probability, by the intriguing monks, he ſummoned the eſtates of the whole kingdom, and ſolemnly conferred upon the clergy the tithes of all the produce of the lands. This act of piety, as it was denominated, was conſidered as the moſt effectual meaſure for reſiſting the Danes. Ethelwolf died in 857. Hume.

ETHER, in *Chemiſtry*, is a light, odorant, inflammable liquid, produced by the action of certain of the acids upon alcohol. The acids that have actually been employed for this purpoſe are the ſulphuric, the nitric, the muriatic, the acetic, and the fluoric; whence originate as many ſpecies, or perhaps varieties of ether, all of which we ſhall deſcribe in due order.

§ 1. *Sulphuric ether.*—The method of preparing this ſubſtance is firſt mentioned in the Diſpenſatory of Valerius Cordus, publiſhed about the year 1540; it was alſo known to Baſil Valentine, Paracelſus, and Boyle: it had, however, attracted the notice of chemiſts only in a very imperfect degree, before it was deſcribed by Froben, a German, in the

Philoſophical Tranſactions for 1730. Since that period the preparation and properties of ſulphuric ether have been carefully inveſtigated by many able chemiſts, eſpecially Scheele, Dollfuſs, Macquer, Pelletier, Vauquelin and Fourcroy.

The mode of obtaining ether in the ſmall way is as follows. Take a tubulated glaſs retort, of the capacity of about ſix quarts, lengthen its beak by an adopter, and paſs the other end of the adopter into a two-neck quilled balloon receiver; fix another adopter into the oppoſite neck of the balloon, and join to this a common quilled balloon receiver, placed in ſuch a poſition that the quill, inſtead of pointing directly downwards, as in the firſt receiver, ſhall ſlant gently upwards; then lute all the junctures with linſeed meal or common paſte, except that of the retort to the firſt adopter; fix alſo a 24 ounce vial to the quill of the firſt receiver, and looſely cloſe the quill of the ſecond with a cork or plug of moiſt paper. The lute being moderately dry and hard, withdraw the retort, and pour in through the tubulure 40 ounces by weight of rectified alcohol, and 32 ounces of the ſtrongeſt ſulphuric acid. Replace the retort with its contents, being careful to ſhake it as little as poſſible, and let it remain for 12 hours or more, during which the acid and alcohol will gradually act on each other, producing a conſiderable degree of heat. Afterwards withdraw the retort, and mix together its contents as accurately as poſſible, by communicating to them a gentle circular motion; this being finiſhed, replace the retort, and carefully cloſe by lute its junction with the adopter, and leave the whole in this ſtate till the contents of the retort have acquired a reddiſh-brown colour, which will take place in a day or two. Now proceed to diſtillation, by placing a pot of lighted charcoal beneath the retort, obſerving to heat it very gradually. The firſt impreſſion of the fire drives off a little highly dephlegmated alcohol, but as ſoon as the mixture begins to boil, the ether itſelf paſſes over and condenſes on the ſides of the receiver in large ſtreaks. It is now eſſentially requiſite to keep the receiver as cool as poſſible, by the application of ice or of wet cloths wrung out in cold water and frequently renewed; and if this is properly attended to, by far the greater part of the ether will be condenſed in the firſt receiver, whence it will flow into the vial beneath; a little, however, will paſs through the ſecond adopter into the ſecond receiver, where it muſt be condenſed by the ſame means as have already been recommended. The contents of the retort are to be kept moderately boiling, till ſulphurous acid gas begins to paſs through the quill of the ſecond receiver, which may be known at once by its ſtrong ſuffocating odour. As ſoon as this is perceived, the fire is to be withdrawn, and the vial is to be detached from the receiver, and its contents poured into a ground-ſtoppered bottle; being then replaced as before, the proceſs of diſtillation is to be re-commenced till about ſix or ſeven ounces of a coloured liquid are produced, after which the operation is to be ſtopped. The original mixture of ſulphuric acid and alcohol is thus divided into three ſeparate products; namely, the reſidue in the retort, and the products of the ſecond and firſt diſtillations. In the retort is a black thickiſh matter, ſmelling ſtrongly of ſulphurous and acetous acids, and intenſely ſour to the taſte. If diluted with an equal bulk of warm water and filtered through pounded glaſs or clean white ſand, it will be ſeparated from the carbonaceous matter with which it was loaded, and by ſubſequent boiling the ſulphurous and acetous acids will be driven off, leaving behind ſulphuric acid in a conſiderable degree of concentration, and applicable to a variety of uſeful purpoſes. The product of the ſecond diſtillation conſiſts of two diſtinct liquids, the heavieſt of which is acidulous water, and the lighter an impure ether, called *oil of wine*, which may be ſeparated from the water by inverting the vial that contains them in warm water; a little of the ether is in conſequence converted into elaſtic vapour, which forces out of the vial the lower and heavier fluid. The product of the firſt diſtillation is impure ether, in quantity about 17$\frac{1}{2}$ ounces. Thus from 32 ounces of ſulphuric acid and 40 ounces of alcohol there are procured about 17$\frac{1}{2}$ ounces of impure ether, and three ounces of oil of wine; and the ſulphuric acid that may be recovered, taking into conſideration its quantity and denſity, amounts to about 46 per cent. of that originally employed.

Ether, when freſh diſtilled, is contaminated by ſulphurous and acetous acids and a little coloured oil, in conſequence of which it is neceſſary to purify it by rectification. This is generally done by adding to the ether ſucceſſive portions of cauſtic potaſh or ſoda diſſolved in water, and ſhaking together the two fluids in a well cloſed bottle, after each addition of alkali, till the ſulphurous odour is totally deſtroyed; the contents of the bottle are then to be poured into a retort, and by the application of a gentle heat, never amounting to ebullition, the ether will paſs into the receiver in a ſtate of great purity, leaving behind a watery ſaline liquor covered by a thin film of browniſh-yellow oil. Scheele recommends that the alkali employed in rectification ſhould be diſſolved in alcohol inſtead of water; the advantage of which is that no ſpontaneous ſeparation of the liquors takes place, and therefore the ſulphurous and acetous acids are neutralized and ſeparated with greater certainty. Diſtillation at a gentle heat will readily ſeparate the ether from the other ingredients. A ſtill cheaper and very effectual method of rectifying ether is the following, firſt employed by Mr. Woulfe. "Fill three-fourths of a bottle with the impure ether, add a little water and a portion of ſlacked lime; agitate the bottle with violence, and keep it for ſome time in cold water, before taking out the cork; if the ſmell of the ſulphurous acid be not removed, add a little more lime and agitate a ſecond time. Decant off the ether into a receiver, and diſtil it off." Another very cheap and ingenious proceſs was invented by Pelletier. It conſiſts in adding to the impure ether a little finely pulverized black oxyd of mangaeſe. The mixture being corked up in a bottle, is to be well ſhaken four or five times a day for the ſpace of a week, at the end of which time the ſulphurous acid will have been converted into ſulphuric, and will have combined with the mangaeſe, from which the ether may be poured off without the neceſſity of diſtillation.

By any of the above methods ether is rectified ſufficiently for any purpoſes to which it is uſually applied; but if the greateſt poſſible degree of purity is required, there ſhould be added to the rectified ether ſucceſſive portions of dry, pulverized muriat of lime, till it ceaſes to be diſſolved; from this mixture, by diſtillation with a very gentle heat, and keeping at the ſame time the receiver quite cold by the application of ice, an ether may be procured, probably entirely free from alcohol and water, and of the ſpecific gravity of 0.65.

Rectified ether exhibits the following properties. It is a tranſparent colourleſs liquor, of a peculiar and to moſt perſons an agreeably fragrant odour, and a hot penetrating, and ſomewhat ſuffocating taſte. Its uſual ſpecific gravity, according to Lavoiſier, is $=0.758$. It is volatilizable at a lower temperature, and more rapidly than any other liquid, a conſiderable proportion being loſt, eſpecially in hot weather, by merely pouring it from one vial into another; hence the veſſels in which it is kept ought to be very exactly cloſed, and for further ſecurity are often kept inverted in cold water. It boils at 98° Fahr. under the uſual atmoſpherical preſſure, and at 20° in vacuo.

Owing to the extraordinary rapidity with which ether evaporates, it poſſeſſes a very great power of refrigeration. This is made obvious to the feeling by pouring a little into the palm of the hand; it is almoſt inſtantly volatilized, and the hand becomes painfully cold. So alſo if ſome fine tow is wrapped about the bulb of a ſmall thermometer, and the blaſt from a pair of double bellows is let upon it, after it has been well ſoaked in ether, the mercury in the thermometer will, in the ſpace of a minute or leſs, be lowered to 0° Fahr. Ether, notwithſtanding its ready volatility, is capable of being congealed at a low temperature. If a ſmall matraſs filled with this fluid is cooled down to −25° Fahr. by a mixture of ſnow and muriat of lime, the liquor becomes gradually filled with brilliant tranſparent cryſtalline laminæ, reſembling benzoic acid or oxymuriat of potaſh; and preſently, eſpecially at a ſomewhat lower temperature, the whole is congealed into a white almoſt inodorous maſs. Ether is remarkably inflammable, taking fire inſtantly on the near approach of an ignited body; it burns with a large white flame and a little ſmoke, and is reſolved into water, carbonic acid, and a minute quantity of charcoal. When paſſed through a red-hot earthenware tube, it is entirely decompoſed, and a large production of carburetted hydrogen takes place. Ether remarkably increaſes the bulk of any of the permanent gaſſes to which it was added, as was firſt obſerved by Dr. Prieſtley. A ſmall quantity of this fluid being mixed with oxygen confined over mercury, exactly doubled its bulk, nor could any additional quantity occaſion a further dilatation. Nearly the ſame effect took place with atmoſpheric air, azot, hydrogen, nitrous gas, and carbonic acid; but by a ſlight agitation in water the ether was abſorbed, and the gas reſumed its former dimenſions without any alteration of its original properties. If oxygen gas thus diluted by ether is ſet fire to, it burns rapidly, but does not explode; but if one part of this mixture is added to three parts of oxygen, the application of an ignited body, or of the electric ſpark, cauſes a violent exploſion, the products of which are water and $2\frac{1}{3}$ parts of carbonic acid. Hence it appears that one part of ether requires 6.8 of oxygen for its ſaturation, and that the proportion of carbon to hydrogen in ſulphuric ether is nearly as 5 to 1.

Water and ether appear to combine with each other in two different proportions. If equal parts of theſe fluids are ſhaken together in a graduated tube, the ether will be found to have diminiſhed in bulk about $\frac{2}{10}$, and the water to have enlarged in nearly the ſame proportion; the lower fluid conſiſts of water ſaturated with ether, and the upper fluid is ether combined with a little water. The ether in this ſtate is ſaid to be *waſhed*, and acquires in conſequence ſome properties which pure ether does not poſſeſs; in particular, it is now capable of diſſolving caoutchouc with great eaſe, whereas this ſubſtance is acted on by pure ether only in a very imperfect manner. Phoſphorus is ſoluble in ether, but the ſolution is not luminous. When ether is boiled with phoſphorus, it often depoſits cryſtals by cooling; agitation with water produces no change in this liquid, but the addition of a little alcohol cauſes an immediate turbidneſs, whence the ſophiſtication of ether by alcohol may be detected by the addition of a few drops of phoſphorized ether. The fixed alkalies ſeem incapable of uniting with ether, but ammoniacal gas is abſorbed by it very copiouſly. The ſame may be obſerved of nitrous gas; but neither of theſe combinations has hitherto been ſubmitted to an accurate examination. Sulphuric acid acts on ether with conſiderable energy, eſpecially if aſſiſted by a gentle heat; it is converted into a browniſh oily fluid, much heavier than ether, called oil of wine, and at a higher temperature is changed into olefiant gas. With regard to the action of oxymuriatic acid on ether, a curious experiment is related by Mr. Cruickſhank. "If we fill a bottle of the capacity of three or four pints with the pure oxymuriatic acid gas, taking care to expel the water as completely as poſſible, and then throw into it about a drachm or half a drachm of good ether, covering its mouth immediately with a piece of light wood or paper, in a few ſeconds white vapour will be perceived, moving circularly in the bottle; this will ſoon be followed by an exploſion, accompanied by flame, at the ſame time a very conſiderable quantity of carbon will be depoſited, and the bottle will be found to contain carbonic acid gas." Nitric acid excites a conſiderable efferveſcence in ether, and ſeems to convert it into oil of wine. The eſſential oils are ſoluble in ether, and it combines with alcohol in almoſt all proportions.

Concerning the theory of etherification, much has been written, and many experiments have been made by able chemiſts, without, however, obtaining the ſatisfaction that could be wiſhed. According to Macquer, ether is a ſubſtance intermediate between alcohol and oil, and alcohol approaches to the ſtate of oil preciſely in proportion as it parts with its water of compoſition. But though it is true that the production of water accompanies the converſion of alchohol into ether, and of ether into oil of wine, yet this is by no means the only phenomenon, ſo that the theory of Macquer is, at beſt, imperfect, ſince the depoſition of charcoal, and the generation of acetous acid, are not at all accounted for. According to Pelletier, Chaptal, and others, the whole proceſs of etherification conſiſts in a transfer of oxygen from the ſulphuric acid to the alcohol: the diſengagement of ſulphurous acid accompanies the production of ether, and therefore ſhews that the ſulphuric acid is deoxygenated: the oxygen, thus ſeparated, does not come over in the ſtate of gas, and therefore muſt be combined with the alcohol forming ether. But in reply, it may be obſerved, that this mode of explanation accounts for only a few of the phenomena, and that the preparation of ether, if carefully managed, may be carried on without the diſengagement of any ſulphurous acid. The moſt elaborate enquiry into this intricate ſubject was undertaken by Vauquelin and Fourcroy, which we ſhall now proceed to detail, though it is by no means ſo complete and ſatisfactory as to preclude the neceſſity of further reſearches. The facts and obſervations by which this theory is ſupported are the following.

If one part of alcohol and two of ſulphuric acid are mixed together, the temperature riſes to about 200° Fahr.; the maſs immediately acquires a deep browniſh-red colour, which deepens into black in a few days after, and at the ſame time exhales a vapour manifeſtly ethereous.

Equal parts of concentrated ſulphuric acid and rectified alcohol acquire on mixture a temperature of 190° Fahr.; bubbles of gas are extricated, the liquor becomes turbid and opaleſcent, and at the end of a few days acquires a deep red colour. The whole being then transferred to a diſtillatory pneumatic apparatus, and being heated to 107° Fahr., ebullition takes place, and ether paſſes over into the recipient; if the operation is carefully conducted no elaſtic fluid is diſengaged, and the vapour, when condenſed, is found to be only water and ether. When the liquor thus obtained amounts to about half of the alcohol employed, ſulphurous acid begins to be manifeſt, and, in a ſhort time, the production of ether ceaſes, and is ſucceeded by oil of wine, accompanied by acetous acid. The contents of the retort being kept boiling, and becoming more and more concentrated as the diſtillation proceeds, are conſtantly acquiring a higher temperature; when this amounts to about 234° Fahr., olefiant gas begins to come over, and continues till the oil of wine ceaſes to flow. At this period carbonic acid gas firſt makes its appearance, and water and ſulphurous acid ſtill continue to be produced, the reſidue in the retort being in the mean time reduced to little elſe than ſulphuric acid thickened by charcoal.

From theſe facts the able chemiſts who obſerved them have concluded,

1. That the ſpontaneous action of alcohol and ſulphuric acid, when this latter is conſiderably in exceſs, is ſufficient for the formation of ether without the aſſiſtance of any extraneous heat, and that by duly proportioning the two ſubſtances, the alcohol might be wholly decompoſed and made to yield all the ether of which it is capable when treated in the uſual manner.

2. That the formation of ether is not owing to the affinity of the oxygen of the ſulphuric acid, for the hydrogen and carbon of the alcohol, becauſe in the preparation of ether no ſulphurous acid gas is evolved till the production of ether has almoſt ceaſed. It muſt therefore be the entire attraction of the acid for one or more of the elements of the alcohol that determines its decompoſition: now ſince water is formed during the whole proceſs, and, ſince the attraction of ſulphuric acid for this ſubſtance is very powerful, it appears likely that this is the cauſe that deſtroys the equilibrium of the affinities by which the elementary particles of alcohol are retained in combination, and induces the oxygen and hydrogen to unite and form water. Hence it might at firſt ſight be ſuppoſed that ether differs from alcohol in containing a ſmaller proportion of oxygen and hydrogen. This however will not be found to be the caſe, when we advert to the depoſition of charcoal, which, equally with the production of water, accompanies the formation of ether: now the amount of charcoal depoſited is greater in proportion to that which is left, than the hydrogen of the water compared to what remains in the ether; therefore this latter fluid, though compoſed of the ſame elements as alcohol, differs from it in containing a ſmaller proportion of carbon compared with the hydrogen. During the progreſs of diſtillation the heat to which the materials in the retort are expoſed is conſtantly increaſing, and (the affinity of the acid and alcohol alſo augmenting) the acid itſelf is at length decompoſed, ſulphurous acid is generated, and the exceſs of oxygen deprives the alcohol of part of its hydrogen whence reſults the oil of wine, differing from ether in containing a larger proportion of carbon; and in confirmation of this, it may be obſerved, that the charcoal depoſited during the production of oil of wine is not ſo abundant as during the generation of ether.

Hence as (according to the authors of the above hypotheſis) no decompoſition of the ſulphuric acid takes place during the formation of ether, the agency of the acid is partly that of detaining the alcohol in a temperature more than ſufficient for the volatilization of this fluid when uncombined, and partly that of aſſiſting the caloric to decompoſe the alcohol in conſequence of its own powerful affinity for water.

A circumſtance, however, firſt remarked by Scheele, but which has hitherto failed to obtain the notice to which it is ſo well entitled, ſufficiently proves that in the formation of ether the acid employed acts a much more important part than is aſſigned to it in the theory of Vauquelin and Fourcroy. The admirable chemiſt above-mentioned ſtates that if ſulphuric ether be duly rectified by agitation with cauſtic alkali and ſubſequent diſtillation, it occaſions no precipitate with barytic ſalts; but if to the ether thus purified there be added nitric acid, a copious precipitate is then produced by any of the ſoluble ſalts of barytes, indicating the preſence of ſulphuric acid. This fact ſtrikingly points out that a portion of the baſe of the acid in a more or leſs deoxygenated ſtate actually combines with the alcohol to compoſe ether. A like fact reſpecting muriatic ether is alſo mentioned by Scheele, namely, that though this ether, when rectified, occaſions no decompoſition of nitrated ſilver, yet the watery reſidue, after combuſtion of the ether, occaſions a copious precipitate of muriated ſilver when mixed with the nitrat of this metal.

§ 2. *Nitrous ether.*—Although nitrous ether appears to have been known to Baſil Valentine and Kunkel, yet the mode of its preparation being kept a ſecret, it ſoon ceaſed to be attended to by chemiſts, till in the year 1740 it was re-diſcovered by Duhamel, and afterwards was more particularly deſcribed by Navier, Sebaſtiani and others. It was prepared by Navier in the following manner. Put 12 ounces of rectified alcohol into a ſtrong bottle, and add to it gradually and at intervals 8 ounces of ſtrong nitric acid; after each portion of acid the liquors are to be well mixed by agitation, and the bottle is to be kept cloſe corked and immerſed up to its neck in ice and water; when the whole of the acid has been added, the bottle is to be well corked and further ſecured by a leathern cap. A ſtratum of ether riſes by degrees to the ſurface of the liquor, and after five or ſix days the cork is to be pierced by a needle in order to let out the nitrous gas formed during the proceſs: this gas having eſcaped, the cork is to be drawn, and the whole contents of the bottle being poured into a ſeparatory funnel, the ether is thus procured unmixed with the heavier fluid on which it floats. This is, however, a very rude way of proceeding, and is attended with the utmoſt riſk to the apparatus, the ether obtained alſo is in ſmall quantity, and very impure. In order to prevent the violent and rapid action of the concentrated acid on the alcohol, which is the chief difficulty in the preparation of nitrous ether, Dr. Black propoſed to interpoſe a thin ſtratum of pure water, and Fiſcher on the ſame principle made uſe of a little weak ſpirit of nitre for the ſame purpoſe. M. Dolfuſs, from a careful repetition of the latter proceſs, obtained the following reſult. Upon two ounces of very ſtrong nitric acid he poured gently ſix drachms of the ſame very much diluted, and upon this three ounces of rectified alcohol. The bottle was looſely corked and ſuffered to ſtand undiſturbed for three days; at this time the lower liquor appeared perfectly homogeneous with a ſtratum of ether floating above it. The whole being put into a retort and ſubjected to a gentle heat, there were obtained two ounces and a drachm of very pure ether unmixed with any acid, and the reſidue in the retort conſiſted of weak acetous acid mixed with oxalic acid, nearly the whole of the nitrous acid having been decompoſed.

The laſt mode by which nitrous ether may be prepared, that we ſhall mention, and which on the whole appears to be the beſt, conſiſts in mixing together alcohol and ſulphuric acid, and pouring the liquor upon pulverized nitre; the ſulphuric acid diſengages the nitre, which immediately re-acts on the alcohol, and ether is the reſult. The able chemiſt whom we have already mentioned has ſhewn the excellence of this method by the following experiment. Having put into a retort four ounces of perfectly dry and pulverized nitre, he added to it a mixture conſiſting of two ounces of concentrated ſulphuric acid, and four ounces of alcohol. The whole being ſubmitted to diſtillation, there came over firſt ſix drachms of dulcified ſpirit of nitre, and then three ounces of a liquor from which by ſubſequent rectification were procured two ounces of pure ether.

Nitrous ether, when recently made, contains in looſe combination a conſiderable quantity of nitrous gas, which in ſome degree modifies its properties, and renders it peculiarly liable to burſt the bottles in which it is kept, eſpecially in warm weather. This loſs and trouble, however, may be avoided by rectifying the ether, which is beſt done in the following way. Pour into a ſtrong vial ſo as to fill it two thirds, one part of ether and four parts of pump-water, and agitate it cautiouſly at firſt, frequently removing the thumb from the mouth of the vial in order to afford a free paſſage to the diſengaged nitrous gas: when no more of this gas is given out add a quantity of dry pearlaſh equal in weight to the ether, and ſhake the whole well together; then put the mixture into a tubulated retort and proceed to diſtillation, taking care that the temperature does not exceed 120° Fahr.; the ether will paſs into the receiver quite pure, and may be kept for any length of time in ſtrong well cloſed bottles, with no more riſk of accidents than ſulphuric ether is ſubject to.

Nitrous ether reſembles ſulphuric ether in moſt of its properties; it has, however, a dilute yellow colour, and a ſomewhat different odour and flavour; this appears to be owing to the preſence of a little reſinous matter, from which it can never be entirely freed; by repeated diſtillations from freſh parcels of dry white ſugar, as Deyeux has obſerved, this impurity may, in great part, be ſeparated, and in proportion as this takes place the ether becomes more and more analogous to that prepared by ſulphuric acid.

Nitrous ether appears capable of uniting with nitrous gas in two proportions; when the ether is in exceſs it forms nitrous ether in the ſtate in which it appears previous to rectification; when the nitrous gas exceeds the ether it forms a permanently elaſtic fluid that has obtained the name of *etherized nitrous gas*. The preparation of this differs only in the rapidity with which the nitrous acid and alcohol are made to act on each other: when the combination takes place very ſlowly much ether and little etherized gas are the reſult, but when the contrary is the caſe, theſe two products are formed in an inverſe proportion. If equal parts of alcohol and ſtrong nitrous acid are mixed together at the common atmoſpheric temperature, or at a higher heat in proportion as the acid is diluted, a very rapid and copious efferveſcence takes place, a little ether is condenſed in the receiver, and a large quantity of gas paſſes through the conducting tube, the firſt portions of which are etherized nitrous gas, and the latter common nitrous gas. What remains in the retort is acetic acid with a little oxalic acid. The properties of etherized nitrous gas (according to Van Diemen and his aſſociates, to whom we are inbebted for its diſcovery) are the following. It has a diſagreeable ethereal odour, exactly reſembling that of olefiant gas when treated with oxymuriatic acid. By the application of flame it takes fire and burns with a yellowiſh lambent flame like alcohol; after the combuſtion has ceaſed, the veſſel in which it was carried on contains a vapour of ſingular pungency. Water abſorbs this gas, but requires a conſiderable time to effect this, except agitation is had recourſe to, reſembling, in this reſpect, carbonic acid. Alcohol produces the ſame effect as water, and takes up the gas not only more rapidly, but alſo in larger proportion. A ſolution of cauſtic potaſh alſo diſſolves it, but with conſiderable difficulty, and on the addition of ſulphuric or muriatic acids the etherized gas is again ſet at liberty unaltered in any of its properties. Ammonia, whether liquid or in the gaſeous ſtate, is incapable of contracting any union with it; the ſame is the caſe with oxygen gas at the common temperature, but a mixture of the two airs, when inflamed, produces a moſt violent exploſion; ſulphuric acid immediately decompoſes this gas, by abſorbing the ether, the nitrous gas retaining its elaſtic ſtate. Sulphurous acid produces the ſame effect, only it requires ſome days for this purpoſe. If ſulphuric acid, previouſly diluted with an equal weight of water, is placed in contact with this gas over mercury, its action is greatly retarded, the diminution of volume in the incloſed air takes place much more ſlowly, and even after ſome days a portion of ether is retained by the nitrous gas, which in conſequence acquires the property of enlarging the flame of a taper that is immerſed in it, in the ſame manner as nitrous oxyd does. Nitrous acid, according to the degree of its concentration, abſorbs either wholly or in part, the ethereous portions of the gas, and the ſame may be obſerved of muriatic acid.

Etherized nitrous gas, when paſſed through a red-hot tube, depoſits a little oil, and by ſubſequent waſhing in lime-water is freed from ſome carbonic acid; the reſidue is nitrous gas, mixed or combined with common carburetted hydrogen, and is not acted on by the ſulphuric, nitric, or muriatic acids, by cauſtic potaſh or alcohol. The addition of oxygen gas produces red vapours, the nitrous gas is converted into acid, and the gaſeous reſidue is carburetted hydrogen.

§ 3 *Muriatic ether.*—After chemiſts had ſhewn the production of ether by means of the ſulphuric and nitric acids, it was natural to attempt its preparation by the muriatic acid. But this latter, in its uſual ſtate of dilution with water, has no action on alcohol, and therefore the various modes that were firſt practiſed to obtain muriatic ether entirely failed. A few chemiſts were ſaid to have ſucceeded by employing ſimple muriatic acid, but in a more concentrated and dry ſtate than the common liquid acid; the proceſs, however, was both difficult and doubtful, and muriatic ether can hardly be ſaid to have been known till Rouelle diſcovered that it might be prepared by diſtilling together alcohol and the ſmoking liquor of Libavius, which is a concentrated muriat of tin in its higheſt ſtate of oxydation. The marquis de Courtanvaux, having repeated the proceſs of Rouelle with great care, propoſes the following as the beſt method of making the ſubſtance in queſtion. Mix together in a retort three parts of the fuming muriat of tin and one of alcohol; a conſiderable degree of heat is immediately excited, and a white ſuffocating vapour ariſes, which, however, ſoon diſappears on agitating the mixture. As ſoon as an ethereous odour is perceived, let two balloon receivers be luted on, and kept as cool as poſſible; then by the application of a gentle heat to the retort there comes over firſt a little dephlegmated alcohol, which is ſucceeded by the ether: by an increaſe of temperature a few drops of coloured oil are produced, and there ariſes, partly in the form of a ſoft butter and partly in that of a denſe brown liquid, a quantity of ſmoking muriat of tin, part of the metallic oxyd remaining in the retort as a grey powder. When the ether thus procured is mixed with pearlaſh, a copious efferveſcence and precipitation take place, owing to the decompoſition of ſome muriat of tin contained in the ether; after which, by diſtillation at a gentle heat, the ether ariſes in a ſtate of great purity, amounting to half the impure product of the firſt diſtillation.

Several other of the metallic muriats have been found to be equally efficacious with the liquor of Libavius; the corroſive muriats of antimony and of arſenic, the muriats of biſmuth and zinc, and the red muriat of iron, have in particular been uſed with ſucceſs in the preparation of muriatic ether. Scheele.

Scheele, the diſcoverer of oxymuriatic acid, was induced to try the effect of this in the preparation of muriatic ether. For this purpoſe he put three ounces of alcohol into a receiver, with which was connected a retort holding two ounces of common ſalt, upon which was poured an equal weight of ſulphuric acid; the muriatic acid thus diſengaged paſſed into the receiver, where it combined with the alcohol; and this, when ſaturated with acid, was transferred to another retort, containing three ounces of black oxyd of manganeſe in fine powder; the mixture inſtantly aſſumed a green colour, and preſently after became ſo hot as to boil. When the ebullition had ceaſed, there was found in the receiver a liquor, from which, on mixture with water, a quantity of ether immediately ſeparated. The ſame method is recommended by Van Mons, except that he employs only one fourth of the manganeſe uſed by Scheele, and performs the ſecond diſtillation in a Woulfe's apparatus, the bottles of which contain a ſolution of cauſtic potaſh, by which the acid is prevented from re-acting on the ether.

Another mode of applying oxymuriatic acid to the preparation of ether, firſt practiſed by Scheele, is mentioned by Pelletier, and deſerves to be repeated, as being perhaps the moſt expeditious and economical of any. He introduced into a large tubulated retort a mixture of eight ounces of manganeſe, and 16 ounces of decrepitated common ſalt, upon which he poured a mixture of 12 ounces of ſulphuric acid, and eight ounces of alcohol. From this maſs ten ounces were drawn off by diſtillation at a gentle heat, which, by ſubſequent rectification, yielded four ounces of ether.

It deſerves to be remarked, that the ether prepared by oxymuriatic acid generally depoſits, during its rectification with potaſh, a conſiderable quantity of a clear aromatic and bitter oil, which ſinks in drops to the bottom of the veſſel; the ether alſo, according to Dollfuſs, at leaſt before rectification, is compleatly miſcible with water when ſhaken with it for ſome time. The preparation of ether, by means of ſimple muriatic acid, is not eaſy, and was readily ſuppoſed to be impoſſible by ſome of the leaders of the modern ſchool of French chemiſts, becauſe it contradicted one of their early theories on the proceſs of etherification; yet Beaumé, a chemiſt of great experience and unqueſtioned veracity, had affirmed, that he had obtained a ſmall quantity of ether, by mixing together alcohol and muriatic acid, both of them in the ſtate of vapour. The practicability of this method appears alſo to be eſtabliſhed beyond doubt by the following formula of M. Baſſe. Keep a quantity of common ſalt in fuſion for about an hour, in order to drive off all the water of cryſtallization, then pulverize it, and put 40 parts into a tubulated retort, connected with a Woulfe's apparatus, in the firſt bottle of which are to be poured 20 parts of moſt highly rectified alcohol; then add to the ſalt in the retort 20 parts of the ſtrongeſt ſulphuric acid, and proceed to diſtillation by a gentle heat, keeping the bottle holding the alcohol as cool as poſſible. When the alcohol is ſaturated with acid, transfer it to a retort, and diſtil over about one half of it; agitate this portion with an alkaline ley, and the ether will preſently ſeparate and float on the ſurface, whence it may be obtained by decantation or diſtillation. The quantity of ether from the above materials amounts to about five parts.

Muriatic ether has a ſtriking reſemblance to that prepared by ſulphuric acid; its ſpecific gravity, however, is greater, amounting, according to Hermbſtadt, to 0.84; its taſte alſo has a peculiar aſtringency like alum, and when burning it exhales a ſtrong acrid odour, ſomewhat reſembling that of ſulphurous acid.

§ 4. *Fluoric ether.*—All that we know of this ſubſtance is derived from the diſcoveries of Scheele. He firſt impregnated rectified alcohol with fluoric acid gas, by diſtilling pulverized fluor ſpar with ſulphuric acid, and placing alcohol in the receiver; the ſmoking ſpirit thus obtained was diſtilled with a gentle heat, but no ſign of ether made its appearance. Another portion of the acidulated ſpirit was then mixed with black oxyd of manganeſe, and by ſubſequent diſtillation an ethereous fluid came over, from which, by ſubſequent rectification, a little ether was obtained of a very agreeable odour, reſembling nitrous ether.

§ 5. *Acetic ether.*—Acetic ether was firſt diſcovered by the Count de Lauraguais; the method of its preparation was by diſtilling together equal parts of alcohol and acetic acid. Scheele, Porner, Bergman, and other chemiſts, repeated this proceſs ineffectually, and hence were induced to ſuſpect ſome error. In conſequence of theſe doubts, Pelletier entered into a careful examination of the ſubject, and has both ſhewn the reaſon of the failure of Scheele, and has given the proper method by which to ſucceed. He diſtilled together equal parts of alcohol and acetic acid, and drew off a little more than half; this liquor was acidulous, and had an ethereal odour, but no true ether could be made to ſeparate. He then mixed together 12 ounces of ſtrong radical vinegar, and the ſame quantity of alcohol, and diſtilled over one half of it at a boiling temperature; this product he poured back into the retort and recommenced the diſtillation; the produce of this and of a third diſtillation were in like manner recohobated, and having diſtilled the whole again for the fourth time, he finally obtained 12 ounces of an ethereous fluid; with this he mixed a quantity of carbonated potaſh, ſufficient to ſaturate the acid which it contained, and then ſubmitted it to gentle diſtillation. The firſt ſix ounces that came over were pure acetous ether, the next four ounces alſo contained ether, but not ſo pure as the former. It is remarkable that during the cohobations a conſiderable abſorption of air took place.

Scheele obtained acetous ether in a much more compendious manner, by mixing together acetat of potaſh, or of lead, or of copper, with alcohol, and then adding as much ſulphuric acid as was requiſite to decompoſe the acetous ſalt, and diſtilling the mixture at a low heat. The produce being ſhaken with water, the ether riſes to the ſurface and may be poured off. From 16 parts acetat of lead, ſix parts ſtrong ſulphuric acid, and nine parts of water, Bucholz obtained ſix parts rectified ether.

Acetic ether always retains the odour of the acid by which it is formed; it is not ſo volatile as the ethers procured by the mineral acids; it burns with a lambent blue flame, like alcohol; it is ſoluble in a little more than twice its bulk of water, and is decompoſable into acetous acid by repeated diſtillations at a very gentle heat.

Various other acids have been diſtilled with alcohol for the purpoſe of procuring ether, but with little or no ſucceſs. Oxalic acid, with an equal weight of alcohol, yielded Bergman a watery ſomewhat etherized alcohol. Benzoic acid and alcohol, according to Scheele, afford no ether, but when a little common muriatic acid is added to the mixture, an ethereous liquor comes over, of which part floats on water and part ſinks in the ſame fluid. The ether, or the lighter portion, has the odour of benzoic acid, burns with a clear flame and ſmoke, and is about equal in volatility to acetic ether. The phoſphoric, boracic, tartarous, citric and ſuccinic acids, were found by the ſame able chemiſt to be incapable of producing ether, either by their own action on alcohol, or when mixed with oxyd of manganeſe or muriatic acid.

ETHER, in *Ancient Geography*, a town of Paleſtine, in the tribe of Juda, which afterwards was aſſigned to the tribe of Simeon.

ETHEREAL Oil. See Oil, *volatile* or *eſſential.*

ETHEREGE, George, in *Biography*, chiefly known as a writer of comedy, was born in the vicinity of London about the year 1636. Little is known of his early years, but it is ſuppoſed he was educated at Cambridge; ſpent ſome time in foreign travel, and afterwards entered himſelf at one of the inns of court. His talents were but ill adapted to the laborious profeſſion of the law; he was fond of gay and polite company, and became a writer for the ſtage. In 1664, his firſt comedy, entitled "The Comical Revenge, or Love in a Tub," was preſented to the town, and well received. The author was immediately enrolled among the wits of the age. His next piece is thought to have been entitled to more praiſe for wit than for morality. It is entitled "She would if ſhe could;" its licentious tendency was juſtly reprobated by the "Spectator," who ſays he knew of but one author who had profeſſedly written a play upon the deſire of multiplying our ſpecies, and that is the polite ſir George Etherege in the play of "She would if ſhe could:" "Other poets," he adds, "have here and there given an intimation, that there is this deſign under all the diſguiſes and affectations which a lady may put on, but no author except this has made ſure work of it, and put the imaginations of his audience upon this one purpoſe, from the beginning to the end of the comedy." His next piece was not produced till the year 1676; it was entitled "The man of the mode, or ſir Fopling Flutter," and dedicated to the ſecond ducheſs of York, Mary of Modena. It was very popular, and regarded as a true model of polite comedy; one of its principal characters was ſaid to be a repreſentative of the earl of Rocheſter, the finiſhed fine gentleman and man of pleaſure. Etherege lived a diſſipated life, and in a few years injured his fortune and conſtitution. With a view of maintaining his rank in ſociety, he paid his addreſſes to a lady of conſiderable fortune, who refuſed to marry him, unleſs he could procure the honour of knighthood. This he readily obtained, and upon the acceſſion of James II. he was ſent out envoy to Ratiſbon, where he reſided ſome time, and from whence he wrote letters which are favourable ſpecimens of his talent for eaſy pleaſantry. He died ſoon after the revolution, but the account of the time and manner of his death has been differently related. By ſome he is ſuppoſed to have died in his native country ſoon after his return from France, whither he had been on public buſineſs, and by others it is ſaid, that it happened at Ratiſbon by a fall down ſtairs. Beſides the comedies already mentioned, Etherege was author of many ſmaller poems. His letters to the duke of Buckingham are in the Biographia Britannica, to which the reader is referred.

ETHERINGTON'S Bay, in *Geography*, a bay on the north-weſt coaſt of the iſland of St. Vincent; a little to the north of Chateau Belair bay.

ETHESIUS Lapis, a name given by ſome authors to the chryſolite.

ETHICAL GOOD, Ethical *poſſible.* See the reſpective articles.

ETHICS, Ηθικη, the doctrine of manners, or the ſcience of moral philoſophy. See Philosophy and Morality.

The word is formed of ηθος, *mores*, *manners*, becauſe the ſcope or object thereof is to form the manners.

Gale makes ethics only the firſt part or branch of moral philoſophy, *viz.* that which regards private perſons, or in a private capacity.

By manners or morals is here meant a way, or manner, of living confirmed by cuſtom or habit, or certain habitudes of doing, or actions which are often repeated, which, if they be according to right reaſon, the morals or manners are ſaid to be good, otherwiſe, evil and vicious.

Hence the object of ethics is the exerciſe of right reaſon in all our affairs, actions, and relations; or it is a man himſelf conſidered as dirigible, and to be conducted according to reaſon: and the end of ethics is to make him good and happy: ſo that if a man conducted himſelf according to right reaſon in all the circumſtances of his actions, affairs, and relations, he would arrive at the higheſt pitch of moral perfection and beatitude.

Whence ethics may be defined a right manner of thinking in order to attain to human felicity, or a ſcience whereby man is directed to conduct his will, and the actions thereof, ſo as to live well and happily. See Will.

The principal, nay, the only topics thereof, are happineſs and manners, whence ariſe two parts or branches of ethics; the firſt on moral happineſs, conſidered as the end; and the ſecond on moral virtues or good manners, as the means to arrive at that end.

ETHICOPROSCOPTÆ, formed of ηθος, *manners*, and προσκοπτω, *offendo*, *I offend*, in *Antiquity*, the name of a ſect. Damaſcenus, in his Treatiſe of Hereſies, tells us, that the denomination of Ethicoproſcoptæ was given to ſuch as erred in matters of morality and things relating to practice that were to be done or to be avoided, &c. who blamed things laudable and good in themſelves, or recommended or practiſed things evil. On this footing the Ethicoproſcoptæ, though a numerous body, were no particular ſect.

ETHIOPIA, in *Ancient Geography*, was a name given to ſeveral countries, both of Aſia and Africa, whoſe inhabitants were either perfectly black or of a ſwarthy complexion; but Ethiopia, in a more reſtricted application of the term, or Ethiopia propria, was limited on the north by Egypt, extending to the leſſer cataract and the iſland Elephantina; on the weſt by Libya interior; on the eaſt by the Red ſea; and on the ſouth by a part of Africa unknown to the ancients, but probably comprehending that ſpace which includes the modern kingdoms of Girgiro, Alaba, Machida, and part of Adel or Zeila. Proper Ethiopia, however, ſeems to have varied in extent at different periods; but for ſeveral ages it ſeems to have been the tract which at this day comprehends the kingdoms of Dongola, Sennaar, and Abaſſia, with part of Adel or Zeila; and conſequently to have taken up 17 degrees of longitude, and to have reached from the tropic of Cancer to within ſix degrees of the line. Some geographers have reſtricted it to the tract of country that lies between Egypt and Abyſſinia, about 600 miles in length, and 500 in breadth, which was called by the Arabian geographers Nubia.

The proper Ethiopia was anciently diſtinguiſhed by a variety of appellations. Sometimes it was called India; ſometimes Cephenia; and moſt uſually Abaſene, in ſound and ſignification approaching very near to the modern Habaſh, Habeſh, or Abaſſia. We alſo find Chaldæa, Aſſyria, and even Perſia denominated Ethiopia by ſome authors of reputation; and it muſt be allowed, that the ancients called all thoſe countries, extending themſelves beyond each ſide of the Red ſea, indiſcriminately India or Ethiopia.

According to the Jews, the LXX, the Vulgate, and other verſions, Cuſh, when applied in ſcripture to a country, is always to be underſtood of the proper Ethiopia. This opinion is ſupported by Philo, Joſephus, Eupolemus in Euſebius, Euſtathius, the author of the Alexandrian Chronicon, and the concurrent teſtimony of the Greek and Latin fathers. See Cush.

Ethiopia did not abound in cities and towns of any conſiderable note. Auxume, Auxumis, or Axome, reckoned the metropolis of Ethiopia, was undoubtedly the ſame city as the modern Axuma, or Axum. This country was extremely mountainous, and therefore the climate in different parts of it was very various. (See ABYSSINIA.) The days and nights, as Ethiopia lay betwixt the tropic of Cancer and the line, were for the moſt part nearly equal. The winds that blew on the mountains were, generally ſpeaking, ſalubrious and pleaſant; but the atmoſphere over the plains ſtagnated and became unwholeſome. The ſoil in thoſe parts that admitted of cultivation was extremely fertile, and produced vaſt quantities of grain, pulſe, and fruit. It abounded with metals, particularly gold, minerals, vegetables, and a great variety of animals. (See ABYSSINIA.) The moſt famous river that waters this country is the Nile. (See NILE.) The chief ports and emporia of ancient Ethiopia were thoſe of Adulis, Mondus, Opore, Moſylon, and the principal city of the Aualitæ, ſeated upon the Red ſea. The Arabs imported from their country into theſe ports fruit, corn, wine, and cloaths; and exported from thence to Ocelis and Muſa, oppoſite harbours in Arabia, ſpices, caſſia, perfumes, ivory, myrrh, and ſeveral other commodities. The moſt noted iſlands pertaining to Ethiopia were Meroe, the Sporades of Agatharcides, Aſtratæ, Ara Palladis, Gythitis, Myronis, Daphnine, Magi, Acanthine, Iſis, Mondus, and Menuthias.

According to Pliny, Ethiopia was anciently divided into 45 kingdoms, of which the moſt powerful and flouriſhing was Meroe; but he does not inform us, whether they were independent of each other, or under one ſupreme head. There is reaſon to believe, however, that the kings of Ethiopia always ruled with an uncontroulable ſway. If we admit the Ethiopian tradition, that a long ſucceſſion of princes, deſcended from Solomon, reigned in this country, it can ſcarcely be denied, that their authority was unlimited, as that of the Hebrew monarch knew no bounds. It appears from Strabo and Pliny, that ſome Ethiopic nations were governed always by queens, whoſe common name was Candace, as that of the Egyptian kings was Pharaoh, and Ptolemy. From Diodorus Siculus we learn, that a great part of Ethiopia was compoſed of ſeveral elective monarchies, the heads of which were choſen out of their prieſts; and that all theſe princes made the laws of their reſpective kingdoms the baſis of their government. According to Diodorus Siculus the laws of Ethiopia agreed in ſubſtance with thoſe of Egypt; which the Ethiopians accounted for by the aſſertion, that Egypt was firſt peopled by colonies that migrated out of their country. Herodotus, however, repreſents the Ethiopians as having been civilized by the Egyptians, and as having learned the cuſtoms and manners of that people at ſo late a period as the reign of Pſammitichus I. Jupiter Ammon, according to the Greek and Latin authors, appears to have been the principal object of religious worſhip in Ethiopia; though the natives paid likewiſe divine honours to Iſis, Pan, Hercules, Æſculapius, and others, whom they conſidered as the greateſt benefactors to mankind; and if theſe authors may be credited, their religion differed not much from that of the Egyptians. Diodorus Siculus tells us, that the Ethiopians valued themſelves upon their being the firſt nation that had a religious eſtabliſhment; and for this reaſon they believed, that their ſacrifices were more acceptable to the gods than thoſe offered by any other people. He aſſures us, however, that ſome of them were atheiſts, who looked upon the ſun, on account of his ſcorching rays, as their implacable enemy. If a tradition of the modern Abaſſines could be relied on, the Ethiopians, or at leaſt a conſiderable part of them, adhered zealouſly to the law of Moſes from the time of Solomon till their converſion to Chriſtianity. According to this tradition, the queen of Sheba, whom our Saviour calls the queen of the ſouth, and who ruled over a powerful nation of Ethiopia, had a ſon by Solomon named Menileck, who was educated at that prince's court, and inſtructed, under the care of his father, in the law of God. Being afterwards anointed king of Ethiopia, and ſent home to take poſſeſſion of his kingdom, at the deſire of ſeveral eminent Iſraelites and doctors of the law that attended him, he introduced his father's religion, which continued among his ſubjects and their poſterity till the time of St. Athanaſius. See ABYSSINIA.

Ethiopia, in ancient times, was a country of vaſt extent, inhabited by different nations; and, therefore, it is natural to ſuppoſe, that a conſiderable variety of languages, or at leaſt of dialects, muſt have prevailed in it. The moſt ancient of theſe was that called the Ethiopic, into which the ſcripture was formerly tranſlated, and in which all the books of the Abaſſines, both ſacred and profane, are written. According to ſome authors, this language nearly reſembles the Chaldee; but, according to Ludolfus, who ſpent 60 years in the ſtudy of it, it bears as great an affinity to the Hebrew and Syriac, and approaches nearer ſtill to the Arabic, from which it appears to be immediately derived. Ludolfus aſſerts, that a competent knowledge of the Hebrew, or any other of the oriental tongues, will enable a ſtudent ſoon to make a very rapid progreſs in the Ethiopic. The pureſt dialect of this tongue was that uſed in the kingdom of Tigré, where Axuma and the old Ethiopian kings reſided. Upon the failure of the Zagæan line, a Sewan prince aſcended the throne, upon which the Amharic dialect was introduced at court, and gradually diffuſed over the whole empire. (See ABYSSINIA.) From comparing the ancient Ethiopic alphabet, as given by the learned Job Ludolfus, in his "Hiſtory of Ethiopia," with the old oriental alphabets, it ſeems not improbable, that ſome of them were derived from the old Aſſyrian, Phœnician, Samaritan, and Syriac characters. The number of letters likewiſe in this alphabet, and the names of ſeveral of them, tend to eſtabliſh the ſame ſuppoſition; though Ludolfus believes theſe characters to have been invented by the Axumites or Ethiopians themſelves, and to be much older than even the Cufic character of the Arabs. The Ethiopians both write and read from the left hand to the right, contrary to the cuſtom of the orientals: a circumſtance which indicates that their alphabet was not entirely of the ſame extraction with that of the Arabs.

The Ethiopians agreed in ſeveral points with the Egyptians, though they had many cuſtoms peculiar to themſelves, ſome of which were very ſingular and uncommon. From this mutual agreement in moſt of their laws, their ſplendid funerals, the deification of their princes, the ſeveral colleges of prieſts, circumciſion, and moſt of their ſacred and civil inſtitutions, it is highly probable that the ſame arts, ſciences, and learning, as well as religion, prevailed in both nations.

The Ethiopians were naturally bold and intrepid, but violent in their temper. They likewiſe ſurpaſſed the people of moſt other nations in beauty and ſize, to which a proportionable degree of ſtrength was generally annexed. According to various authors, the proper ancient Ethiopians were, in general, perfectly black, as we find their poſterity at this day, though thoſe of ſome particular cantons were white, called by Pliny white Ethiopians. Their women were ſtrong and luſty, and brought forth their children with little pain. From the teſtimony of Herodotus, compared with the relations of ſome modern authors, it is not unlikely, that they died of old age, a few only excepted, who fell by the ſword, or were devoured by wild beaſts, as Salluſt has obſerved of the ancient Africans. Anc. Un. Hiſt. vol. xvi. See Abyssinia and Cush.

Ethiopia, in *Modern Geography*, is a denomination including the countries of Nubia, Abyſſinia, Abeſh or Abex, and Anian, which are bounded by Egypt and the deſart of Barca on the north; by the Red ſea and the eaſtern ocean on the eaſt; by Zanguebar and Caffraria on the ſouth; and by Guinea, Nigritia, and Zaara, on the weſt. Nevertheleſs, all the countries ſtill, according to the ancient diviſion, that lie almoſt in a ſtraight line from Egypt to the Cape of Good Hope, may be comprehended under the general name of Ethiopia. Ethiopia is divided into Upper and Lower, the former including Nubia and Abyſſinia; and the latter comprehending all the kingdoms ſouth of the equinoctial line, as Congo, Lower Guinea, Caffraria, Monomotapa, &c. which ſee reſpectively.

ETHIOPIC Version. See Bible, *Ethiopic*.

Ethiopic *Year*. See Year.

ETHLEC, in *Ancient Geography*, a town of Upper Mœſia, according to Antonine's Itinerary.

ETHMOID, or Ethmoidal, in *Anatomy*, a name given to one of the bones of the head. See Cranium.

ETHNARCHA, Ethnarch, formed of εθνος, *nation*, and αρχη, *command*, a governor and ruler of a nation.

There are ſome medals of Herod I. ſurnamed the *Great*, on one ſide whereof is found Ηρωδου, and on the other Εθναρχου, q. d. *Herod* the *Ethnarch*. After the battle of Philippi, we read that Antony, paſſing over into Syria, conſtituted Herod and Phaſael his brother tetrarchs, and in that quality committed to them the adminiſtration of the affairs of Judea. (Joſ. Ant. lib. xiv. cap. 23.) Herod therefore had the government of the province before ever the Parthians entered Syria, or before Antigonus's invaſion, which did not happen till ſix or ſeven years after Herod was commander in Galilee. (Joſ. lib. xiv. cap. 24, 25.) Conſequently Herod was then truly ethnarch, for he can be no otherwiſe denominated; ſo that it muſt have been in that ſpace of time that the medals were ſtruck, which only gave him this title: which medals are a confirmation of what we read in hiſtory of the government which that prince was intruſted with before he was raiſed to the royalty.

Joſephus gives Herod the appellation of tetrarch in lieu of that of ethnarch; but the two terms come ſo near to each other, that it is eaſy to confound them together.

Though Herod the Great left by will to Archelaus all Judea, Samaria, and Idumea, yet Joſephus tells us he was then only called ethnarch.

ETHNOPHRONES, in *Antiquity*, a ſect of heretics in the ſeventh century, who made a profeſſion of Chriſtianity, but joined thereto all the ceremonies and follies of paganiſm, as judicial aſtrology, ſortileges, auguries, and other divinations.

They derive their denomination from εθνος, *nation*, and φρην, *thought*, *ſentiment*. q. d. *paganizers*, or perſons whoſe thoughts or ſentiments were ſtill heathen or gentile.

They practiſed all the expiations of the gentiles, celebrated all their feaſts, and obſerved all their days, months, times, and ſeaſons. See Damaſcenus, Hæreſ. N° 94.

ETHOLOGUS, among the *Ancients*, a mimic, or actor, who could repreſent all the various habits and diſpoſitions of the mind.

ETHOPŒIA, or Ethopea, in *Rhetoric*, called alſo *Ethology*, a draught or deſcription, expreſſing the manners, paſſions, genius, tempers, aims, &c. of another perſon.

The word is of Greek original, being formed of εθος, *mos*, *conſuetudo*, and ποιεω, *facio*, *fingo*, *deſcribo*. Quintilian, lib. ix. cap. 2. calls this figure *imitatio morum alienorum*; and in Greek, μιμησις, *imitation*. In Engliſh we denominate it a *picture* or *character*.

Such is that beautiful paſſage in Salluſt, in his "Bellum Catilinarium," wherein he gives us a picture of Cataline: "He had an uncommon ſtrength both of body and mind, but an ill-turned and wicked diſpoſition. When very young, his great pleaſure was in inteſtine broils, rapine, ſlaughter, and civil diſcord. His body was formed to undergo faſting, cold, and watching, beyond all belief. His mind was daring, deceitful, and various, and could imitate or accommodate itſelf to every body; he was extremely covetous of other people's goods, and profuſe of his own. His luſts and deſires were very high; his ſtock of eloquence conſiderable, but he had little or no diſcretion."

The ethopœia is divided into *proſopographia* and *ethopœia*, properly ſo called; the former of which is a picture of the body, countenance, make, dreſs, gait, &c. and the latter of the mind.

ETHULIA, in *Botany*, a name concerning whoſe origin or meaning we have met with no conjecture. Linnæus its author rarely explained names of his own contrivance, nor is any thing upon this occaſion mentioned in his ſon's Decas Prima Plantarum, where *Ethulia* firſt appeared. Could he poſſibly allude to the remote country whence it came, as *e*, *extra*, (beyond) *Thule*, ſuppoſed by the ancients the uttermoſt part of the earth? If the plant had been of American origin, ſuch an appellation would, not inelegantly, have alluded to the famous prophecy in Seneca's Medea, ſo expreſſive of the diſcovery of the weſtern world, and ending

——"nec ſit terris
Ultima Thule."——

It was however ſuppoſed to come from Ceylon, and is actually a native of the banks of the Nile. If the above conjecture be inadmiſſible, the name muſt depend on its harmony for protection. Linnæus might well be glad to get rid of the harſh *Sparganophorus* of Vaillant, to which he would object as compoſed of *Sparganium*, a generic name already eſtabliſhed. But it is probable he did not at firſt obſerve that Vaillant's genus was his *Ethulia*, though he ſoon recognized it. Linn. Gen. 413. Schreb. 545. Willd. Sp. Pl. v. 3. 1740. Mart. Mill. Dict. v. 2. Ait. Hort. Kew. v. 3. 158. Juſſ. 184. Gærtn. t. 164. (Sparganophorus; Vaill. Act. Paris. Ann. 1719. Gærtn. t. 165.) Claſs and order, *Syngeneſia Polygamia-æqualis*. Nat. Ord. *Compoſitæ diſcoideæ*, Linn. *Corymbiferæ*, Juſſ.

Gen. Ch. *Common Calyx* rounded, ſimple, of many linear, equal, ſpreading-pointed ſcales. *Cor.* compound, diſcoid. Florets all fertile, numerous, uniform, tubular, funnel-ſhaped, with ſome ſpace between them; their limbs five-cleft, erect. *Stam.* Filaments five, very ſhort, capillary; anthers united into a cylindrical tube. *Piſt.* Germen angular; ſtyle thread-ſhaped, the length of the ſtamens; ſtigmas two, recurved. *Peric.* none, except the permanent calyx. *Seeds* ſolitary, truncated, top-ſhaped, five-ſided, five-furrowed; crown none, except a prominent margin. *Recept.* naked, convex, dotted with minute excavations.

Eſſ. Ch. Receptacle naked. Seed-down none. Florets tubular, five-cleft, numerous. Scales of the calyx pointed.

This is but a vague and confuſed genus, depending properly on the three following ſpecies only.

1. E. *conyzoides*. Linn. Sp. Pl. 1171. L. fil. Dec. Pl. Rar. 1. t. 1. "Flowers panicled."—Seeds of this were

ſent by Profeſſor David Van Royen to Linnæus, who raiſed them in his ſtove at Upſal, and the plant proving new, was deſcribed and figured by his ſon, in a work of which only two faſciculi ever appeared. Linnæus ſuppoſed it a native of Ceylon, which may poſſibly be correct. No new information appeared concerning it, till it was mentioned in the Hortus Kewenſis as ſent by Thouin, and ſoon afterwards Vahl diſcovered it to be the *Kahiria* of Forſkall, ſo that we hence learn it to be certainly a native of the muddy banks of the Nile, where it flowers early in November. The *root* is annual, fibrous. *Stem* four feet high, alternately branched, hollow, downy, leafy. *Leaves* alternate, on ſhort ſtalks, lanceolate, pointed, equally ſerrated, fragrant, downy beneath, three inches long; without ſtipulas. *Flowers* pale blue, in compound corymboſe panicles about the tops of the branches, remarkable for the ſlender and diſtant tubes of their florets. The *ſeeds* form an almoſt globoſe head; each of them is crowned with a pale undivided angular border.

2. E. *Sparganophora.* Linn. Sp. Pl. 1171. (Sparganophorus Vaillantii; Gærtn. v. 2. 395. t. 165.) "Flowers in ſeſſile axillary cluſters. Calyx-ſcales recurved."—This we know only from the work of Vaillant, (from whom Linnæus adopted it,) and that of Gærtner; nor is its native country aſcertained. The *leaves* are ſaid to be like thoſe of Golden Rod. *Seeds* exactly like the laſt in general ſtructure, nor does there ſeem any doubt of their belonging to one and the ſame genus.

3. E. *Struchium.* Swartz. Prod. 111. (Struchium; Browne Jam. 312. t. 34. f. 2.) Flowers axillary, ſeſſile, moſtly ſolitary. Calyx with ſtraight ſpinous points.—Gathered by Browne in Jamaica. *Stem* herbaceous, two or three feet high, leafy, ſmoothiſh. *Leaves* elliptic-lanceolate, four or five inches long, pointed, ſtrongly ſerrated, thin, very ſlightly pubeſcent, on ſtalks an inch in length. *Flowers* ſmall, axillary, ſeſſile, either ſolitary or in pairs, or if more together, they have ſmaller leaves between them. We preſume the ſtraight ſpinous points of the calyx-ſcales will afford a certain ſpecific difference between this and the laſt, whether their foliage be different or not.

In his firſt Mantiſſa, p. 110, Linnæus added three ſpecies to his genus *Ethulia.* Of theſe *E. tomentoſa* muſt be entirely ſtruck out of the ſyſtem, being no other than his own *Artemiſia chinenſis*, and not having either the habit or characters of an *Ethulia.* The ſecond is *E. divaricata*, Burm. Ind. 176. t. 58. f. 1. (Chryſanthemum bengalenſe anguſtifolium puſillum, ſummo caule ramoſum; Pluk. Phyt. t. 21. f. 4.) Leaves linear, toothed, decurrent. Flowers ſolitary, ſtalked, terminal. Stem divaricated.—Native of rice-fields in Malabar. *Koenig.* *Root* annual. *Stem* three or four inches high, erect, much branched in a corymboſe manner; branches leafy, quadrangular, winged, ſomewhat cottony. *Leaves* alternate, linear-lanceolate, toothed, running down into the wings of the branches. *Flowers* on ſhort, ſimple, ſolitary, terminal ſtalks; *Calyx* of numerous, imbricated, ſharp and ſomewhat ſpinous, ſpreading, purpliſh ſcales. *Seeds* without any crown.—We have, as Willdenow has already done, preſumed to correct the deſcription of Linnæus, and his quotation of Burmann. Linnæus moreover quotes his own *Artemiſia minima*, Sp. Pl. ed. 1. n. 19, with the original ſpecimen before him, for this *Ethulia*, but very erroneouſly, and his citation of Burmann is ſo placed as to imply that he had committed the ſame fault, which is not true. We cannot but obſerve here that Burmann in his Flora Indica has copied *E. conyzoides* and *E. Sparganophora* from Linnæus, without any real knowledge of them, ſo that his authority is of no avail reſpecting thoſe ſpecies. Gærtner, v. 2. 389. t. 164, retains this *E. divaricata* as the only real *Ethulia*, adding a good ſynonym from Plukenet (who figures the plant twice), Chryſanthemum parvum ramoſiſſimum, membranaceo-caule maderaſpatenſe; Pluk. Phyt. t. 160. f. 5. Gærtner therefore preſerves the name and genus of Vaillant's *Sparganophorus*, which he contends is a very diſtinct genus from this plant. In the laſt particular he appears to be right, but the above three ſpecies unqueſtionably conſtitute what Linnæus meant by *Ethulia*, and they only agree with his generic deſcription, ſo that the *divaricata* ought perhaps to be referred, notwithſtanding its want of a ſeed-crown, to the *Grangea* of Adanſon and Juſſieu, as the latter ſuſpects, or rather to make a genus by itſelf. (See GRANGEA.) Juſſieu indeed preſerves Browne's *Struchium* as a genus, but, as we preſume, improperly.

One more ſuppoſed *Ethulia* remains to be noticed, named *bidentis*, Mant. 110, from its reſemblance to *Bidens tripartita.* This has nothing to do with the genus under conſideration, being the very identical *Flaveria capitata* of Juſſieu, of which we ſhall ſpeak under that name hereafter. It is a native of Chili.

With the *Ethulia uniflora* of Walter and Willdenow we are not at all acquainted. S.

ETIENNE, in *Biography*, the name of a family who have been celebrated as learned printers, and are more commonly known by the epithet of Stephanus, or in Engliſh by that of the learned Stephens. The founder of the family was Henry, a printer at Paris. He is chiefly diſtinguiſhed as the editor of a Pſalter, in which the compoſitions were divided into verſes, and diſtinguiſhed by figures, being the firſt book of Scripture in which this practice was obſerved. He died at Lyons, leaving behind him three ſons, all eminent printers, of whom the ſecond was,

ETIENNE, ROBERT. This young man worked at firſt under Simon de Colines, who had married his mother, and then ſet up in buſineſs for himſelf at Paris. He had received a very liberal education, and was well acquainted with the ancient languages, and was deeply ſkilled in principles of ſound criticiſm. He carried the art of typography to a very high pitch of excellence, as a number of his books well known at preſent will teſtify. His office is ſaid to have reſembled a learned ſeminary, in which the Latin language was the only one allowed to be ſpoken by all the perſons employed by him. He eſtabliſhed an early reputation by the editions of the bible in different languages. He was the firſt perſon who introduced the diviſion of the whole into verſes; of which, we are informed, he made the neceſſary preparations, as he was on a journey on horſeback from Paris to Lyons. Theſe diviſions have been uſeful as marks for reference, but in other reſpects they have been injurious to the work, on account of the faultineſs of the diviſions which not unfrequently give a wrong ſenſe to important paſſages of the ſacred writings. In the year 1532 he publiſhed his excellent "Theſaurus Linguæ Latinæ" in two volumes folio. This work obtained a very high reputation, and has paſſed through many editions: the beſt are ſaid to be that printed in London in 1734, and the one printed at Baſil in 1740. Both editions conſiſt of four volumes folio. In the year 1539 the reputation of Robert attracted the attention of Francis I. who reimburſed him ſome of his expences in procuring manuſcripts and founding new types, and gave him the honour of king's printer for Greek and Latin books. At the reformation this worthy printer, in common with many biblical critics, fell under the ſuſpicion of hereſy, and endured a long perſecution excited by the doctors of the Sorbonne, who, in the year 1548 unanimouſly decreed that his bible with a verſion by Leo Judæ, and notes, ought to be ſuppreſſed, and placed in the liſt of prohibited books. By many liberal and reſpectable perſons Etienne was ſupported againſt the fanaticiſm of bigots and prieſts, but, at length, he thought it adviſeable to withdraw to Geneva, where he more openly avowed himſelf a friend to the reformed religion. He felt himſelf called on to vindicate his conduct, and publiſhed an apology, in which he retaliated upon his perſecutors, and the church, by whom he had been driven into a kind of exile. At Geneva he continued to follow his profeſſion, and publiſhed many books in favour of the Proteſtant cauſe. He was elected burgher of Geneva, and lived in habits of friendſhip with Beza and Calvin. He died in the year 1559, at the age of fifty-ſix. He has been, ſince his death, to the preſent day, the theme of admiration with the learned, and by the illuſtrious De Thou he was conſidered as better entitled to the gratitude of his country, by the perfection which he gave to the art of printing, than thoſe warriors who had extended the boundaries of the French empire. Moreri.

Etienne, Charles, a phyſician of the faculty of Paris, who is conſidered by his biographers as an honour to the age in which he lived, in conſequence of the extent and variety of his attainments. He was born about the year 1503. His father, Henry Etienne, and his brothers, Francis and Robert, were all celebrated for the ingenuity with which they cultivated the art of printing. But this family was not leſs unfortunate than ingenious; for, being attached to the cauſe of the Proteſtant reformation, ſome of them were baniſhed from France, and others died in priſon. Charles, however, during theſe troubles, lived and flouriſhed at Paris, where he had for many years practiſed his profeſſion, when his brother Robert became the object of perſecution, and fled to Geneva. He immediately undertook the ſuperintendence of his printing-office, which he continued to manage for ſeveral years, in the hope of effecting the reſtoration of his brother, practiſing medicine at the ſame time with his former diſtinction and ſucceſs. Robert died at Geneva, however, in 1559; and Charles terminated his life unfortunately, a few years afterwards, having died in a dungeon in 1564, at the age of about ſixty.

Dr. Etienne, the ſubject of this article, made ſeveral diſcoveries of minor importance in anatomy, which had eſcaped his predeceſſors, eſpecially Galen, of whom he was a great admirer; he publiſhed ſome anatomical figures, the execution of which, however, was claimed by a ſurgeon of the name of Riviere, and generally allowed to be his; but the explanations were admitted to be Etienne's. He publiſhed a great number of works, ſome of which have no connection with his profeſſion, eſpecially the hiſtories of Lorraine, of Flanders, and of the dukes of Milan. The works relative to medicine, beſides the anatomical book juſt mentioned, were principally on botanical ſubjects. He alſo wrote a volume, conſiſting of three books, "De Nutrimentis," Paris, 1550. Eloy.

Etienne, Henry, the ſon of Robert, was born at Paris in 1528, and became diſtinguiſhed as one of the moſt learned men of his time. His father ſpared neither pains nor expence in his education, and the youth had a great facility in acquiring the Greek language. At the age of eighteen he aſſiſted his father in collating the MSS. of Dionyſius Halicarnenſis. After he had performed this buſineſs he ſet out on his travels; ſtaid ſome time in Italy, where he became well acquainted with the learned men of that country, and obtained much valuable information from the Italian libraries. From Italy he came to England, and from thence he paſſed through the Low Countries in his way to Paris, whither he returned at the moment his father was driven from that city. Here he followed the united profeſſions of printer and editor. In 1554 he publiſhed the Odes of Anacreon from the MSS. which he found in Italy. He accompanied his edition with fragments of Sappho and other lyric poets, and with an elegant metrical verſion. To him the learned are likewiſe indebted for various other Greek authors, publiſhed from MSS. which he had collected in his travels, all of which he corrected and enriched with valuable annotations. In 1572 he publiſhed his "Theſaurus Linguæ Græcæ," in four volumes folio, a capital companion to the Latin Theſaurus by his father. Scapula made an abridgement of this vaſt work, which greatly hindered the ſale of the original, and thus defrauded the learned author of the recompence to which he had the moſt ſolid claim. This valuable man was protected by Henry IV. of France, who was ſo far attached to him, that he employed him in a work entitled "Sur la precellence de la Langue Francoiſe." He was, however, too deeply imbued with the liberal principles which real literature almoſt always infuſes in the minds of her votaries, to eſcape the malice of the monks. They brought a proſecution againſt him for his "Preparation á l'Apologie pour Herodote." Appriſed of his great danger, and well knowing the rancour of his enemies, he fled from the city and took refuge in the mountains of Auvergne. Scarcely had he left the city, when finding that he had eſcaped their cruel fangs, they burnt the excellent man in effigy, regretting, no doubt, that they had not his perſon on which to wreak their vengeance. After this Etienne reſided chiefly at Geneva, though he made occaſional viſits to his literary friends in Germany and France. He was ſubject to many difficulties, and doomed to other and ſevere perſecutions, which at length ſo far broke his ſpirits as to cauſe derangement, and in this ſtate, as well as in poverty, he died at an alms-houſe at Lyons in 1598. Beſides editing the Poetæ Græci Principes; Maximus Tyrius; Diodorus Siculus; Medicæ artis Principes poſt Hippoc. and Galen; and the Nov. Teſt. Græc., to which he prefixed an admirable preface; he was author of ſome excellent pieces, beſides what have been already mentioned; *viz.* Dialogues "De bene inſtituendis linguæ Græcæ ſtudiis;" "De criticis veteribus Græcis et Latinis," and other pieces in the French language, as well in verſe as in proſe. He was a man of many ſingularities, but truly reſpectable, and highly reſpected. He left ſeveral children, of whom his ſon Paul ſucceeded him in his Genevan printing-office, and inherited a ſhare of his reputation. Moreri.

Etienne, *Saint*, in Latin *Fanum Sancti Stephani*, or *Furania*, in *Geography*, a conſiderable town of France, in the department of the Loire, chief place of a diſtrict of the ſame name, with a population of 16,259 individuals. It is ſituated on the river Furan, 36 miles S.W. of Lyons, and 348 miles S. by E. of Paris. N. lat. 45° 22′. The town is divided into two cantons, Eaſt and Weſt, the former with three communes and 12,735 inhabitants, the latter with three communes and 14,669 inhabitants; the whole canton has a territorial extent of 92½ kilometres. There are at Saint Etienne and in the neighbourhood ſeveral manufactures of ſwords and fire arms, cutlery, and hardware of all ſorts, ribbands, ſilks, and good bleaching grounds. The diſtrict abounds with coal-mines, and the proximity of two large rivers, the Rhône and Loire, affords great facility for the tranſport of the produce of the manufactures.

As chief place of a diſtrict, Saint Etienne has a ſub-prefect, two courts of juſtice, and a regiſter office. The diſtrict contains 9 cantons, 76 communes, and 99,261 inhabitants,

ants, on a territorial extent of 1142½ kiliometres.—Alſo, a ſmall town of France, in the department of the Maritime Alps, chief place of a canton in the diſtrict of Puget-Theniers, with a population of 1689 individuals; its canton has a territorial extent of 212½ kiliometres, and three communes, with 3089 inhabitants.

Etienne *de Baigorry*, *Saint*, a town of France, in the department of the Lower Pyrenées, chief place of a canton in the diſtrict of Mauléon, with a population of 6187 individuals. The canton contains 10 communes and 10,939 inhabitants, on a territorial extent of 210 kiliometres.

Etienne *de Cuines*, *Saint*, a ſmall town of France, in the department of Montblanc, chief place of a canton in the diſtrict of St. Jean de Maurienne, with a population of 830 individuals. The canton has a territorial extent of 117½ kiliometres and 6 communes, with 6496 inhabitants.

Etienne *de Lugdarès*, *Saint*, a ſmall town of France, in the department of the Ardèche, chief place of a canton in the diſtrict of l'Argentiere, with a population of 1509 individuals. The canton has ſeven communes and 3439 inhabitants, on a territorial extent of 185 kiliometres.

Etienne *de Montluc*, *Saint*, a town of France, in the department of the Lower Loire, chief place of a canton in the diſtrict of Savenay, with a population of 4118 individuals. The number of the inhabitants of the canton amounts to 12,453; they are diſperſed in five communes, on a territorial extent of 272½ kiliometres.

Etienne *de Saint Geoire*, *Saint*, a ſmall town of France, in the department of the Iſère, chief place of a canton in the diſtrict of St. Marcellin. It has 1546 inhabitants, and its canton compriſes, on a territorial extent of 162½ kiliometres, 13 communes, with a population of 9381 individuals.

Etienne *en Dévoluy*, *Saint*, a ſmall town of France, in the department of the Upper Alps, chief place of a canton in the diſtrict of Cap, with only 766 inhabitants: but the canton has four communes, and a population of 2184 individuals, on a territorial extent of 262½ kiliometres.

Etienne *les Orgues*, *Saint*, a ſmall town of France, in the department of the Lower Alps, chief place of a canton in the diſtrict of Forcalquier, with a population of 984 individuals. The canton has a territorial extent of 272½ kiliometres, 12 communes, and 4260 inhabitants.

ETIOLATION *of Plants*, in *Gardening*, the rendering them white, criſp, and tender, by excluding the action of light from them. See Blanching.

ETIQUETTE, a French term, primarily denoting a ticket or title affixed to a bag or bundle of papers, expreſſing its contents. It is alſo uſed when applied to the Spaniſh and ſome other courts, to ſignify a particular account of what is to be done daily in the king's houſhold, and in the chief ceremonies relating to it. It likewiſe denotes thoſe forms that regulate the decorum of conduct towards perſons of various ranks and ſtations.

ETIVAZ in *Geography*, a ſmall town of Switzerland, in that part of the canton of Berne which is called the Ober Land, or Upper Country, being at the foot of the higheſt Alps, and extending to the glaciers, or ice mountains. It is ſituated in the diſtrict of Geſſenay, and is remarkable for its mineral ſprings, the water of which has a ſulphureous taſte.

ETLINGEN, or Ettlingen, a ſmall town of Germany, in the grand duchy of Baden, ſituated on the river Alb, between Pfortzheim and Raſtadt, at the diſtance of 12 miles from each. N. lat. 48° 55'.

ETMARSHAUSEN, or Etmershausen, a ſmall town of Germany, in the duchy of Saxe Coburg, in the diſtrict of Saltzungen, remarkable only for the following inſcription, which is engraved on an old garden gate of ſtone, in Latin characters: "wer weiſz obs wahr iſt," (who knows whether it be true.) It is become a proverbial ſaying in that part of Saxony, and frequently uſed as a polite inſinuation that a perſon is ſuſpected of having rather deviated from or embelliſhed the truth; people then obſerve that what has been related is engraven at the garden gate at Etmarſhauſen. The origin, occaſion, or motive of the inſcription itſelf, has never yet been explained, and has puzzled ſeveral antiquaries of the neighbourhood.

ETMASER, a town of Arabia, in the province of Yemen; 36 miles N. of Chamir.

ETMULLER, Michael, in *Biography*, an eminent phyſician, was born at Leipſic on the 26th of May, 1644. Poſſeſſing a taſte for the ſciences which his native city afforded him the moſt ample means of cultivating, he diligently ſtudied under the celebrated profeſſors of that period. He afterwards ſpent a conſiderable time in travelling through France, England, Holland, Italy, and Germany, with a view to the farther acquiſition of knowledge; and on his return took the degree of doctor of medicine at Leipſic in Auguſt 1668. In the year 1676, he was appointed profeſſor of botany in that univerſity, and extraordinary profeſſor of ſurgery and anatomy. He fulfilled thoſe offices with great applauſe; and his death, which happened on the 9th of March, 1683, when he was but 39 years of age, was generally regretted by the faculty of Leipſic. The diſorder, which occaſioned it, was contracted while he was employed in ſome chemical experiments. He was a very voluminous writer, and his works were deemed ſufficiently intereſting at the time of their publication to be tranſlated into moſt of the European languages. His medical practice and opinions were built upon the theory of Sylvius de la Boë, and the chemical ſect.

Etmuller, Michael Ernest, ſon of the preceding, was born at Leipſic on the 26th of Auguſt, 1673; and, after having ſtudied at Zittau, Altemberg, and other ſchools of Germany, he took the degree of doctor of medicine at his native place, in 1697. He afterwards travelled to the moſt eminent univerſities of Europe, and became ſucceſſively profeſſor of anatomy, of philoſophy, and of pathology at Leipſic. He had likewiſe been two years director of the Academia Naturæ Curioſorum, when his death occurred, on the 25th of September, 1732. He has left ſome diſſertations of his own, but is chiefly known as the editor of the works of his father.

ETNA. See Ætna.

ETOBESA, or Etobema, in *Ancient Geography*, a town of Spain, in Edetania, mentioned by Livy under the name of Etoviſſa, and ſituated at ſome diſtance W. of Valencia.

ETOCETUM, a place in the iſle of Albion, according to the Itinerary of Antonine, which Gale fixes at Wall, near Litchfield.

ETOILE, in *Geography*, a town of France, in the deparment of Drôme, and diſtrict of Valence; 3 leagues N.W. of Creſt.

ETOLIA. See Ætolia.

ETON, in *Geography*, a large village in the hundred of Stoke, and county of Buckingham, England, is noted for its great public ſeminary, or college, in which many eminent ſtateſmen, authors, military heroes, &c. have received their ſcholaſtic education. This college was originally founded by king Henry the Sixth, in the year 1440, for a provoſt, ten prieſts, four clerks, ſix choriſters, twenty-five poor grammar-ſcholars, and twenty-five poor men. The firſt provoſt was Henry Sever, who was ſucceeded by William Waynfleet, founder of Magdalen college, Oxford. This foundation was particularly excepted in the act for the diſſolution of colleges and chantries, in the time of Edward VI. Its eſtabliſhment, however, has been in ſome degree altered, and now conſiſts of a provoſt, ſeven fellows, two ſchoolmaſters, two conducts, ſeven clerks, ſeventy ſcholars, and ten choriſters, beſides inferior officers and ſervants. The annual election of ſcholars to King's college, Cambridge, founded alſo by Henry VI. takes place about the end of July, or the beginning of Auguſt, when twelve of the ſenior boys are put on the roll to ſucceed in this college as vacancies occur. The average number of vacancies are about nine in two years: at nineteen years of age the ſcholars are ſuperannuated. Eton college alſo ſends two ſcholars to Merton college, Oxford, where they are denominated poſtmaſters. It has a few exhibitions, of twenty-one guineas each, for its ſuperannuated ſcholars, towards whoſe aſſiſtance Mr. Chamberlayne, a late fellow, has bequeathed an eſtate of 80*l. per annum*, after the death of his widow. The ſcholars elected to King's college ſucceed to fellowſhips at three years' ſtanding. The independent ſcholars at Eton, commonly called Oppidans, are very numerous; the average number having been for ſeveral years paſt from 300 to 350: when Dr. Bernard was maſter, under whom the ſchool particularly flouriſhed, the number at one time exceeded 520. Among the many diſtinguiſhed perſons who received their education here we find the names of biſhop Fleetwood, biſhop Pearſon, John Hales, Dr. Stanhope, ſir Robert Walpole, Horace Walpole, Oughtred the mathematician, Boyle the philoſopher, Waller, Gray, Weſt, the late earls Camden and Chatham, and the late learned Jacob Bryant; with many other eminent literary and public characters of the preſent day.

An ancient cuſtom, appertaining to this college, called the "Montem," or "Ad montem," muſt not be paſſed unnoticed. This is a proceſſion of all the ſcholars, &c., made every third year on Whit-Tueſday, to a tumulus, which has acquired the name of *Salt-hill*, by which alſo the neighbouring inns have been long known. The chief object of this ceremony is to collect money for *ſalt*, as the phraſe is, from all perſons preſent, even from paſſengers travelling the road. The collecting ſcholars are called ſalt-bearers, and are dreſſed in rich ſilk habits. This ceremony has been frequently honoured with the preſence of the king and royal family, whoſe liberal contributions, added to thoſe of the nobility and gentry educated at Eton, who purpoſely attend this meeting, have ſo far augmented the collection, that it has been known to exceed 800*l.* The ſum ſo collected is given to the ſenior ſcholar who is going to Cambridge for his ſupport at the univerſity. It would perhaps be a vain endeavour to trace the origin of all the circumſtances of this ſingular cuſtom, particularly that of collecting money for *ſalt*, which has been in uſe for time immemorial. The proceſſion itſelf ſeems to have been coeval with the foundation of the college, and it has been conjectured, with much probability, that it was that of the bairn or boy biſhop. It is ſo aſſerted in a note among the MS. collections bequeathed to the Britiſh Muſeum by Mr. Cole, who was of Eton and King's college: but whence he procured this information, which, if correct, might be deciſive, does not appear. The cuſtom of hunting a ram by the Eton ſcholars on Saturday in the election week, ſuppoſed to have been an ancient tenure, was aboliſhed by the late provoſt Dr. Cooke.

Eton college conſiſts of two quadrangles: in the firſt are the ſchool, the chapel, and lodgings for the maſters and ſcholars. The other is occupied by the library, the provoſt's lodgings, and the apartments of the fellows. The chapel, as far as relates to its external appearance, is a very handſome ſtructure; the inſide has none of that ornamental architecture ſo much admired in King's college chapel at Cambridge, to which this has ſometimes been compared, but is quite plain, and has been much diſfigured by ſome injudicious alterations, made in the beginning of the laſt century, when ſeveral of the monuments were removed, and others concealed behind the wainſcot then placed at the eaſt end. The whole length of the chapel is 175 feet, including the ante-chapel, which is 62 feet long. Among the eminent perſons who are buried in this chapel, are Richard, lord Grey of Wilton, henchman to king Henry VIII.; John Longland, biſhop of Lincoln, confeſſor to that monarch; ſir Henry Saville, the learned warden of Merton, and provoſt of this college, who founded the Savilian profeſſorſhips of aſtronomy and geometry at Oxford; ſir Henry Wotton, an eminent ambaſſador and ſtateſman, who was alſo provoſt of Eton; Francis Rowſe, a diſtinguiſhed writer among the puritans, and one of the lords of Cromwell's upper-houſe, who died while provoſt of Eton in 1658; Dr. Alleſtree, alſo provoſt, an eminent royaliſt, who built the new or upper ſchool, with the cloiſters beneath, at the expence of 1500*l.*, and died in 1680; and Nathaniel Ingelo, who died in 1683. The monuments of ſome of the above-mentioned perſons are not now to ſeen. Sir Henry Wotton's tomb has the following ſingular inſcription:

> "Hic jacet hujus ſententiæ primus auctor—
> Diſputandi pruritus fit eccleſiarum ſcabies"
> "Nomen alias quære."

In the ante-chapel is a ſtatue of the founder, by Bacon, erected in 1786; the ſum of 600*l.* having been bequeathed for that purpoſe by the Rev. Edward Betham, fellow of the college, who died in 1783: and a monument of the young earl of Waldegrave, who was drowned when at Eton ſchool, in 1794.

The college library contains a very large and valuable collection of books, having been from time to time enriched by munificent bequeſts.

In 1452 the college had a charter for a market on Wedneſdays, with conſiderable privileges; but it has been long diſuſed. Two fairs were granted by the charter of 1444: one for the three days following Aſh Wedneſday, the other for ſix days next after the 13th of Auguſt. There is now only one fair, held on Aſh-Wedneſday. The pariſh church of Eton, called in ancient records Eton-Gildables, having been ſuffered to fall to decay, the inhabitants are permitted to attend divine ſervice in the college chapel. The provoſt is always rector, and has archidiaconal juriſdiction within the pariſh. There is a chapel of eaſe in the village ſerved by one of the conducts of the college; it was built for the uſe of the inhabitants by William Hetherington, who had been one of the fellows, and was a very liberal benefactor to the blind and to the poor of other deſcriptions.

Eton is ſituated on the northern banks of the Thames, oppoſite to Windſor, with which it is connected by a bridge. It is 22 miles diſtant from London; conſiſts chiefly of one ſtreet; and contains 290 houſes, and 2026 inhabitants. Lyſons's Magna Britannia, vol. i. Beauties of England and Wales, vol. i.

ETORPU, one of the Kuriſkoy or Kurile iſlands, lying 30 verſts from Urup; and about 300 verſts in extent. The whole iſland is covered with lofty mountains; one of which, at the northern extremity, emits a continual ſmoke, and occaſionally flames. The ſummits of the mountains are bald, with ſteep cliffs and heaps of rubbiſh. Here are foreſts, conſiſting of the ſame trees with thoſe of the iſland

Urup. In the ſouthern half, near about the centre of the iſland, grew larch-trees, in the proximity of the ſea, but ſlender, though further inland, in the plains of the vallies, good timber trees, fit for the purpoſes of building. Here are likewiſe black bears, and in the foreſts ſables and foxes are met with. Of rats there is no ſcarcity; fiſh-otters haunt the ſtreams; and the brooks abound in fiſh. During the ſtorms that happen here, whales and large dolphins are thrown aſhore by the ſea. The ſea-otter is not ſeen here, but ſea-lions, though not of any great dimenſions. The inhabitants are hairy Kurils, who dwell together in villages. They are numbered in the capitation-tax at 92 perſons.

ETREPAGNY, or ESTREPAGNI, a ſmall town of France, in the department of the Eure, chief place of a canton in the diſtrict of Les Andélys, with a population of 1201 individuals. It is ſituated 9 miles from les Andélys, and 9 miles W. of Giſors; its canton contains 10,442 inhabitants, diſperſed in 26 communes, on a territorial extent of 140 kiliometres.

ETRIGNY, a town of France, in the department of the Saone and Loire, and diſtrict of Chalons-ſur-Saone; 3½ leagues S. of Chalons.

ETRIS, a town of Egypt; 18 miles N.W. of Cairo.

ETROEUNG, a town of France, in the department of the North, and diſtrict of Aveſnes; 1¼ league S. of Aveſnes.

ETRURIA, in *Ancient Geography*, a country of Italy, ſeparated on the weſt from Liguria by the river Macra; from Latium and Umbria on the eaſt by the Tiber; on the north-eaſt by a part of the Apennines from the country of the people called Boii and Senones; and on the ſouth-weſt waſhed by a portion of the Mediterranean ſea, called Mare Tuſcum, or Tyrrhenum, the Tyrrhenian ſea. This country was once more extenſive than the preſent Tuſcany, as it reached as far as the Tiber. The inhabitants of Etruria, who for a long time poſſeſſed a great part of Italy, were denominated Tuſci or Etruſci. (See ETRUSCI.) The principal rivers of this country were the Arnus, the Umbro, the Clanis, and the Tiber. The chief lakes were the Lacus Traſimanus, and Vulſinienſis. Among the moſt conſiderable cities we may reckon Luna, Piſæ, Luca, Pittoria, Florentia, Feſulæ, Portus Herculis, Labronis, Voluterræ, Sena Julia, Arretium, Cortona, Peruſia, Cluſium, Vetularii, &c. &c.

ETRURIA, in *Geography*, a country ſituated between the Mediterranean, the Tiber, and the Apennines; bounded on the eaſt by the dominions of the pope, on the north and north-eaſt by the kingdom of Italy, on the weſt by the republic of Lucca, and on the ſouth-weſt by the Mediterranean; about 115 miles in length, and 80 in breadth. The face of this country is beautifully varied with hills and vallies, and the ſoil which is rich and fertile produces abundance of corn, and excellent fruit, oranges, lemons, olives and grapes. The air is in ſeveral parts rendered inſalubrious by fens and moraſſes; the ſalt-pits are rich. Manna is gathered in the marſh-lands near the ſea; and the mountainous parts are rich in mines and minerals. Several medicinal ſprings have been diſcovered beſides thoſe of Piſa. Arno is the principal river; and Florence is the capital. After ſeveral revolutions, Etruria became a republic, and deriving its name from its capital, was called Florence. And in this republic the Medici family obtained by commerce the wealth and rank of princes. It was alſo denominated *Tuſcany*, which ſee; and in 1569, Coſmo I. was declared duke of Tuſcany by pope Pius V., which title was ratified by the emperor Maximilian II. in the year 1575, on condition of his enjoying and holding it as a fief of the empire. By the fifth article of the quadruple alliance, made in 1718, it was ſtipulated that, with the conſent of the Germanic body, the emperor ſhould confer it as a fief on the king of Spain's eldeſt ſon by the ſecond marriage, and that it ſhould devolve to his male deſcendants, and on their failure to the younger brother and his heirs. In 1737 the duchy of Tuſcany became annexed to the houſe of Auſtria. By the fifth article of the treaty of Luneville in 1801, the duchy of Tuſcany was ceded to the duke of Parma, and erected into a kingdom, under the name of Etruria. It has ſince been annexed to the kingdom of Italy.

ETRUSCA TERRA, in the *Materia Medica*, a kind of bole of which there are two ſpecies, the white and the red; theſe are called by many authors the *terra ſigillata alba & rubra magni ducis*, as they are brought to us ſealed with different impreſſions.

The *white Tuſcan earth* is a denſe and compact ſubſtance of a dull deadiſh white, which in drying acquires ſome degree of yellowneſs; it is of a ſmooth ſurface, and does not ſtain the fingers in handling. It is not eaſily broken, and but ſlightly adheres to the tongue, and freely melts into a ſubſtance like butter in the mouth. It makes a ſlight efferveſcence with acid menſtruums.

The *red Tuſcan earth* is a pure bole, very heavy, and of a compact texture, and of a dull browniſh red colour. It is naturally of a ſmooth ſurface, breaks eaſily between the fingers, and does not ſtain the hands; it adheres ſtrongly to the tongue, and melts freely in the mouth, and has a ſtrong aſtringent taſte, and leaves no ſandy harſhneſs between the teeth. It makes an efferveſcence with acid menſtrua. This is made up of ſmall flat cakes, and impreſſed with a ſhield bearing a ducal coronet, &c. Theſe are the characters by which both theſe earths may be known from others of the ſame colour: they are both dug in ſeveral parts of Italy, particularly in the neighbourhood of Florence: they are kept in the ſhops there, and preſcribed with ſucceſs in fevers of many kinds, and in diarrhœas, dyſenteries, and the like caſes.

ETRUSCI, ETRUSCANS, in *Ancient Geography*, a people of Italy, who inhabited that part which is now called Tuſcany; though it was formerly much more extenſive under the name of *Etruria*. The Etruſcans, in very ancient times, are ſuppoſed to have been maſters of almoſt all Italy; for the whole region called Italia by the Latins was denominated by the more ancient Greeks Tyrrhenia, according to Dionyſius Halicarnaſſenſis (Antiq. Rom. lib. i.); whence it is inferred, that it was formerly ſubject to the Tyrrhenians, or Etruſcans, and from them received that denomination. Livy and Plutarch intimate, that the ſeas, which partly ſurround Italy, *viz.* the Tyrrhenian, Ionian, and Adriatic, were anciently denominated the Etruſcan ſea; and that the Etruſcans poſſeſſed the whole large tract extending from the Alps to the ſtraits ſeparating Italy from Sicily. They built twelve cities beyond the Tiber, which were afterwards the boundary of Etruria Proper on one ſide; and they were the founders of Nola and Capua, and poſſeſſed twelve capital cities in the tract terminated by th Po and the Alps. Virgil and Silius Italicus rank Cæſena and Mantua among the cities of Etruſcan extraction; and we learn from Livy, that this ancient nation in very early times occupied the whole tract between the Alps and the Apennines. According to Pliny, Bononia, or Bologne, was anciently regarded as the principal city of Etruria; and we may obſerve, that many Etruſcan relics and fragments of antiquity have been dug up in various provinces of the kingdom of Naples, Verona, Padua, &c. as well as the duchy of Tuſcany, or the Proper Etruria. The kingdom of Latium was probably a colony of the Etruſcans; and the firſt traces of the city of Rome may poſſibly have been owing to that nation. However, in proceſs of time, the Gauls made ſeveral irruptions into Etruria, and ſeized upon that part of it which lay between the Alps and the Apennines. The firſt of theſe irruptions happened about 600 years B.C. and the laſt a little before the taking of Rome by Brennus. Several colonies of Greeks made ſettlements in the ſuperior part of Etruria; and from them it was denominated Magna Græcia. The Etruſcans were likewiſe diſpoſſeſſed of a large extent of territory by the Samnites and Ligurians, long before they ſubmitted to the Romans; ſo that at laſt they found themſelves confined within the limits of Etruria Propria, where for ſeveral ages they made a very conſiderable figure. Etruria was called by the moſt ancient Greeks Tyrſenia; but Polybius, and thoſe who lived after him, denominated this country Tyrrhenia. Tyrſenia is ſaid to be the true name, as it correſponds with that of the Lydian prince, Tyrſenus, under whoſe conduct, according to Herodotus, the Tyrſeni, or Tyrrheni, firſt made a ſettlement in Italy. Etruria was divided into twelve ſtates or dynaſties, each of which had its peculiar city. Each ſtate or tribe was governed by its own prince, called in the Etruſcan language "Lucumo," and received its denomination from the capital city. See Etruria.

The Tyrſeni, or Etruſcans, were a branch of the Pelaſgi, that migrated into Europe, according to Dionyſius Halicarnaſſenſis, not many ages after the diſperſion. Thoſe who marched by land as far as Lydia detached a colony under the conduct of Tyrſenus to Italy. This colony ſeems to have been joined by a body of Pelaſgi, previouſly ſettled in ſome of the iſlands of the Archipelago. Hence ſome have concluded that the Lydian Pelaſgi, or Etruſcans, conducted by Tyrſenus into Italy, and the firſt Pelaſgi that inhabited Greece, were the ſame people; but Dionyſius Halicarnaſſenſis makes the Tyrſenians and Pelaſgi two different nations. The Etruſcans denominated themſelves Raſeni, from their leader Raſan, or Raſen; and Tyrſenus, or Tyrſen, is ſaid to be only the name Reſen, with the ſervile letter T ſuperadded. This circumſtance ſerves to evince, not only that the Etruſcan name of the people under conſideration agreed with that of the Greeks, but likewiſe that they were both of oriental extraction. See Pelasgi.

The Etruſcans ſeem to have derived their appellation from Etruri, or Eturi, as they were anciently denominated; and that this appellation was deduced from Athuria, or Aturia, that of their parental country, may be proved from Dionyſius Halicarnaſſenſis, Strabo, and Dio. Moreover, Aturia and Aſſyria differ merely in dialect; the former being equivalent to the Chaldæan word אתוריא, and the latter to the Hebrew אשור, as may be evinced from Bochart (Phaleg. l. ii. c. 3.) and others. Since, therefore, nothing is more frequent than the permutation of A and E in oriental words, eſpecially when written in Greek letters, Atura and Etura muſt be regarded as the ſame word, and as the ancient name of Etruria. More eſpecially if we conſider that Reſen was a city of Aturia or Aſſyria, whence, probably, the leaders of the Etrurian or Etruſcan colony were denominated Raſeni, or Reſeni; and that, from the ſacred hiſtorian, we may conclude Aſhur to have been the brother of Lud, or great anceſtor of the Lydians. The term Tuſci, or Thuſci, is of a later date, and ſeems to have been given to the Etruſcans by the Greeks. The ſacrifices, or uſe of frankincenſe, that prevailed among the Tuſcans in after ages, probably ſuggeſted this appellation to that people.

As each of the twelve tribes, or cantons, called in the Tuſcan language "Lucumonin," was governed by its own prince, a king preſided over the whole; and whilſt the lucumo aſſumed the adminiſtration of affairs in his own province, the king was conſulted on all extraordinary occaſions, and convened the general diet of the twelve nations on all preſſing emergencies. This diet was held at the temple of Voltumna, which was a celebrated city of Etruria, ſeated on the ſpot which is occupied, according to Cluverius, by the preſent city of Viterbo; and in this temple meaſures were concerted for making war upon, or concluding peace with their neighbours. Although the power of each lucumo was limited, the Etruſcan kings ſeem to have been veſted with a ſort of abſolute authority, conſonant to the firſt oriental form of government.

Some of the principal Tuſcan laws were ſuch as follow: 1. By the original conſtitution of Etruria, no ſingle ſtate, or lucumony, could enter upon a war, or conclude a peace, with any neighbouring power, without the participation of the whole Etruſcan body. 2. The Etruſcans, by a particular law (Athen. Deipnoſ. l. i. p. 23.) admitted their women to all nocturnal entertainments; in which they were afterwards followed by the Romans. 3. They obliged themſelves to treat all foreigners with the utmoſt humanity. 4. They gave all poſſible encouragement, as it ſhould ſeem, by virtue of their conſtitution, to all polite arts and artificers. 5. In order to deter people from contracting larger debts than they were able to pay, the Tuſcan boys, by way of ridicule, followed all inſolvent debtors with an empty purſe. 6. They muſt have had many good moral inſtitutions, ſince from them the Romans received a ſupplement to their Twelve Tables. 7. The jura fecialia were firſt obſerved by the Etruſcans. 8. The Etruſcan polity, in general, ſeems to have been founded upon maxims of the moſt conſummate wiſdom, as may be collected from Ariſtotle, and Heraclides Ponticus in Athenæus's Deipnos.; to which the curious reader may be referred for further information.

The religion of the Etruſcans was a groſs and multifarious idolatry. In common with the ancient Greeks, and Phœnicians, they worſhipped the Cabiri, or Dii magni majorum gentium. They were alſo initiated in the Samothracian or Cabirian myſteries.

Beſides the Greek and Roman deities, they had ſeveral peculiar to themſelves; ſome of which were confined to particular towns or diſtricts. The divine ſervice and ſacred myſteries of the old Etruſcans agreed, in ſeveral points, with thoſe of the Greeks, but in others differed from them, and theſe they communicated to the Romans long before that nation had any intercourſe with the Greeks. The feſtivals, holy days, and ſtated times of public worſhip of the Romans and Etruſcans, muſt alſo have agreed in ſeveral particulars, as the Romans, before they became acquainted with the Greeks, received every thing relating to religion, and even their calendar itſelf, from the Etruſcans. The latter borrowed of the Egyptians, or rather the Phœnician ſhepherds expelled Egypt, their public ſupplications, pomps, and ſolemn proceſſions, which occurred in ſome of their principal feſtivals. The rites and ceremonies uſed by the haruſpices, augurs, and pontifices at Rome, were derived from the Etruſcans, who ſeem to have been the moſt celebrated nation in the Pagan world for ſkill in augury, and divination, as well as knowledge of the nature of ſacrifices, to which all rites and ceremonies neceſſarily relate. This, however, was their character among the Romans, as Cicero and Livy have teſtified. Hence this branch of ſcience was emphatically ſtyled at Rome "Ars Etruſca," and "Diſciplina Etruſca;" ſo that Etruria was denominated by Arnobius' the mother of ſuperſtition. It is obſervable, that neither the Etruſcans nor the Romans had any magnificent temples in the earlier ages. The Etruſcans had ſome peculiarities in their religion, which diſtinguiſhed it from that of every other nation; but the ancient Egyptian and Phœnician modes of worſhip were the ſame with thoſe, for many of the earlieſt ages, uſed in Etruria; nor can any material difference be found between the oldeſt oriental and Etruſcan divinities. With regard to the theological notions of the Etruſcans, they believed one ſupreme Being, whom they called Jave, or Jove; they conſidered him as the great governor of the univerſe, as the principle of life and motion. They were firmly perſuaded of the immortality of the ſoul, and therefore believed a future ſtate of rewards and puniſhments; though in later times they ſeem to have followed the ſyſtem of Pythagoras, and conſequently to have adopted the metempſychoſis of that philoſopher. However, the generality of the Tuſcans adhered to the Sabian ſuperſtition, in common with moſt of the inhabitants of the Eaſt.

The Etruſcan language muſt have been the ſame, or nearly ſo, with the Hebrew and Phœnician. The firſt Pelaſgic ſettlements in Etruria could not have taken place many centuries after the deluge, and very few after the diſperſion; and at that time the languages, or rather dialects of the Egyptians, Aſſyrians, Babylonians, Celtes, Syrians, and Arabs, muſt have approached extremely near to the Hebrew and Phœnician, which the learned allow to have been almoſt the ſame. In ſhort both ſacred and profane hiſtory concur in ſhewing the Hebrew, Phœnician, and Etruſcan tongues to have been, in the earlier ages, nearly the ſame. This alſo appears from the letters and manner of writing anciently uſed in Etruria. The letters are almoſt the ſame with thoſe of the earlieſt Greeks, brought by Cadmus out of Phœnicia. The manner of writing is purely oriental, the letters being drawn from the right hand to the left, agreeably to the practice of the eaſtern nations. The former point is rendered indiſputable by the Eugubian tables, in conjunction with the Sigæan inſcription; and the latter by merely peruſing the Etruſcan inſcriptions. The very remote antiquity of the firſt colonies that ſettled in Etruria, as well as of the Etruſcan language and alphabet, may be eaſily inferred from theſe inſcriptions; for as the Pelaſgic alphabet, that prevailed in Greece before the age of Deucalion, conſiſted of ſixteen letters, the Etruſcan or Pelaſgic alphabet, firſt brought into Italy, compoſed only of thirteen letters, muſt have preceded the reign of that prince. The high, and indeed the almoſt incredible antiquity of the Etruſcan language and alphabet, has been clearly evinced in two diſſertations, printed at Oxford in the year 1746. For other particulars relating to this ſubject, we refer to Dempſter's "Etruria regalis," Gori in his "Muſeum Etruſcum," publiſhed at Florence in 1737; M. Bourguet's Diſſertation publiſhed in 1733, and Buonarota's of Florence in 1726; and Swinton's Etruſcan alphabet, publiſhed at Oxford; and for an abſtract, Anc. Un. Hiſt. vol. xviii.

The Etruſcans were extremely well verſed in all the arts of war and peace, and from them the Romans derived thoſe arts and ſciences that paved the way to the empire of the world. In the beſt ages of Rome, the Romans imitated the Etruſcans; nevertheleſs, in after-ages the Etruſcans became thoroughly debauched both in principle and practice. Augury, and every kind of divination; all the principal religious inſtitutions, temples, ſtatues of gods and heroes, the manner of forming or building cities, fortifications, conſecrations, and nuptial rites were tranſmitted to the Romans by the Etruſcans. Every thing alſo that bore any relation to civil government at Rome, ſuch as enſigns of royalty, the diſtinction of nobles from plebeians, the ſecures and faſces, the lictors, &c. was derived from the ſame ſource. Arms, inſtruments of military muſic, military accoutrements and decorations, trophies, triumphs, chariots, crowns, &c. and in ſhort every thing belonging to the art of war, or military exerciſes, that prevailed at Rome, were brought from Etruria. This was alſo the caſe with reſpect to money, locks and keys, lamps, candleſticks, glaſſes, cups, drinking veſſels, together with the laws and cuſtoms relating to banquets and entertainments. Agriculture, planting of vines, all inſtruments requiſite in huſbandry, mills, architecture, muſic, and a variety of muſical inſtruments, many ſorts of diverſions, eſpecially tragedies, various kinds of garments, and even the rudiments of phyſic, ſeem to have been introduced into Italy by the Etruſcans. Scenical amuſements, maſks, pantomimes, wreſtlers, the cuſtom of anointing their bodies, the uſe of wool, plaſtic ſtatuary, the fabulæ oſcæ or Atellanæ, nuptial verſes, or verſus Feſcenini, and the art of making earthenware, were alſo derived from the Etruſcans. The art of conſtructing ſhips and of navigating them, the method of equipping fleets, and all kinds of naval armaments, were known to the Etruſcans before the time of Romulus; and hence we may conclude, that this nation muſt have been a maritime power, and that it muſt have poſſeſſed an extenſive commerce in the earlier ages of the world. The Etruſcans, who were followers of Pythagoras, and who cultivated the principles of the Italian philoſophy, muſt have cultivated the art of muſic and poetry, and muſt have been well verſed in natural philoſophy and aſtronomy. Tragedy is ſaid to have owed its birth to this nation; or at leaſt they firſt communicated it to the Romans. The firſt actors who appeared upon the ſtage of Rome were ſent for from Etruria. Beſides, the ancient Etruſcans, valuing themſelves upon being the diſciples of Pythagoras, could not be ſtrangers to geometry, nor indeed to any of the mathematical ſciences. For military learning they were famous, and eſpecially for the art of drawing up an army, and making diſpoſitions for an engagement. Athenæus informs us, that the formation of the phalanx, and manner of fighting conſequent upon it, was invented by the Etruſcans, or at leaſt borrowed from them by the Romans. To all the other branches of literature and ſcience for which the Etruſcans were diſtinguiſhed, we may add that they excelled in the knowledge and compoſition of hiſtory.

The firſt perſon who fixed monarchical government in Etruria was Janus, ſuppoſed by ſome to be the Javan of ſcripture, or one of his poſterity, and in ſubſequent ages deified by his ſubjects as a ſingular benefactor. The hiſtory of their ſucceeding kings is intermixed with much fable, and, of courſe, very obſcure and uncertain. It appears, however, that they were a maritime power in the time of the Argonauts; and that they commanded reſpect as ſuch at leaſt a generation before the Trojan war, and made a figure at ſea before the Greeks. That the Etruſcans were a powerful and poliſhed nation, when Romulus founded or rather reſtored Rome, appears from ſome approved authors. That prince could not carry the deſign he had formed into execution, without the aſſiſtance of the Etruſcans. From them he derived all his civil and religious inſtitutions. Anc. Un. Hiſt. vol. xviiii.

ETSED, in *Geography*, a town of Hungary, 40 miles N.W. of Zatmar. N. lat. 48° 2'. E. long. 21° 51'.

ETTENHIEM, a town of Germany, in the biſhopric of Straſburg; 12 miles S.S.E. of Straſburg.

ETTENSTATT, a town of Germany, in the principality of Anſpach; 5 miles N.E. of Weiſſemburg.

ETTERSHAUSEN, a town of Germany, in the principality of Wurzburg; 3 miles N. of Volckach.

ETTLSTORFF, a town of the archduchy of Auſtria; 9 miles W. of Sonneberg.

ETTRICK, a river of Scotland, which originates in the S.W. angle of the ſhire of Selkirk, and runs N.E. augmented by many ſmall ſtreams in its progreſs through a pleaſant valley to the Tweed, into which it falls near Sunderland-hall, 1½ mile below Selkirk. The banks of this river were formerly ſhaded with woods, whence the county obtained the name of Ettrick foreſt.

ETUEND, a mountain of Perſia, in the province of Irak; 60 miles S.E. of Hamadan.

ETYMOLOGICON, is uſed for a book, containing the etymologies of many languages. See ETYMOLOGY.

ETYMOLOGY, (from the Greek ετυμος, *true*, and λογος, *a word*,) means a true or real account of words: and as this true account is obtained by tracing them to their origin, etymology hence ſignifies that part of grammar which teaches the derivation of words.

Etymology is an eſſential and uſeful branch of philology; but from partial views, and an inattention to the principles which it implies, it is regarded by many as the fruitleſs ſtudy of words, in which neither knowledge nor certainty is attained. In order to limit, as much as poſſible, the province of etymology, and to remove the objections which have been made againſt it, we ſhall here briefly ſtate the laws which direct, and the conſiderations which give it the preciſion and the fixedneſs of a ſcience.

1. Etymology implies a due attention to the ſtructure of the vocal organs, or to the affinities of elementary ſounds. All men have the ſame organs of ſpeech, and the ſame letters are ſounded by a ſimilar modification of thoſe organs. Letters pronounced by the ſame organs, or the ſame parts of the mouth, approximate in ſound to each other, and from this conſideration become more eaſily corrupted and changed one for another. Thus all the vowels, whatever peculiarity in character and ſound they preſent to a perſon familiar with them, have yet a cloſer affinity to each other than to other letters; and hence are even interchanged. The more modern art of printing, indeed, has contributed to fix the fluctuating ſounds of the vowels, by uniformly preſenting them to the eye under diſtinct characters; but ſtill in an etymological view they are utterly to be diſregarded, or to be regarded only as one capricious, ever fluctuating impulſe of the voice.

The juſtneſs of theſe obſervations will immediately appear to any one who conſiders thoſe words in Latin, which are evidently derived from the Greek; or thoſe in French and in Italian, which are derived from the Latin; or thoſe in modern Engliſh, which are borrowed from the Gothic and Saxon tongues, and are ſtill farther diverſified in the Scotch, Iriſh, and Welſh dialects.

While the vowels form, as it were, the ever corrupting fleſh, or the ever varying complexion of language, the conſonants are the ſinews and bones which impart to it ſtrength and firmneſs, and which alone render it a ſubject of philoſophical inveſtigation. But the conſonants have a cloſer alliance to ſome than to other letters; and their affinity depends on the manner in which they are enunciated. Thus, *p*, *b*, *f*, *v*, *w*, *m*, or φ in Greek, are kindred letters, being produced principally by the *lips*, and are therefore often changed one for another, as caprice or cuſtom ſhall dictate. The ſame obſervation holds in regard to the letters *ſ*, *t*, *d*, *r*, *l*, which being produced by the tongue, impreſſed in various degrees on the extremity of the upper teeth, are called *dentals*; to thoſe which are produced by the tongue and the roof of the mouth and the palate, ſuch as *g*, *j*, *z*, *ch*, and finally to the gutturals, which, though they exiſt not in our tongue, form an important claſs of letters in moſt other languages. To this diſtribution of the conſonants into *labials*, *dentals*, *palatines*, and *gutturals*, the ſcientific etymologiſt will pay a ſtrict attention, and obſervation will ſoon teach him that, however perfect any alphabet may be in regard to etymology, each claſs is but a variation of the ſame letter.

2. Etymology ſuppoſes a ſtrict attention to be paid to *analogy*, that is, to thoſe general principles by which any language is formed in regard to its internal ſtructure, to the diſtinguiſhing terminations of its nouns and verbs, to its general mode of combining words, and to thoſe changes which words uſually undergo after they have been imported and naturalized, as it were, from any foreign tongue. In order to diſcover the nativity and parentage of any term, we muſt, as it were, ſtrip it of the dreſs with which the cuſtom of the country has clothed it, and we can trace it to its true origin, only when we view it ſeparated from the termination by which it is diſguiſed: thus μηνη, when imported into Engliſh, appears under the form of *moon*, having dropped *η*, its peculiar termination; and when expreſſing that period of time which comprehends one revolution of the moon, it aſſumes the termination *th*, which the analogy of the language hath warranted *month*; while in Latin it exiſts in the ſhape of *men-ſis*. And here it is to be obſerved, that the general principles of analogy, as in natural philoſophy, ſo in etymology, are to be collected by *induction* from inſtances that are ſimple, unequivocal, and definite, and then applied to words that are not ſo. The propriety and juſtice of theſe remarks it will be neceſſary to illuſtrate by a few examples.

Suppoſe we were aſked the derivation of οινος, *wine*, ὁυ, or ἑ, *ſelf*; ανασσω, *to rule*, in Greek; we ſhould be able to aſcertain this only by unfolding a general principle in the ſtructure of that language. The oriental tongues, to which the Greek owes its origin, abound with gutturals, which by degrees ſoftened down into an aſpirate in many of thoſe words derived from them; while in others they melted into ſimple vowels, or were replaced by a labial, ſuch as φ, *f*, *b*, *v*, or *w*. Thus חי, *khee*, *life*, *ſelf*, became ὁυ, חאן, *khaan*, *a king*, ανασσω, *to rule*, and יין, *yeen*, οινος. In theſe derivations our conviction would be complete, becauſe it is juſtified by a general principle that holds in a thouſand other inſtances.

Suppoſe, farther, we were aſked what were the origin of the Latin *vicus*, *a village*; *video*, *to ſee*; *vinum*, *wine*; *ovis*, *a ſheep*; or of *wheel*, *year*, *well*, *weal*, in our own tongue; we anſwer that the ſubſtitution of a labial for an aſpirate or a guttural, or a diphthong, forms a general principle which pervades the Latin tongue in its formation from the Greek. Hence *vicus* is from οικος; *vinum* from οινος; *ovis*, from οις; *video* from ειδω. With reſpect to our own language a ſimilar analogy obtains, which has converted a guttural into a labial; thus *laugh* is pronounced *laff*; *enough*, *enuff*; and moſt of thoſe words which begin or end with *y* and *w*, whether derived from Hebrew, Greek, or Gothic, began or ended with a guttural. On this general principle *year* may ſafely be ſaid to be derived directly or indirecty from γυρος, *a circle*, and means a period or revolution of time; *wheel*, from κυλιω, *to roll*; *well*, from גיל, *geel*, *a fountain*; and *weal* from חיל, *kheel*, *ſtrength*, which alſo has given birth to the words *heal*, and *health*.

Moreover, if we were aſked the origin of *ſperno*, *to deſpiſe*, we ſhould ſay that it comes from πτερνη, *the heel*, for the prefixing of the letter *s* to Greek words is a principle that pervades the Latin tongue; thus the primary ſenſe of *ſperno*, is to put the heel upon; on the ſame principle is *ſalio*, *inſilio*, *inſult*, taken from ἅλλομαι. The French generally drop the gutturals either in the middle or at the end of words; hence we ſhould be juſtified by an invariable analogy in ſaying, that *eau*, *water*, is from *aqua*, and *ſeul* from *ſingulus*. The Italians generally drop the liquid *l*; agreeably to this cuſtom of the language, *fiume* is derived from *flumen*, *a ſtream*, and *piano* from *planus*, *a plain*. In German moſt of thoſe words which have *t* in Engliſh are uſed with an *s*; as *waſer*, *water*; *beſſer*, *better*; *es*, *it*: and the corruption of *m* into *f*, or *v*, is a principle that runs through the Welſh tongue; thus, *ve*, *voer*, and *vayr*, are but the Latin words *me*, *mare*, and *major*.

3. Etymology, in order to claim its proper rank as a branch of ſcience, requires a ſtrict attention to the *aſſociation of ideas*, the great law which regulates the human mind. The opinions and cuſtoms of men, it is well known, greatly influence their language; and this influence is produced by the ſecret and unerring impulſe of aſſociation; and the reaſon why this branch of philology has been ſo much abuſed or called in queſtion, is, that little or no regard has been hitherto paid to its connection with that grand invariable principle which governs the human underſtanding. He who attempts at etymology in any language muſt know the philoſophical, the religious, and the political notions of the people who uſe it; he muſt be acquainted even with the phyſical peculiarities of their country, and from an acquaintance with the laws of the human mind he ſhould be able to trace the ſecret proceſs by which thoſe circumſtances influence their ſpeech. We will give a few examples in illuſtration of theſe remarks.

In the early ages of the world, the principal idea under which the character of *God* preſented itſelf was that of *ſuperior power*; and, accordingly, the feelings which it awakened in the beholder were chiefly thoſe of *fear*. And even the Jews, who had far more rational notions of the Deity than the Gentiles, apprehended that no one could ſee God and live. Accordingly moſt of thoſe names, which ſignify a god, are in Greek either immediately derived from a word which ſignifies *fear*, or both from a common origin; thus, from באב, *baab*, *the firſt principle of things*, are taken φοιβος, ποποι, *Gods*; and φοβος, *fear*; ταρβος, *terror*, owes its origin to the Chaldæan תרף, *Terph*, *a houſehold god*. Παν, the god *Pan*, is only the Hebrew פון, *pon*, *conſternation*: δειμων is the *god of terror*, and hence δαιμων, *an inviſible ſpirit*, which was an object of *fear*, and δεισιδαιμων, *the fear of the dæmons*, *religion*. It was the common notion that thoſe dæmons produced violent paſſions and diſorders in the mind and body: hence came the verb δαιμοναω, *to be mad*. It was thought, too, that they were the agents of God in preſiding over men; hence ευδαιμων, *one who had a good dæmon for his guardian angel*, and κακοδαιμων, *one who had an evil one*.

The introduction of evil into the creation could not be accounted for by the heathen philoſophers, only by ſuppoſing the exiſtence of two principles equal in power, and oppoſite in character and operation. The good principle they naturally aſſimilated to the *ſun*, the moſt ſplendid body in nature, whilſt the evil they called *darkneſs*; hence the ſaying *God is light*: צי, is pronounced by the Perſians *tzee*, but by the Arabians *tdee*, or *tdeio*, *light*; hence ζευς from the former mode of pronunciation, and θεος from the latter. On this principle the Chaldean אזא, *aza*, *to make hot*, the action of the ſun, gave birth to ἅζω, *to worſhip*, or *reverence*. The general opinion among the philoſophers was that water is the firſt principle of things. Hence the Arabic *mao* came, in Perſian, with little variation, to ſignify *fruit*, *wine*, and in Greek, μαια, *the goddeſs of birth*, and in Engliſh the producing month, *May*. The ſame word in Hebrew, by aſſuming *t* after the analogy of feminine nouns, is מות, *mot*, *death*, which means *reſolution into water*; hence the Egyptian *mot*, (whence Moſes is ſuppoſed to have been taken,) and *mud*, what is waſhed together by water, juſt as *lutum*, *clay*, is the ſupine of *lavo*, or *luo*, *to waſh*.

In eaſtern countries, where the heat of the ſun is violent and long continued, rain is deemed the greateſt bleſſing, and all the terms expreſſive, in moſt of the Aſiatic tongues, of plenty, ſucceſs, and joy, are generally borrowed from the names of water; hence the Hebrew ברך, *berek*, *to bleſs*; in Greek is βρεχω, *to rain*; in Latin *precor*, *to aſk for bleſſing*, *parco*, *to give bleſſing*; *ſpare*, and *ſpargo*, *to ſhed as the dew*, *or ſcatter as ſeed*. The ſame root exiſts in Engliſh in the form of *brook*, the effect of rain.

4. Etymology, in order to become a rational ſtudy, implies an extenſive and an accurate acquaintance with languages. It is not ſufficient to be acquainted with Latin to know Greek; nor to know Italian to be acquainted with Latin, nor to know Engliſh to be acquainted with the Saxon or Gothic; but to be a good etymologiſt in either of theſe, a man muſt comprehend them all. So manifold is the intercommunity between all languages, that no language exiſts derived from one and the ſame ſource. Words exiſt in Engliſh which exiſt alſo in moſt other tongues, under differences of character and termination; and they are derived not from each other, but from a common origin; and a ſcientific etymologiſt, inſtead of deriving them from each other, will trace them all till they meet in a few primitive terms. It would probably be wrong, or at leaſt it would be very doubtful to ſay, that *hand* comes from the Latin obſolete *hendo*, *to catch with the hand*, or from χανδω, the parent of *hendo*, but it would be right to ſay that theſe are *connate*, or *kindred* terms, ſprung, if not from each other, from ſome common root. In Hebrew, Perſian, and Arabic כף, *caph*, *is the hand*. The action of this is two-fold, as it *imparts*, or as it *receives*. In the former ſenſe it gave birth to the Saxon or Gothic *giff*, and hence *if*;—in the latter to *capio*. *To take in hand is to begin a thing*; hence the ſame word exiſts in the form of *Cæpio*; and paſſing into Greece it produced κωπη, *a handle*.

And here it is obvious to remark, that as the root, paſſing into different countries, produces as it were new branches; thoſe branches will not continue long till they in their turn become the ſtems of more numerous and diverſified ſhoots; and as they thus multiply by accident, the progreſs of knowledge, the multiplication and diſtinction of ideas attendant thereon, ſeize, as it were, theſe wild and promiſcuous offspring, and give them the ſanction of cuſtom, the ſupreme arbiter of ſpeech, thus conſidering as genuine, words which at firſt were mere *corruptions*. Thus in our own tongue *guſt* is wind; hence *ghoſt*, what conſiſts of *wind*, *ſpectre*, *a-ghaſt*, *ghoſtly*, like a ſpectre, and *gas*, an aeriform fluid, ſo denominated from ghoſt, firſt by Van Helmont. Thus alſo in Latin, from πηγω, *to join together*, is *pango*, *to faſten*, *paco*, *to unite in concord*, *pacify*. To paint is to faſten adventitious colours on a thing; hence *pingo*, and to give to falſehood the adventitious colours of truth is *fingo*, *to feign*. Again, from μενος is *men's mind*, *force*, *eſſence*, *memini*, *to call to mind*, *moneo*, *to put in mind*; *manus*, *force*, or that organ in which the ſtrength of the human body chiefly conſiſts, *manes*, *the ſouls or departed ſpirits*, ſpirit being the eſſence of man; and *maneo*, *to exiſt*, the ſoul being that which exiſts after the deſtruction of the body.

Etymology, then, to be raiſed above the caprice of fruitleſs ſtudy, and to be claſſed among the uſeful and ſolid branches of ſcience, muſt be founded on a juſt regard to the affinities of letters, and to the ſtructure of the organs of ſpeech. It ſuppoſes an acquaintance with the philoſophy of the human mind; with the analogies which form and diſtinguiſh each language; with the hiſtory of mankind, philoſophical, religious, and political. From theſe, its qualifications, reſults its utility as a department of human knowledge. Etymology, it is evident, furniſhes the readieſt and moſt effectual means to acquire the knowledge of language; and as language is but the dreſs of our ideas, it holds up a mirror to delineate and reflect the operations of the human mind. It helps to aſcertain the poſitions of ancient places, to clear obſcurities in the antiquities of nations and families. What is more, when confined within its proper limits, and purſued to its full extent, it will throw much light and additional evidence on the truth of the Moſaic hiſtory, reſpecting the origin and propagation of mankind.

EU, or Eo, in *Geography*. See Eo.

Eu, a ſea-port town of France, and chief place of a canton, in the department of the Lower Seine, and diſtrict of Dieppe, ſeated on the Breſſe, near the coaſt of the Engliſh channel; 15 miles N. of Dieppe. The place contains 3400 and the canton 12,810 inhabitants, on a territorial extent of 182½ kiliometres; and in 27 communes.

EVA, in *Ancient Geography*, a town of the Peloponneſus, in Arcadia.—Alſo, a hill of the Peloponneſus, in Laconia, near Sellaſia. Polybius.

EVACUANTS, in *Medicine*, are thoſe remedies which operate by diminiſhing the quantity of fluids in the body. This effect may be produced either directly, by an artificial opening into the veſſels or cavities containing the fluid to be evacuated; as by blood-letting, by means of the lancet, or by cupping; by tapping; &c. Or the evacuation may be accompliſhed indirectly, by exciting the action of the veſſels, which are naturally deſtined to throw off redundant fluids, on the one hand; or by producing inflammation, and a conſequent diſcharge of fluids, from parts not naturally ſecreting them. Evacuants acting upon the natural emunctories, as the organs of excretion have been called, are of various quality and denomination, according to the parts upon which their action is exerted: thus, ſome ſtimulate the veſſels which open into the cavity of the inteſtines, and carry off the fluids by ſtool, and are called *purgatives*, *laxatives*, or CATHARTICS; others excite the veſſels of the kidnies to increaſed action, and are denominated DIURETICS; others augment the perſpiration, and are termed DIAPHORETICS and *ſudorifics*; others again ſtimulate the ſalivary glands, and produce a great diſcharge of ſaliva, whence they are called SIALOGOGUES; and others excite an increaſed diſcharge of the mucus of the noſtrils, and are termed ERRHINES. All theſe kinds of evacuant medicines are occaſionally employed, with a view to relieve the conſtitution at large, or ſome part of the body, from an inflammatory or febrile condition; or to remove local congeſtions in particular organs, &c. See BLEEDING, CUPPING, and the words in capitals; under which heads the principles of the evacuation, thus variouſly effected, are explained.

EVACUATION, ſee the preceding article.

Evacuation, in a *Military Senſe*, relates to the withdrawing of troops from any fortreſs or poſt, not beſieged, but intended to be relinquiſhed, or eventually to be diſmantled. This term is ſometimes erroneouſly uſed in capitulations, where it is expreſſed that the garriſon ſhall evacuate within a certain number of hours. Now, as it is in almoſt every caſe, a ſtipulation on the part of the victors, that they ſhall be put in poſſeſſion of certain gates, or defences, previous to the garriſon marching out; thereby ſecuring every advantage that may have been obtained; it ſtands to reaſon, that the term evacuation is incorrectly applied. We have, indeed, but rarely inſtances wherein it is properly introduced; one very recent caſe is however very prominent; namely, the evacuation of certain fortreſſes in Pruſſia by the French troops; for, if we are correctly informed, the Pruſſian forces did not, in ſome inſtances, attempt to enter until their *friends* had completely withdrawn.

It is ſometimes made a condition, that particular approaches, lines, or poſts, ſhall be evacuated; there we ſee the term appropriately uſed; becauſe ſuch approaches, and lines eſpecially, are not conſidered as permanent works; therefore are intended to be diſmantled ſo ſoon as thoſe who erected them ſhould retire.

Where a place is to be evacuated under the expreſs condition of all damages being paid for, it becomes the duty of the future poſſeſſors to be very correct in cauſing an enquiry to be made into all depredations and grievances, before the forces about to retire quit the place. Commiſſioners on both ſides are neceſſary; in order that every matter may be adjuſted at the moment, ſo as to obviate future diſagreements. This appears to have been attended to when the Portugueſe territory was evacuated by Junot; though we have ſtrong reaſon to apprehend that great evaſion, and many highly nefarious acts, were practiſed by the French on that occaſion.

EUÆMIA, of ευ, *well*, and αιμα, *blood*, is uſed by Tremelius and ſome other writers, to denote a good and healthy ſtate of the maſs of blood.

EUÆMON, in *Ancient Geography*, a town of Greece, placed by Steph. Byz. in the territory of the Orchomenians.

EVAGRIUS, in *Biography*, patriarch or biſhop of Conſtantinople, who ſucceeded Eudoxus in 370, and whoſe election was much reſented by the emperor Valens. From this event commenced a cruel perſecution againſt the Catholics, which did not terminate till the acceſſion of Gratian to the throne. Evagrius probably died in exile during this period.

Evagrius, biſhop of Antioch, ſucceeded Paulinus in the year 389; in conſequence of whoſe election, in oppoſition to Flavianus, the ſchiſm in the church of Antioch, that has been much lamented by the orthodox, was continued. However, by the influence of Siricius biſhop of Rome, in the council of Capua, held in 390, Evagrius's election was approved. Two years afterwards Evagrius died, and the ſchiſm terminated. Evagrius was the friend and companion of St. Jerome, who repreſents him as a perſon of an active and ardent ſpirit, and as the author of various writings, which he had peruſed. None of theſe that deſerve particular mention are now extant. Cave. Dupin.

Evagrius, ſurnamed *Ponticus*, and by St. Jerome *Hyperborita*, on account of the ſituation of the place of his nativity near the Euxine ſea, flouriſhed near the cloſe of the fourth century. Having been ordained deacon of Conſtantinople by St. Gregory Nazianzen, he was inſtructed by this biſhop in biblical learning, and advanced to the office of his archdeacon. His perſon and manners recommended him to the favour of the ladies; and being ſuſpected of an improper intimacy with the wife of a man of conſequence, he was obliged to retire from Conſtantinople in the year 385, and to remove to ſome diſtant place. At Jeruſalem he embraced the monaſtic life, and paſſed 15 years at a monaſtery amidſt the deſerts of Nitria in Egypt.

Whilſt he was in this ſituation he refuſed the epiſcopal dignity which was offered him by Theophilus biſhop of Alexandria. He afterwards defended the opinions of Origen, and laid the foundation of the tenets which, in the courſe of a few years, were propagated by Pelagius and his followers. He lived to an advanced age, but the time of his death has not been aſcertained. Sozomen ſpeaks of him as a man, diſtinguiſhed by his learning, judgment, and eloquence; and repreſents him as devout, humble, abſtemious, and irreproachable in his manners. Some of his writings are found entire in the "Bibliotheca Patrum," and in "Cotelerius's Monum. Eccl. Græc.;" but fragments only of the greater number are diſperſed in the works of Socrates and other authors. Socrates' Hiſt. Eccl. Cave. Dupin. Another monk of this name flouriſhed among the eccleſiaſtical writers of the fifth century. Cave. Dupin.

Evagrius, an ancient eccleſiaſtical hiſtorian, was born at Epiphania, a city of Syria in 536 or 537. From the ſtudy of rhetoric and the profeſſion of an advocate, in which he acquired conſiderable reputation, he derived the ſurname of *Scholaſticus*. At Antioch he lived in habits of intimacy with Gregory, patriarch of that city, and when Gregory was charged with the crime of inceſt, and made an appeal to the emperor and a ſynod, Evagrius attended him to Conſtantinople, where his abilities and character were held in high eſtimation; nor was he leſs reſpected at Antioch, the place of his cuſtomary reſidence. The intervals of leiſure which he could gain from the public duties of the ſeveral offices which he ſuſtained, were devoted to the compoſition of his "Eccleſiaſtical Hiſtory, in 6 books," comprehending the period from the year 430 to 594, and including the events that occurred from the cloſe of the hiſtories of Theodoret and Socrates till the twelfth year of the emperor Mauricius. His books of "Epiſtles, &c." and "Panegyrical Oration on Mauricius," &c. are loſt. His hiſtory is, upon the whole, a work of induſtrious reſearch, general information, and conſiderable merit; though it manifeſts, on the part of the author, a great degree of credulity. The writers of the Romiſh church extol him as the only Greek eccleſiaſtical hiſtorian who has maintained the doctrine of the true faith; and Photius repreſents his ſtyle as ſometimes elegant and beautiful, often too redundant and luxuriant.

The original Greek of this hiſtory was publiſhed at Paris in 1544, in folio, by Robert Stephens; in 1612 at Geneva, in folio, accompanied with a Latin verſion; in 1679 by Valeſius, with a new verſion and notes; and in 1720 this laſt edition was republiſhed at Cambridge in folio, with many additional notes. Cave. Valeſii Præf. Dupin.

EVANDRIA, in *Ancient Geography*, a ſmall town of Spain, in Luſitania, according to Ptolemy; ſuppoſed to be "Talavera la Veja."

EVANDRIUS Mons, one of the ſeven mountains, forming the ſite of the city of Rome, called alſo mount Palatine.

EVANGELICAL *Harmony* and *Economy*. See the ſubſtantives.

EVANGELISTS, the inſpired authors of the Goſpels. See Matthew, Mark, Luke and John. The ſymbols of theſe in the order now recited, according to Jerom, are a man, a lion, a calf or ox, and an eagle. According to St. Auguſtine, in his interpretation of Ezekiel, ch. i. 5.—10. and Rev. iv. 7, they are a lion, a man, an ox, and an eagle.

The word is derived from the Greek, ευαγγελιον, formed of ευ, *bene*, *well*, and αγγελος, *angel*, *meſſenger*.

The denomination evangeliſts was likewiſe given in the ancient church to ſuch as preached the Goſpel up and down, without being attached to any particular church, being either commiſſioned by the apoſtles to inſtruct the nations, or of their own accord, abandoning every worldly attachment, conſecrated themſelves to the ſacred office of preaching the Goſpel.

In which ſenſe ſome interpreters think it is that St. Philip, who was one of the ſeven deacons, is called the evangeliſt, in the twenty-firſt chapter of the Acts of the Apoſtles, ver. 8. Again, St. Paul writing to Timothy, Ep. ii. chap. iv. ver. 5. bids him do the work of an evangeliſt. The ſame apoſtle, Eph. iv. 11. ranks the evangeliſts after the apoſtles and prophets.

Evangelists, in *Geography*, four ſmall iſlands at the weſtern extremity of the Straits of Magellan, near the coaſt of South America; three are low, and one, at ſome diſtance, appears like a hay-ſtack. S. lat. 52° 45′. W. long. 67° 16′.

EVANIA, in *Entomology*. See Sphex.

EVANID, a name which ſome authors give to thoſe colours which are tranſient, or not of long duration; as thoſe in the rainbow, in clouds, before and after ſun-ſet, &c.

Evanid colours are the ſame with thoſe otherwiſe called fantaſtical and emphatical colours. Some authors alſo uſe the ſame term to expreſs thoſe flowers of plants whoſe petals fall off as ſoon as they are opened.

EVANS, John, in *Biography*, was born at Wrexham, Denbighſhire, in the year 1680. His father was one of the ejected miniſters in 1662, who, on account of his nonconformity, being driven from the eſtabliſhed church, became miniſter to an independent congregation at Wrexham. The ſon was educated with great care, and inducted to the different branches of literature neceſſary to qualify him for the office of the miniſtry, which he afterwards exerciſed in London, firſt as an aſſiſtant, and afterwards as ſucceſſor to Dr. Daniel Williams. He died in the year 1730, in the fifty-firſt year of his age, highly eſteemed by all who knew him. He had ever been eminent for piety, integrity, and public ſpirit; in his principles he was orthodox, but diſpoſed to think well of, and to honour, thoſe who differed from him, without any regard to the ſentiments which they might hold. He received a diploma of doctor in divinity from the univerſities of Edinburgh and Aberdeen. His principal work as an author conſiſted of two volumes of ſermons, entitled "Practical Diſcourſes concerning the Chriſtian Temper," which are ſtill in conſiderable eſtimation. The celebrated Dr. Watts characterized them as "the moſt complete ſummary of thoſe duties which make up the Chriſtian life." Gen. Biog.

Evans's *iſland*, in *Geography*, a ſmall American iſland, near the coaſt of Main. N. lat. 44° 31′. W. long. 67° 3′.

EVANSHAM, a town of America, the capital of Wythe county, in Virginia, ſituated on the E. ſide of Reedy creek, which falls into the Great Kanhaway, Woods or New River. It contains a court-houſe, gaol, and about 25 houſes; 40 miles W. by S. from Chriſtianſburg.

EVANTES, in *Antiquity*, the prieſteſſes of Bacchus, thus called, becauſe in celebrating the orgia they ran about as if diſtracted, crying *evan, evan, ohe evan!*

The word is formed from Ευαν, a title or appellation of Bacchus.

EUANTHI Colores, in *Painting*, a term uſed by the Greeks to expreſs what the Romans call the *floridi colores*; theſe were ſuch colours as had a remarkable brightneſs in their works. The other duller and coarſer colours the Romans called *auſteri colores*, and the Greeks *bathyi*.

Of the firſt ſort were cinnabar, lapis armenus, chryſocolla, minium, indigo, and purpuriſſa, according to the Romans; but the Greeks, as we find by Dioſcorides, made cinnabar one of the auſtere colours.

EUAPHION, (from ευ, *eaſe*, and αφη, *the touch*,) in *Surgery*, a medicine for the hemorrhoids, named from its gentleneſs. Galen.

EVAPORATION, in *Natural Philoſophy*, is that proceſs by which water and other liquids are converted into vapour or ſteam, an elaſtic fluid, and diſſipated in the atmoſphere. Certain ſolid bodies, too, are ſubject to a ſimilar diſſipation in air; this is uſually denominated *exhalation*: but as the cauſe is no doubt the ſame in both caſes, it may be properly conſidered under this head.

The ſpontaneous evaporation of water, or that which is conſtantly going on in a greater or leſs degree from all parts of the ſurface of the globe, has always been an intereſting phenomenon to the ſpeculative philoſopher. Various hypotheſes have been advanced to account for the aſcent of water into the atmoſphere in an inviſible form, and for its ſubſequent deſcent in the form of rain; but the opinions of early writers on this ſubject are of little importance, as they were not acquainted with the principal facts and experiments which ought to guide us in the inveſtigation. Ariſtotle ſeems to have aſcribed the formation of vapour to the action of fire; and ſo far his notion was correct. Halley ſuppoſes ſmall hollow ſpheres of water to be filled with a ſubtile elaſtic fluid, ſo as to make them ſpecifically lighter than air; he alſo hints at a chemical affinity between air and water, ſimilar to that between water and ſalts. Deſaguliers, after having ſhewn the inſufficiency of former hypotheſes, propoſes a new one; he aſſerts that water is capable of being converted by heat into an elaſtic fluid much lighter than air, and refers to the ſteam engine as a proof; he ſhews, too, that a glaſs veſſel filled with water, and inverted in another veſſel of water, and then expoſed to the heat of ebullition, has its water expelled, and ſteam, an elaſtic inviſible fluid, takes its place. This ſteam, he ſhews, is again condenſed into water as the veſſel cools. He argues that ſteam is $16\frac{1}{2}$ times lighter than air, and that when formed at a low temperature it muſt aſcend in the atmoſphere till it meets with air of the ſame denſity, and there it will ſtop; but when accumulated, the cold condenſes a portion of it into drops of water: hence clouds and rain. This notion, which goes to identify vapour in the air, with the ſteam or vapour of water formed by heat in a vacuum, is ingenious and apparently original, but how the vapour ſhould aſcend till it arrives at air of the ſame denſity, is not very eaſily conceivable: for the vapour, in aſcending, muſt expand as the preſſure is diminiſhed, according to the eſtabliſhed laws of elaſtic fluids, and therefore never can obtain the ſame denſity as the air. The vapours might indeed aſcend to the top of the atmoſphere, and form a diſtinct ſtratum, as ſome have imagined with reſpect to hydrogen gas. The author has extravagantly under-rated the ſpecific gravity of ſteam, or aqueous vapour, which is certainly at leaſt one-half that of atmoſpheric air. Upon the whole, this hypotheſis was more plauſible than that adopted by Halley.

As the ſcience of chemiſtry gradually expanded, the phenomena of evaporation began to be conſidered as moſt nearly allied to thoſe of chemical ſolution. From the year 1743 to 1766 the eſſays of Nollet, Franklin, Roi, Hamilton and others, tended to eſtabliſh the opinion that water is taken up into the air by chemical ſolution, in a ſimilar way to that in which water and other liquids diſſolve ſalts. In the 55th vol. of the Philoſophical Tranſactions, there is an eſſay of Profeſſor Hamilton on evaporation, in which he inſiſts at large on the hypotheſis of ſolution. Hot water, he obſerves, diſſolves ſalts ſooner and in greater quantities than cold water, and depoſits a part of the ſame on cooling: ſo warm air takes up more water than cold air; but the water is depoſited again when the air cools, or by the contact of a cold body, as a glaſs of cold water. Evaporation always produces cold; this is obſerved when any part of the human body is moiſtened with water, and the ſame ſuffered to evaporate, but ſtill more remarkably when moiſtened with ether or other fluids more evaporable than water; in like manner, certain ſalts diſſolved in water conſtantly produce cold. In ſhort, the points of reſemblance between evaporation and chemical ſolution are ſo numerous and ſtriking, that the generality of philoſophers ſeem to have adopted the idea that air poſſeſſes a chemical affinity for water, and attaches a portion of it to itſelf, which becomes incorporated with the elaſtic maſs of the atmoſphere, under the denomination of vapour, till cold, or ſome other cauſe, reduces it again to the ſtate of water.

In the year 1783, Sauſſure of Geneva publiſhed his celebrated eſſays on hygrometry, in which the ſubject of evaporation is diſcuſſed much more largely than had been previouſly done. This author does not claim the merit of any new theory; for, he ſays, "the converſion of water into elaſtic vapour has been known time immemorial; the diſſolution of water in air was diſcovered by Roi, and the veſicules, which compoſe fogs and clouds, were conceived by Halley, and ocularly demonſtrated by Kratzenſtein. But no philoſopher has, I believe, clearly diſtinguiſhed the different modifications of vapours: all the ſyſtematic authors have endeavoured to reduce all vapours to one and the ſame ſpecies, whilſt in reality they exiſt under forms abſolutely different. It had not been perceived that water, on being diſſolved in the air, is converted into an elaſtic fluid; but I have ſhewn this to be the fact by the moſt exact experiments; and further, the preciſe effect which the ſolution of a given quantity of water in air has upon the ſpecific gravity of the air. Finally, the laws according to which the humidity of the air varies in proportion to its condenſation and rarefaction, form an entirely new ſubject, on which our ideas hitherto have been vague and erroneous. Theſe, I believe, will be found to have received a ſatisfactory elucidation." Preface, page 10. Before we examine the concluſions of Sauſſure, it may be proper to advert to the facts which are alluded to above. Having procured a large glaſs balloon, containing $4\frac{1}{4}$ cubic feet of air, Sauſſure adapted to it a manometer or inſtrument to meaſure the force of elaſtic fluids; the balloon being filled with air of the natural humidity, the manometer, or thermometer, and a veſſel containing cauſtic alkali of a given weight, were all encloſed in the balloon, and confined from the action of the external air. The cauſtic alkali abſorbed the vapour in the balloon, and the manometer ſhewed the diminution of elaſticity conſequent thereon; after the experiment was carried as far as was deſired, the balloon was opened, and the increaſe of weight of the alkaline veſſel was aſcertained. Hence were derived data for calculating the influence of vapour on the elaſticity of the air, and likewiſe the whole quantity of water in a ſtate of vapour in a given bulk of air. This might be called the analytic experiment; but the ſynthetic one was alſo made. By encloſing a piece of wet linen of a given weight in the balloon containing air as dry as poſſible, along with the other inſtruments, the moiſture of the linen evaporating increaſed the elaſticity of the confined air a quantity which could be obſerved; and at the cloſe of the experiment the loſs of weight of the linen indicated the quantity of water which had been evaporated, and had increaſed the elaſticity. The two methods were thus found to corroborate each other remarkably well. The reſults were, that at the temperature of 64°, a quantity of extremely dry air acquires an increaſe of $\frac{1}{34}$th in elaſticity in attaining extreme humidity; and *vice verſâ*: that a cubic foot of air takes up 10 grains of water in paſſing from extreme dryneſs to extreme humidity; and that conſequently it diminiſhes the ſpecific gravity of the air, as if a volume of elaſtic fluid, equal in weight to 10 grains, and of $\frac{3}{4}$ths the ſpecific gravity of air were added to it. Of the general accuracy of theſe reſults there is no room for doubt. They form a valuable acquiſition to this branch of ſcience. One important fact was ſtill wanting; as air was ſuppoſed to diſſolve water by virtue of an affinity, it was reaſonable to expect that every ſpecies of air would have its peculiar affinity, or take up a certain portion of water peculiar to itſelf, agreeably to what is obſerved in other caſes of chemical ſaturation. Sauſſure aſcertained this point clearly in regard to inflammable and fixed air, that is, hydrogen and carbonic acid. Both theſe gaſes were found in their pure ſtate, and when mixed with any proportion of common air, to affect the hygrometer in the ſame way as common air, and to promote evaporation in the ſame degree. In ſhort, there was not any appearance to indicate that they contained either leſs or more vapour than common air in like circumſtances. Sauſſure found that evaporation was accelerated in proportion to the rarefaction of the air; this circumſtance he accounted for by obſerving that the preſſure of the atmoſphere retards evaporation; however, upon the principle of ſolution, it might have been expected that the greater quantity and denſity of the ſolvent would have compenſated for the greater preſſure. The condenſation of air, on the contrary, uniformly tends to make it depoſit moiſture, and retards evaporation. This he explains by obſerving, that the ſolvent power of air does not increaſe quite ſo rapidly as its denſity; continued condenſation therefore muſt firſt ſaturate the air with moiſture, and then make it depoſit a portion. Sauſſure found that warm and denſe air required more vapour to ſaturate it than cold and rare air; he was led too haſtily to aſcribe the ſolvent power of the air partly to its temperature and partly to its denſity; but it has ſince been proved that temperature alone is concerned, and the denſity has no effect whatever. On the head of rarefaction and condenſation, Sauſſure adverts to a curious fact, known by every philoſopher, but not ſatiſfactorily explained by any one; namely, the abundant and inſtantaneous formation of a cloud or miſt upon exhauſting a receiver by the air-pump. As the rarefaction of air is found to promote evaporation, it appears aſtoniſhing at firſt ſight that the air ſhould exhibit ſigns of ſuperſaturation at the ſame inſtant. When the pump plate is covered with wet leathers the above appearance never fails; but the abbé Nollet found it to take place when water was totally excluded. Sauſſure, however, denies this to be the fact; he thinks that water muſt not have been excluded with ſufficient care in Nollet's experiments; and affirms that from his own experience no appearance of miſt was found upon exhauſtion, when the pump was carefully dried. The hygrometer at the time was 70°, extreme moiſture being 100°. As the two authors here appear to be at iſſue as to the fact, the writer of this article, from his own experience, can venture to affirm that both of them may ſtill be correct. When care is taken to exclude water from the pump and receiver, the miſt is by no means ſo copious as otherwiſe; it is alſo more diminutive as the air is dry or far from extreme humidity; with both theſe circumſtances and a large receiver, no miſt will appear by a moderate rate of exhauſtion; but it may always be produced by uſing a ſmall receiver, and rapid exhauſtion. Sauſſure's explanation of the fact is very inadequate, and unworthy of repetition; he further notices the dew obſerved on the receiver of an air-pump after letting in the air, and very juſtly aſcribes it to the condenſation of the vapour raiſed up into the receiver after exhauſtion; the air taking in with it nearly as much vapour as it is capable of holding. Upon liberating condenſed air a great miſt is obſerved in the receiver; Sauſſure explains this in the ſame unſatisfactory manner as before, and that in one caſe only, namely, when the receiver contains water; but his explanation does not apply when the receiver is perfectly dry; yet the phenomenon of miſt is equally apparent in that caſe. The true explanation is, that a great but momentary cold, of 50° or more, occaſions the precipitation of vapour, both upon rarefying air and liberating condenſed air. The fact has ſince been demonſtrated by Mr. Dalton; but it was hinted at by Lambert, as quoted by Sauſſure, page 331.

Though Sauſſure does not affect to introduce any new theory on the ſubject of evaporation, he certainly advances ſome notions on the ſubject that were not previouſly held by others, eſpecially by thoſe who adopted the chemical ſolution of water in air. He ſays, "evaporation, properly ſpeaking, is the reſult or rather the effect of the intimate union of elementary fire with water; by this union the water and fire combined form an elaſtic fluid ſpecifically lighter than air, and which is peculiarly diſtinguiſhed by the name of *vapour*. This vapour being formed in a vacuum, or otherwiſe when the heat is ſufficient to give it force ſuperior to atmoſpheric preſſure, ſo as to expel the air from any veſſel in which it is formed, is called *pure elaſtic vapour*." Page 361. This repreſentation is, in all probability, correct, and will be generally adopted without heſitation. He proceeds: "but when the vapour cannot entirely ſurmount the preſſure of the air, it penetrates it, mixes with it, undergoes a true ſolution, and may then be properly called *diſſolved elaſtic vapour*." Page 362. Certainly the advocates for the ſolution of water in air cannot adopt this language. Pure elaſtic vapour is firſt formed; then by means of ſuch force as it happens to have, which is generally ſmall, it penetrates and mixes with the air; afterwards it is diſſolved by the air; that is, the particles of air finding thoſe compound particles of water and fire amongſt them, attract them, and form triple compounds of air, water, and fire. Here the buſineſs for which ſolution is called in is performed beforehand; for we muſt ſuppoſe it to be the affinity of air for water which enables the latter to riſe at all againſt ſo ſuperior a preſſure. If the vapour can, by virtue of its elaſticity, penetrate the air, why may it not continue there by virtue of the ſame elaſticity? Sauſſure proceeds; "when afterwards the air ſaturated lets fall the water which it contains, this water ſometimes takes the form of veſicules or bubbles; theſe veſicules, filled and ſurrounded with a ſubtile elaſtic fluid, are ſupported in the air, and even ſometimes riſe in it, by their leſs ſpecific gravity. Theſe veſicules are eſſentially diſtinct from the air, as well as from the vapour above defined; but according to cuſtom I have arranged them in the claſs of vapours, and diſtinguiſhed them by the name of *veſicular vapour*. Finally, when the elaſtic vapour, or the veſicules themſelves, condenſe into ſolid drops, which only differ from drops of rain by their extreme ſmallneſs, they are ſtill very different from vapours properly ſpeaking. Notwithſtanding, as theſe ſmall particles float in the air, and can even be ſupported in it for ſome time, by its agitation and viſcoſity, I have claſſed them alſo amongſt vapours, and given them the name of *concrete vapours*."

Page 363. It may be proper to obſerve here, that the veſicular vapour of Dr. Halley was ſuppoſed to be tranſparent, and therefore to correſpond to the *diſſolved elaſtic vapour* of Sauſſure. It was moreover hypothetical; but Kratzenſtein and Sauſſure affirm that the ſmall viſible particles floating over ſteaming water, as well as thoſe of certain fogs, are diſcernible by a microſcope to be hollow or veſicular. Theſe viſible particles are the *veſicular vapour* of Sauſſure. Though it is by no means improbable that the vapour iſſuing from warm water is enveloped in a film of water, juſt as we ſee it in ebullition, and that the ſame bubble of ſteam on cooling may ſhrink into a veſicule, containing an atom of air, the original nucleus of the ſteam; yet it is not equally probable that in the condenſation of pure vapour a veſicule ſhould be formed: ſtill leſs likely is it that ſometimes veſicules, and at other times ſolid drops, ſhould be formed. Microſcopic obſervations on atoms dancing about in the air are ſcarcely to be relied on. But whatever may be the fact as to the conſtitution of condenſed vapour, that is, whether the particles are hollow or ſolid, there is not any ſufficient reaſon for ſuppoſing them conſtituted of any other principles than water and atmoſpheric air. The only one that has been advanced in ſupport of the hypotheſis is, that without ſome ſubtile elaſtic fluid, internal or external, the watery particles conſtituting clouds muſt conſtantly deſcend; whereas clouds are ſeen to remain ſtationary and ſometimes even to aſcend, which, it is alleged, could not take place, were not the particles of leſs ſpecific gravity than the air. Now the aſcent of clouds is in all probability an optical deception. It is occaſioned by the diſſolution or evaporation of the under ſurface of the cloud, and the ſuperior new formation of a cloud. We have no ſufficient reaſon for believing that the individual particles of clouds aſcend; yet they frequently deſcend with a velocity almoſt imperceptible; this ariſes from the reſiſtance the air makes to the motion of ſmall bodies, which, it is well known, increaſes in proportion as their diameters decreaſe. The epithet *vapour*, which denotes an elaſtic fluid, cannot, with philoſophical propriety, be applied to the viſible particles of water conſtituting clouds.

Mr. Pictet of Geneva publiſhed an ingenious eſſay on fire, which was tranſlated into Engliſh and publiſhed in 1791. This gentleman, impreſſed with ſuch ideas of the powers of fire in every thing which relates to evaporation, is tempted to look upon it as the ſole agent in this claſs of phenomena, and to renounce the idea that air acts in the manner of chemical *diſſolvents*. He obſerves, "the very ſpecious arguments of my learned colleague (Sauſſure,) in his hygrometry in favour of that opinion, had long ſeduced me; but the charming ſimplicity which the theory of evaporation would acquire if we could diveſt it of the agency of air; the poſſibility I perceive of reducing the whole to the action of fire; the probability which increaſes with the ſimplicity of every natural hypotheſis, attract me, I confeſs, ſtill more forcibly." Page 222.

In the Philoſ. Tranſac. for 1792, there is an eſſay of De Luc on evaporation. This acute philoſopher diſtinctly maintains that vapour in the air is preciſely the ſame as vapour in vacuo, and in both caſes is formed by the intimate union of fire with water; he denominates it *ſteam*, and ſhews that ſteam in air of any denſity, and ſteam in vacuo, affect the hygrometer alike, provided the ſteam has the ſame temperature and elaſticity, at leaſt within the ordinary range of atmoſpheric temperature. He ſtrengthens his opinion of ſteam in air, and in vacuo being the ſame from the fact that cold is produced, or heat abſorbed, by evaporation in both caſes. From the facts as aſcertained reſpecting ſteam by Mr. Watt and others he juſtly infers, that there is a certain minimum diſtance of the particles of ſteam for each temperature, at which they retain their elaſticity; if they are condenſed by any mechanical force within the limit of this diſtance, they loſe their elaſticity and become water; if not, they retain it, and act as any other permanently elaſtic fluid. In ſpeaking of ſteam in air, he obſerves, "that no mechanical cauſe can produce the decompoſition (condenſation) of that fluid, but by forcing its particles to become nearer each other than the actual temperature can admit, which cannot happen in the atmoſphere, except by the accumulation of ſteam itſelf in ſome part of it." "He concludes that the product of evaporation is always of the ſame nature, namely, an expanſible fluid, which either alone, or mixed with air, affects the manometer by preſſure, and the hygrometer by moiſture, without any difference ariſing from the preſence or abſence of air, at leaſt without any perceived hitherto."

In 1793, Mr. Dalton publiſhed a volume of meteorological eſſays, in which he gives a theory of vapour, very nearly allied to that of De Luc above-mentioned, and to the opinion of Pictet, though he ſeems to have been unacquainted with theſe circumſtances. From the reſults of certain experiments and obſervations he concludes, "that the vapour of water (and probably of moſt other liquids) exiſts at all times in the atmoſphere, and is capable of bearing any known degree of cold without a total condenſation, and that the vapour ſo exiſting is one and the ſame thing as *ſteam* or vapour of 212° or upwards. The idea, therefore, that vapour cannot exiſt in the open atmoſphere under the temperature of 212°, unleſs chemically combined therewith, I conſider as erroneous; it has taken its riſe from a ſuppoſition that *air* preſſing upon vapour condenſes the vapour equally with *vapour* preſſing upon vapour, a ſuppoſition we have no right to aſſume, and which, I apprehend, will plainly appear to be contradictory to reaſon and unwarranted by facts; for, when a particle of vapour exiſts between two particles of air, let their equal and oppoſite preſſures upon it be what they may, they cannot bring it nearer to another particle of vapour, without which no condenſation can take place, all other circumſtances being the ſame; and it has never been proved that the vapour in a receiver from which the air has been exhauſted, is precipitated upon the admiſſion of perfectly dry air. Hence then we ought to conclude, till the contrary can be proved, that the condenſation of vapour expoſed to the common air does not in any manner depend upon the preſſure of the air." Eſſays, p. 201.

In 1802, Mr. Dalton publiſhed, in the fifth vol. of the Mancheſter Memoirs, a ſeries of intereſting eſſays relative to evaporation; he found, 1ſt. The expanſive force of pure ſteam over water in vacuo at all temperatures from 32° to 212°; 2d. The expanſive force of dry air for the ſame range of temperature; and, 3d. The expanſive force of dry air in contact with water for the like range. From a compariſion of theſe experiments it appeared that the obſervation of De Luc was univerſally true; namely, that ſteam in vacuo and ſteam in air are preciſely of the ſame force at the ſame temperature. The law was found to apply equally to the ſteam from ether and other liquids, and to other elaſtic fluids, as well as common air. Mr. Dalton conſiders theſe facts to be deciſive as to the nature of the connection between ſteam and air, and infers that ſteam forms a mechanical mixture with air, and not a chemical compound, as ſome have ſuppoſed. This concluſion was confirmed by experiments upon the quantity of water evaporated at different temperatures; which was always is proportion to the elaſtic force of vapour at the temperature. For inſtance, water at 212°, or kept juſt boiling, evaporates twice as faſt as water of 180°, and this twice as faſt as water of 150°; and the forces of pure ſteam at thoſe temperatures are 30, 15, and $7\frac{1}{2}$ inches of mercury reſpectively. The rule, however, does not apply without a correction for low temperatures; becauſe the ſteam already in the air prevents in degree the aſcenſion of freſh ſteam; whereas in high temperatures, the ſmall portion of ſteam commonly in the air is too trifling to have any obſervable effect. Mr. Dalton has given a table founded upon experience, and adapted to the above-mentioned law, by which not only the actual quantity of water evaporated in atmoſpheric temperatures may be aſcertained, but alſo the quantity of vapour exiſting in the air may be found, provided the rate of evaporation is given. The following is an abſtract of it.

The firſt column of the table expreſſes the temperature; the ſecond, the correſponding force of vapour in vacuo, derived from experiment; the third column expreſſes the number of grains of water evaporated per minute, from a ſurface of $28\frac{1}{4}$ ſquare inches, in a moderate current of air or nearly calm; the fourth is the like evaporation in a medium current; and the fifth is the evaporation when a ſtrong breeze exiſts, or a rapid current of air ſweeps over the evaporating ſurface. The air is ſuppoſed to be perfectly dry or free from vapour; otherwiſe every particular ſtate of atmoſpheric vapour would require a table. The table is intended to be uſed when we want to find the quantity of water evaporated from a given ſurface by the ſlow and gradual operation of the atmoſpheric temperature, or what has been called *ſpontaneous* evaporation. But as it is adapted to air perfectly free from vapour, it cannot be of any practical utility without further data. The force of vapour actually exiſting in the atmoſphere at the time muſt be firſt aſcertained, by determining the temperature at which dew begins to be formed on a glaſs, &c. containing cold water or a cold mixture. Then the force due to that temperature muſt always be ſubtracted from the whole force due to the given temperature of the evaporating water.

TABLE.

Temperature	Force of vapour in Inch. of Mer.	Grains of Water evaporated.		
		Loweſt	Mean	Higheſt
212°	30.00	120	154	189
20°	.129	.52	.67	.82
25	.156	.62	.79	.97
30	.186	.74	.95	1.17
35	.221	.80	1.14	1.39
40	.263	1.05	1.35	1.65
45	.316	1.26	1.62	1.99
50	.375	1.50	1.92	2.36
55	.443	1.77	2.28	2.78
60	.524	2.10	2.70	3.30
65	.616	2.46	3.16	3.87
70	.721	2.88	3.70	4.53
75	.851	3.40	4.37	5.34
80	1.000	4.00	5.14	6.29
85	1.17	4.68	6.07	7.46

Problem 1.—Having given the quantity of force of atmoſpheric vapour, to find the rate of evaporation,—

Suppoſe that atmoſpheric vapour begins to be condenſed at 50°, and the temperature of the air is 60°; query the rate of evaporation, with a medium breeze?

Whole evaporating force, per table, for 60° = 2.70 grains.
Exiſting force of atmoſpheric vapour for 50° = 1.92 grains.
Remainder - - .78 grains.

Hence a ſurface of $28\frac{1}{4}$ inches would loſe $\frac{78}{100}$dths of a grain in each minute.

Again; ſuppoſe the atmoſpheric vapour to be at 20°, with a ſtrong breeze, in one caſe, the air being 32°; and the atmoſpheric vapour to be at 50°, in another caſe, with calm air at 58°; query the rates of evaporation in thoſe two caſes?

1ſt Caſe. Whole evaporating force per table, for 32° - - - = 1.26 grains.
Exiſting force of atmoſ. vap. for 20° = .82 grains.
Remainder, or rate of evaporation = .44 grains.

2d Caſe. Whole evaporating force, per table, for 58° - - - = 1.96 grains.
Exiſting force of atmoſ. vap. for 50° = 1.50 grains.
Remainder, or rate of evaporation = .46 grains.

Hence it appears that under the circumſtances above-mentioned the evaporation would be nearly the ſame in both caſes.

Problem 2.—Having given the rate of evaporation, to find the quantity or force of amoſpheric vapour.

Suppoſe the evaporation from a ſurface of $28\frac{1}{4}$ inches is found to be one grain in a minute, with a medium breeze, the temperature being 70°; query the quantity and force of atmoſpheric vapour?

Whole evaporating force, per table, at 70° = 3.70 grains.
Obſerved evaporating force - - = 1.00 grains.
Remainder = exiſting atmoſpheric force 2.70 grains,

which correſponds to 60°, for the temperature at which the atmoſpheric vapour would be found to be condenſed at the time.

Mr. Dalton contends that all the different gaſes conſtituting the atmoſphere, namely, azotic, oxygenous, carbonic acid, and ſteam, are independent of each other; ſo that they preſs the ſurface of the earth and other bodies with their own weight only, when in a ſtate of equilibrium. Whence he conſiders the *quantity* and *force* of ſteam in the atmoſphere as ſynonymous terms. Thus in the above example, the force of ſteam of 60° being repreſented by .524 parts of an inch of mercury, the weight of the incumbent atmoſphere of ſteam muſt be the ſame, or equal to 7 inches of water nearly. This notion, concerning the whole quantity of ſteam in the atmoſphere incumbent upon any place, is entirely new; and, if correct, muſt be of the firſt importance in meteorology.

Though the reaſons aſſigned by De Luc and Dalton for the non-condenſation of ſteam, already exiſting in air, appear to be incontrovertible, yet from what has been ſaid above, no ſufficient reaſon has been given by either of them for the *entrance* of ſteam of low temperatures into the atmoſphere. How does ſteam of $\frac{1}{60}$th part of the force of the atmoſphere at firſt penetrate it? Even Sauſſure ſpeaks of the fact, and as if there were no difficulty attending it. De Luc does not attempt any explanation. Dalton ſeems to have been fully aware that the hypotheſis of pure ſteam exiſting in air was not tenable without obviating this difficulty. Accordingly he conceived that the particles of ſteam are not repulſive to thoſe of air, but only to other particles of ſteam; hence the new formed ſteam has a kind of vacuum, to enter in the pores or interſtices of the air. But this, it is thought by many, is going into the other extreme, and making the facility much too great; beſides, there is no notion ſo general and ſo probable, as the one that heat is the cauſe of repulſion; and if this notion be true, the particles of ſteam cannot be admitted to be repulſive of each other, and indifferent to thoſe of air. Mr. Dalton, it ſeems, now conſiders the inequality in the ſize of the ultimate particles of different elaſtic fluids to be the cauſe why they are conſtantly diffuſing themſelves through each other, and never obtain a proper equilibrium till their particles take the arrangement, which they would do in a vacuum; and the elevation of ſteam from the ſurface of water, he ſuppoſes, takes place, becauſe certain particles of the ſurface are in a great meaſure exempt from the preſſure of the atmoſphere. See New Syſtem of Chemical Philoſophy, p. 190.

From the experiments of Mr. Watt on ſteam, it appears that evaporation at high and low temperatures is much the ſame as to the expenditure of heat for a given weight of water.

The evaporation from ice of 32° does not differ materially from that of water, at the ſame temperature. Electricity is ſaid to promote evaporation in ſome degree.

Evaporation in Meteorology.—With reſpect to the natural evaporation of water from the ſurface of the earth, the experiments of Mr. Hoyle and Mr. Dalton, of Mancheſter, are nearly the only ones that are ſufficiently numerous from which to draw any concluſions. They took a cylindrical veſſel of tinned iron, 10 inches in diameter, and three feet deep; there were two pipes ſoldered into it, one at the bottom, the other at the top, for the water to run off into bottles. The veſſel was filled with gravel, ſand, and ſoil, and ſubſequently the ſoil was covered with graſs and other living vegetables. It was nearly buried in the ground in an open ſituation, and proviſion made for placing bottles to the two pipes. In this manner it was expoſed to receive the rain, and to ſuffer evaporation from the ſurface, the ſame as the ſurrounding green ground. A regular regiſter was kept of the water which percolated through the ſoil and gravel into the bottles; and a rain gage of the ſame ſurface was kept cloſe by, for the ſake of compariſon. The reſults are contained in the table below, together with the mean evaporation from a like ſurface of water, for the three ſucceeding years.

Water through the two Pipes.							
	1796	1697	1798	Mean.	Mean Rain.	Mean Evap. from Ground	Mean Evap. from Water.
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
January	1.90	.68	1.77	1.45	2.46	1.01	1.50
February	1.78	.92	1.12	1.27	1.80	.53	2.00
March	.43	.07	.34	.28	.90	.62	3.50
April	.22	.30	.18	.23	1.72	1.49	4.50
May	2.03	2.44	.01	1.49	4.18	2.69	4.96
June	.17	.73	—	.30	2.48	2.18	6.49
July	.15	03	—	.06	4.15	4.09	5.63
Auguſt	—	—	.50	.17	3.55	3.38	6.06
September	—	.98	—	.33	3.28	2.95	3.90
October	—	.68	—	.23	2.90	2.67	2.35
November	—	1.04	1.59	.88	2.93	2.05	2.04
December	.20	3.08	1.88	1.72	3.20	1.48	1.50
	6.88	10.95	7.39	8.41	33.55	25.14	44.43
Rain	30.63	38.79	31.26				
Evap.	23.75	27.84	23.87				

From this table it appears that the evaporation from a ſurface of water, is nearly twice as much as from green ground; alſo, that about eight or nine inches of rain are left for the ſupply of ſprings and rivers. This ſurplus of water muſt be evaporated from the ſea, and return to it again by the rivers.

Evaporation in Chemiſtry.—When artificial heat is applied, the quantity evaporated will be nearly in geometrical progreſſion to the exceſs of temperature, above that of the air. It is always nearly in proportion to the ſurface expoſed. When the liquid is much below the margin of the veſſel, the evaporation is greatly retarded.

Evaporation in the Arts. In certain arts, ſuch as dyeing, printing, &c. quick evaporation is expedient. This is effected by expoſing the wet pieces in a ſtove, which has commonly a fire and long flues from which the heat is diſſipated into the room. The cold air ſhould be admitted into the room as near the fire and flues as poſſible; and ſeveral ſmall openings at the top of the ſtove ſhould be made to ſuffer the vapoury air to eſcape.

See the articles CLOUDS, DEW, DISTILLATION, HYGROMETER, RAIN, STEAM, &c.

EVAPORATION, in *Pharmacy*, *Chemiſtry*, &c. denotes an operation by which the more aqueous and volatile parts of fluids are ſpent, or driven away in ſteam, ſo as to leave the remaining part ſtronger, or of a higher conſiſtence than before.

Evaporation is effected by ſetting a liquor over a gentle heat, to carry off the moſt fluid and volatile parts, without leſſening the quantity of the other matters with which the liquor is impregnated.

The veſſels uſed for this purpoſe are baſons, teſts, or crucibles, which are made of glaſs, metal, or earth, according to the nature of the bodies on which the operation is to be performed. They are flat, ſhallow, and wide, ſo that the body from which the evaporation is to be made may preſent a large ſurface to the air. In all evaporations the degree of heat ought to be proportioned to the volatility of the ſubſtance to be evaporated, and to the degree of fixity of the ſubſtance intended to be left, and of its adheſion to the volatile parts. In ſome caſes, as in obtaining oil from rectified ſpirit of wine and ether, the liquors ought to be evaporated upon the ſurface of water in open air, without any other heat than that of the atmoſphere; in others, when the part to be evaporated is not very volatile, and when the remaining ſubſtance is very fixed, and does not adhere much to the volatile part, as in the purification of gold by antimony, a ſtrong heat may be applied, and a current of air directed upon the ſurface of the body. Macquer.

EVARCHUS, in *Ancient Geography*, a river of Aſia, forming the boundary between Paphlagonia and Cappadocia. Valerius Flaccus aſſigns it to Scythia, and ſays it abounded with ſwans.

EVARISTUS, in *Biography*, biſhop of Rome, was elected to that office about the year 100, in which he continued eight or nine years. Much has been ſaid of him with regard to his decretals; his diſtribution of Rome into pariſhes, his preſenting Adrian with a book concerning the excellence of the Chriſtian religion, and his martyrdom under the reign of that emperor; but theſe and other facts collected by modern writers do not ſtand on ſufficient authority to obtain credit. Moreri.

EVASION, EVASIO, in *Law*, is uſed for any ſubtile endeavour to ſet aſide truth, or to eſcape the puniſhment of the law, which will not be endured. Thus, if a perſon ſays to another that he will not ſtrike him, but will give him a pot of ale to ſtrike him firſt; and accordingly he ſtrikes, the returning of it is puniſhable; and if the perſon firſt ſtriking be killed, it is murder; for no man ſhall evade the juſtice of the law by ſuch a pretence to cover his malice. 1 Hawk. P. C. 81.

EUASPLA, in *Geography*, a river of India, in the northern part of the mountain Paropamiſus, which ran S.E. into the Indus.

EVATES, a branch or diviſion of the ancient Celtic philoſophers, the Druids.

Strabo diſtributes the philoſophers among the Britons and Gauls into three ſects; Βαρδοι, *Bards*, Ουατεις, *Evates*, and Δρυιδαι, *Druids*. He adds, that the Bards were poets and muſicians; the Evates, prieſts and naturaliſts; and the Druids, moraliſts as well as naturaliſts. But Marcellinus, Voſſius, and Hornius, reduce them all to two ſects, *viz.* Bards and Druids. Laſtly, Cæſar, lib. vi. comprehends them all under the name of *Druids*; which ſee.

The Evates or Vates of Strabo might probably be what other authors, and particularly Ammian. Marcellin. calls *Eubages*; but Mr. Bouche, in his Hiſt. de Provence, lib. ii. chap. 2. diſtinguiſhes between them. The Vates, he ſays, were ſuch as took care of the ſacrifices and other ceremonies of religion; and the Eubages, thoſe who ſpent their time in the ſearch and contemplation of the great myſteries of nature.

EVAUX, in *Geography*, a town of France, in the department of Creuſe, and chief place of a canton, in the diſtrict of Aubuſſon; 26 miles E. of Gueret. The number of inhabitants in the place is 2,081, and in the canton 8,036, and the territorial extent of 232½ kiliometres includes 12 communes. Near it are a mineral ſpring and baths. N. lat. 46° 10′. E. long. 3° 33′.

EVAX, in *Botany*, Gærtn. v. 2. 393, ſee Filago.

EVAZA, in *Ancient Geography*, an epiſcopal ſee of Aſia propria, under the metropolis of Epheſus; mentioned in the acts of the council of Epheſus.

EUBAGES, an order of prieſts or philoſophers among the ancient Celtæ or Gauls. Chorier takes the Eubages to be the ſame with the Druids and Saronidæ of Diodorus. Others will have the Eubages to be thoſe whom Strabo, lib. iv. p. 197. calls Ουατεις, *Evates*, or *Vates*, on which principle there is room to conjecture, that the word ſhould be written Ουαγεις, it being eaſy to miſtake a Γ for a T. See Druid.

EUBELSTADT, in *Geography*, a town of Germany, in the biſhopric of Wurzburg, on the Maine; three miles S. of Wurzburg.

EUBŒA, in *Ancient Geography*, one of the moſt conſiderable of the Greek iſlands, formerly joined to Bœotia, as Pliny informs us, by an iſthmus, ſo narrow is the Euripus in ſome places, which ſeparates it from the continent; and extending from north-eaſt to ſouth-weſt 150 miles; but where broadeſt being only 40 miles, and 20 where it is narroweſt. In compaſs it is eſtimated at 365 miles. This iſland was anciently denominated Chalcis, Ellopia, Aonia, Abantis or Abantia, Macris, Oche, Bomo, &c. Its appellation Eubœa is ſaid to be derived from a famous cave on the eaſtern coaſt of the iſland, called by the Greeks αυλη βοος, or the ox ſtall, and this name was probably deduced from its excellent paſtures. Eubœa had ſeveral remarkable promontories, which ſtretched far into the ſea; of theſe Pliny and Mela mention three, *viz.* Geraſtus and Caphareus to the ſouth, and Cenæum to the north; and Strabo mentions a fourth, which he calls Petalia, over-againſt Sunium. Cenæum, now Capo Liter, and Geraſtus, now Capo Roſſo, are, according to Strabo, 1200 furlongs diſtant from each other, which meaſure exactly the length of the iſland, as it is ſet down by Pliny. The mountains of Eubœa are high, and covered during a great part of the year with ſnow. The famous city of Chalcis was ſituated under one of them of the ſame name, and on another, called Dryphis, was a temple dedicated to Diana. The following rivers are mentioned by Strabo, *viz.* Callas, Budarus, Cireczus, and Neleus or Melas. The champaign country was exceedingly fertile, and yielded great plenty of corn, wine, oil, and all ſorts of delicious fruits; but it was chiefly famous for its rich paſtures. This iſland had in former times many cities of great note, which are mentioned by Strabo, Pliny, Ptolemy, and Mela. On the eaſtern coaſt ſtood the cities of Geraſtus, which was a famous haven, Petalia, and Caryſtus, near which were the celebrated quarries of Caryſtian marble, ſo much valued by the Romans, and alſo of Amianthus or Aſbeſtos. About five miles from Caryſtus was the village of Amarynthus, famous for a temple of Diana. On the ſame coaſt ſtood Eretria and Chalcis, which ſee reſpectively. Between Chalcis and the promontory Cenæum, ſtood the cities of Edepſum and Oreos; the former being famous for its hot-baths, and the latter one of the moſt powerful cities of Eubœa during the Trojan war, and occupying the fourth part of the iſland, in the time of Philip, the father of Alexander. The name Oreos was changed by the Athenians, when they became maſters of the iſland by means of Pericles, into that of Iſtiæa, or Heſtiæa, which was the name of their tribe. On the north ſide of the iſland, oppoſite Theſſaly, and extending from Cenæum to Artemiſium, ſtood Dia, or Athenæ Diades; and on the coaſt, waſhed by the Ægean ſea, ſtood the maritime city of Cerinthus. The inland cities mentioned by Strabo, Pliny, Ptolemy, &c. were Ellopia, Nyſa, Eubœa, Orabiæ, Rhamnus, Porthmus, Algæ, and Tamyna.

Eubœa was probably one of the iſlands in which the firſt Orientals, who paſſed from the continent of Aſia towards the coaſts of Greece, made a ſettlement. It muſt have formed a very powerful ſtate at an early period, ſince its king Elephenor conducted 40 ſhips to the war of Troy. Solinus aſcribes the commencement of this monarchy to the Titans. Others ſuppoſe Abas to have been the firſt ſovereign of Eubœa. The ſucceſſion of its ſovereigns is little known. In the time of Darius Hyſtaſpis, the cities of Chalcis, Eretria, Caryſtus, and Oreos, formed diſtinct republics, governed by the nobles, whom they called hippobates, or horſemen; none being received into the government who were not able to maintain a certain number of horſes. This oligarchy was not of long duration; but it was ſucceeded by a democracy, compoſed of domeſtic tyrants, who ſeized all power to themſelves, and ruled in their ſeveral cities without controul. At length the Eubœans ſubmitted firſt to Philip of Macedon, and then to his ſon Alexander, on whoſe death they endeavoured to ſhake off the Macedonian yoke; but they were again brought under ſubjection by Antigonus. When the Romans firſt paſſed into Greece, the kings of Macedon held this iſland in ſubjection; but it was ſoon after declared free by the ſenate, in order to weaken the power of Philip in theſe parts. But not being ſupplied with forces, they were unable to maintain their liberty; and fell under the power of Antiochus the Great, and Mithridates king of Pontus. The Romans, however, prevailing in the Eaſt, reſtored the Eubœans to their former ſtate of liberty. It was not long before Marc Antony ſubjected them to Athens; but Auguſtus, incenſed againſt the Athenians for aſſiſting his rival, firſt gave freedom to the city of Eretria, and ſoon after to the whole iſland, which remained in a flouriſhing condition, under its own laws, till the reign of Veſpaſian, when it underwent the ſame fate as the other ſtates of Greece.

Eubœa, the name of ſeveral towns in the iſland of Eubœa, Corcyra, and Lemnos.

EUBULIDES, in *Biography*, a native of Miletus, was a ſucceſſor of Euclid in the Megaric ſchool. He was a ſtrong opponent of Ariſtotle, and ſeized every occaſion of cenſuring his writings and calumniating his character. He introduced new ſubtleties into the art of diſputation, ſeveral of which, though often mentioned as proofs of great ingenuity, deſerve only to be remembered as examples of egregious trifling. They belong to that ſophiſtical mode of reaſoning, called by Ariſtotle eriſtic ſyllogiſms. A ſingle ſpecimen will be ſufficient. It ſhall be of the ſophiſm, called from the example, "the Lying:" if, when you ſpeak the truth, you ſay you lie, you lie; but you ſay you lie, when you ſpeak the truth; therefore in ſpeaking the truth, you lie. Theſe ſilly inventions for perplexing plain truth were formerly in ſuch high repute, that Chryſippus wrote ſix books upon the above mentioned ſophiſm; and Philetas, a Choan, died of a conſumption which he contracted by the cloſe ſtudy he beſtowed upon it. The inſcription upon his tomb was Ὁ ψευδόμενος, "The Deceived." Brucker's Hiſt. Phil. by Enfield, vol. i. p. 192.

EUCALYPTUS, in *Botany*, from ευ, *well*, and καλυπτος, *covered*, alluding to the peculiar lid which covers the calyx and encloſes the organs of impregnation. L'Herit. Sert. Angl. 18. Ait. Hort. Kew. v. 2. 157. Willd. Sp. Pl. v. 2. 976. Mart. Mill. Dict. v. 2. Sm. Bot. of N. Holl. 39. Juſſ. 451. Claſs and order, *Icoſandria Monogynia*. Nat. Ord. *Heſperideæ*, Linn. *Myrti*, Juſſ.

Gen. Ch. *Cal.* Perianth ſuperior, of one leaf, abrupt, entire, permanent, cloſed before impregnation with a convex or conical, entire, deciduous lid, which is ſometimes, if not always, of two or three layers. *Cor.* none. *Stam.* Filaments numerous, thread-ſhaped, equal, inſerted into the margin of the calyx within the lid, and not expanding till after it falls, anthers roundiſh, two-lobed, ſmall. *Piſt.* Germen inferior, urceolate, firmly united with the baſe of the calyx, ſometimes angular; ſtyle ſimple, columnar, about as long as the full-grown ſtamens; ſtigma ſimple, bluntiſh. *Peric.* Capſule roundiſh, crowned with the rim of the calyx, of three or four cells, opening at the top. *Seeds* numerous, angular, ſmall.

Eſſ. Ch. Calyx ſuperior, permanent, truncated, covered before flowering with an entire lid, which ſoon falls off. Capſule of three or four cells, opening at the top. Seeds numerous.

This genus was founded by the late M. L'Heritier in his Sertum Anglicum, upon a ſingle ſpecies, from Van Diemen's land, named by him *obliqua*, and figured in the 20th plate of that work. Its deſcription never appeared. The generic characters were by him communicated to the Hortus Kewenſis, and adopted, with ſome neceſſary corrections, in Dr. Smith's Botany of New Holland, where a ſecond ſpecies is figured, *E. robuſta*, t. 13. This is called New Holland Mahogany, or Brown Gum Tree, and is one of the lofticſt trees about Port Jackſon, being often 100 feet high, and proportionably thick. The wood hard, heavy, ſtrong, red and very reſinous. *Leaves* alternate, ſtalked, ovate, entire, a little oblique and unequal. *Flowers* in denſe ſimple umbels, of a tawny yellow, on ſimple or divided angular ſtalks, growing in a corymboſe manner about the ends of the branches. The *lid* in this ſpecies is conical, as long as the calyx and germen, with a ſtricture in the middle; that of the former is ſhort and hemiſpherical, with a minute point. Four more ſpecies from New South Wales are deſcribed in the work laſt mentioned, and ſix additional ones by the ſame author in the Tranſ. of the Linn. Soc. v. 3. p. 283—288. All theſe 12 are adopted by Willdenow in his Sp. Pl. A new one, *E. marginata*, was added to this liſt by Dr. Smith in Tr. of Linn. Soc. v. 6. 302, who has ſince figured and fully deſcribed one of the moſt important of the former, *E. reſinifera*, the Red Gum Tree, in his Exotic Botany, v. 2. 49. t. 84. This bloſſomed in Lady De Clifford's greenhouſe at Paddington. The *flowers* are green with white ſtamens. *Lid* conical, twice as long as the calyx and germen, conſiſting of three coats, of which the outermoſt is formed of three ribs originating from the angles of the germen.—The tree produces an aſtringent reſin of a fine deep red, whoſe probable uſes in medicine or the arts merit enquiry. Many more ſpecies of this genus are ſaid to abound in New Holland, all lofty trees, deſtitute of hairineſs, with ſimple, lanceolate, or ſomewhat ovate, pointed, entire leaves, generally oblique, and often unequal, at the baſe; without ſtipulas. They are commodiouſly divided into two ſections, by their hemiſpherical or conical lids.

EUCARPIA, in *Ancient Geography*, a town of Aſia, in Greater Phrygia, according to Ptolemy and Strabo.

EUCERA, in *Entomology*, a genus of Hymenoptera, propoſed by Scopoli, and adopted by various late writers. Under this denomination are comprehended thoſe of the Linnæan genus Apis (bee), which have the mandibles horny, incurvated, acute, and toothleſs; jaw elongated, and membranaceous at the tip; lip horny, five-cleft; tongue inflected and ſeven-cleft; antennæ cylindrical, thoſe of the male very long, and often exceeding the length of the body; the abdomen ſhort and downy; tail of the female armed with a ſting. The inſects of this genus form cylindrical cavities in the earth, in which they depoſit their eggs, each included in a ſeparate cell, and furniſhed with a ſuitable proviſion of honey for the ſubſiſtence of the young when hatched. In the winged ſtate the Euceræ fly with great rapidity, and like the bee, collect the farina and nectar of flowers with great induſtry and activity. The females commonly differ much in appearance from the males of the ſame ſpecies, independently of the length of the antennæ.

Species.

Longicornis. Black; ſummit of the head, thorax, and two firſt rings of the abdomen above grey-downy; reſt of the abdomen nearly glabrous. Latreille. *Eucera longicornis*, Fabr. Kirby. Ap. Angl.

Native of Europe. The female of this ſpecies is not diſtinctly aſcertained. Mr. Kirby ſeems to entertain no doubt of its being the inſect figured by Panzer under the name of Andrena ſtrigoſa. Since his obſervations appeared, however, Latreille has written on the ſame ſubject, and though he does not refer to the remark of Mr. Kirby, he evidently alludes to it in the following paſſage, "Je doute que l'andrene, que Panzer nomme *ſtrigoſa*, ſoit la femelle de cette eſpèce. Son abdomen eſt très-différent par ſes taches de celui de *l'eucere longicorne* et cet inſecte ne paroît qu'au milieu du l'ete, tandis que le dernier ne ſe voit, qu'au printemps." The difference of the abdomen may perhaps be conſidered in this ambiguous race leſs definitive than the time of its appearance in the winged ſtate; for if the firſt be conſtantly found only in the middle of the ſummer, and the other in ſpring, we ſhould admit them to be diſtinct. It further merits obſervation that Latreille deſcribes an inſect which he imagines to be the true female, "La femelle, &c."—"The female, or, at leaſt, that which I regard as ſuch, and of which I have ſeen an individual in the collection of the naturaliſt Baumhaaver, differs only in the ſhortneſs of the antennæ; the head entirely black, and the poſterior feet very downy." The ſpecies inhabits Europe.

Atricornis. Antennæ black, as long as the body, which is hairy and ferruginous. Fabr.

Native of Barbary.

Glauca. Antennæ ferruginous, as long as the body, the latter hairy and glaucous. Fabr. Sp. Inſ. &c.

Inhabits the Eaſt; two firſt ſegments of the abdomen with a black band.

Linguaria. Antennæ black, length of the abdomen; thorax cinereous; abdomen black. Fabr.

Native of Europe, on flowers.

Tumulorum. Antennæ length of the abdomen; body black; legs and jaws yellowiſh. Linn. Fn. Suec. *Eucera tumulorum*, Fabr.

An European inſect, alſo found on flowers.

Griſescens. Antennæ black, as long as the body; the latter hairy and cinereous. Fabr.

Inhabits Barbary.

Antennata. Antennæ as long as the body; abdomen black, with whitiſh ſtreaks. Fabr.

A ſmall inſect, found in abundance in the environs of Paris in autumn, and alſo in other parts of Europe. The lip is marked with a trilobate ſpot of yellow; the head and thorax cinereous; abdomen glabrous; edges of the ſegments fringed with white, legs teſtaceous.

Curvicornis. Blackiſh-grey; antennæ convoluted, ſub-clavated; abdomen roundiſh; margin of the wings black. Scopoli. Native of Carniola.

Brevicornis. Ferruginous hairy; abdomen braſſy; antennæ ſhort and black. Fabr. Suppl.

This is an inhabitant of Italy, and is deſcribed by Fabricius from the cabinet of Dr. Allioni. The head, thorax, and legs with ferruginous hairs.

Craſſipes. Hairy cinereous; abdomen black, with the margins of the ſegments greeniſh; poſterior thighs thick. Fabr. Suppl.

Native of Tranquebar in the cabinet of Lund. The antennæ of this inſect are ſhort; the wings are duſky with fuſcous tip; legs yellowiſh; thighs of the poſterior pair thick, dentated, and black; ſhanks incurvated, toothed, and yellow. Whether this and the ſpecies immediately preceding ought ſtrictly to be placed with the Euceræ, (ſo named from the length of their antennæ,) if they ſhould be of the male kind, may be ſubmitted with deference; the ſex is not mentioned in either inſtance. Fabricius deſcribed them as Euceræ, and they agree in every reſpect with that genus, except in the remarkable brevity of the antennæ.

EUCHARIST, Euchariſtia, the ſacrament of the Supper, or a participation of the body and blood of Chriſt, under the ſpecies or figures of bread and wine. See Communion, Sacrament, Species, Tranſubſtantiation, and Conſubſtantiation.

The word in its original Greek, Ευχαριϛια, literally imports *thankſgiving*, being formed of ευ, *bene*, *well*, and χαρις, *gratia*, *thanks*.

EUCHENDORF, in *Geography*, a town of Lower Bavaria, on the Vils; 14 miles W. of Vilzhofen.

EUCHERIUS, in *Biography*, a biſhop of Lyons in the fifth century, began his career in ſecular life, in the various offices of which he acquired wealth. He ſuſtained the rank of ſenator, and having married, had ſeveral children, among whom were two ſons, whom he lived to ſee advanced to the epiſcopal dignity. Wearied with the purſuits of the world, he embraced a monaſtic life, which he quitted for the biſhopric of Lyons in the year 434. He attended the deliberations of the firſt council of Orleans in the year 441, and was diſtinguiſhed for his learning and ſagacity. He was a popular preacher, upon thoſe principles of grace which were vindicated by St. Auguſtine. He died about the year 454. Among the various pieces attributed to Eucherius, may be noted "Epiſtola de Laude Eremi, ſeu de Vita Solitaria," intended to extol the advantages of aſcetic life, written, for the times, with uncommon beauty and purity of language: "Epiſtola Parænetica de contemptu Mundi, et Sæcularis Philoſophiæ ad Valerianum Cognatum ſuum," which was publiſhed by Eraſmns, with annotations, at Baſil in the year 1520, and pronounced to be one of the moſt elegant pieces of antiquity. To theſe may be added two treatiſes intended to illuſtrate difficult paſſages of Scripture, of leſs value than thoſe mentioned above. Theſe, and ſome others attributed to Eucherius, were collected and publiſhed at Baſil in 1531, at Rome in 1564, and are likewiſe to be found in the ſixth volume of the "Bibliotheca Patrum." There was another Eucherius who was likewiſe a biſhop of Lyons, and aſſiſted at the ſecond council of Orleans about the year 529. Moreri.

EUCHITES, or Euchitæ, in *Eccleſiaſtical Hiſtory*, a ſect of ancient heretics, who were firſt formed into a religious body towards the end of the fourth century, though their doctrine and diſcipline ſubſiſted in Syria, Egypt, and other eaſtern countries before the birth of Chriſt; they were thus called becauſe they prayed without ceaſing, imagining that prayer alone was ſufficient to ſave them.

Their great foundation was thoſe words of St. Paul, Epiſt. i. to the Theſſalonians, chap. v. ver. 17. *pray without ceaſing.*

The word is formed of the Greek, ευχη, *prayer*, whence ευχιται, the ſame with the Latin, *precatores*, *prayers*. They were alſo called *Enthuſiaſts* and *Maſſalians*, a term of Hebrew origin, denoting the ſame as Euchites.

The Euchites were a ſort of myſtics who imagined, according to the oriental notion, that two ſouls reſided in man, the one good and the other evil; and who were zealous in expelling the evil ſoul or dæmon, and haſtening the return of the good ſpirit of God, by contemplation, prayer, and ſinging of hymns. They alſo embraced the opinions nearly reſembling the Manichean doctrine, and which they derived from the tenets of the oriental philoſophy. The ſame denomination was uſed in the twelfth century, to denote certain fanatics who infeſted the Greek and Eaſtern churches, and who were charged with believing a double Trinity, rejecting wedlock, abſtaining from fleſh, treating with contempt the ſacraments of Baptiſm and the Lord's Supper, and the various branches of external worſhip, and placing the eſſence of religion ſolely in external prayer, and maintaining the efficacy of perpetual ſupplications to the Supreme Being for expelling an evil being or genius, which dwelt in the breaſt of every mortal. This ſect is ſaid to have been founded by a perſon called Lucopetrus, whoſe chief diſciple was named Tychicus. By degrees it became a general and invidious appellation for perſons of eminent piety and zeal for genuine Chriſtianity, who oppoſed the vicious practices and inſolent tyranny of the prieſthood; much in the ſame manner as the Latins comprehended all the adverſaries of the Roman pontiff under the general terms of *Waldenſes* and *Albigenſes*. Moſh. Eccl. Hiſt. Eng. edit. 8vo. vol. i. p. 350. and vol. ii. p. 441.

St. Cyril of Alexandria, in one of his letters, takes occaſion to cenſure ſeveral monks in Egypt, who, under pretence of reſigning themſelves wholly to prayer, led a lazy, ſcandalous life. A cenſure likewiſe applicable to monaſteries in general.

EUCHOLOGIUM, Ευχολογιον, a Greek term, ſignifying, literally, *a diſcourſe on prayer.*

The word is formed of ευχη, *prayer*, and λογος, *diſcourſe.*

The Euchologium is properly the Greek ritual, wherein are preſcribed the order and manner of every thing relating to the order and adminiſtration of their ceremonies, ſacraments, ordinations, &c.

Fa. Goaar has given us an edition of the Greek Euchologium in Greek and Latin, with notes, at Paris.

EUCHROON, in *Surgery*, a plaſter mentioned by Scribonius Largus.

EUCHYMIA, from ευ, *good*, and χυμος, *juice*, in *Medicine*, a good temper of the blood, or other juices and fluids in an animal body.

EUCLABRIS, in *Antiquity*, a table whereon the ſlaughtered victim was ſpread, in order to have its inteſtines carefully inſpected. It was from this table that the veſſels uſed in ſacrifices were called *euclabria.*

EUCLASE. The colour of this mineral is a very clear ſea-green. It occurs only cryſtallized. Its primitive form is that of an oblique quadrilateral priſm, but its ſummits are generally ſo complicated by truncatures and bevellings as to render a mere verbal deſcription of it wholly unintelligible: in this ſtate it reſembles certain varieties of topaz, but may readily be diſtinguiſhed by meaſuring the obtuſe angles of the priſm, which in this mineral are 133°, whereas in the topaz they are 124°; its lamellæ alſo are not perpendicular to the axis of the priſm. It has a brilliant vitreous luſtre. Its fracture in the direction of its axis and parallel to the ſmall diagonal of its baſe is perfectly lamellar; but when parallel to the large diagonal is very imperfectly ſo. Its croſs fracture is ſomewhat conchoidal. It is tranſparent and has a double refraction. It is ſufficiently hard to ſcratch quartz, but is remarkably brittle. Sp. gr. = 3.06.

When expoſed to the blowpipe, it firſt loſes its tranſparency, and then melts into a white enamel. It has been analyſed by Vauquelin, with the following reſult:

Silex	35 to 36
Alumine	18 — 19
Glycine	14 — 15
Iron	2 — 3
	69 — 73
Loſs	31 — 27
	100 — 100

This mineral is ſo very rare that only a ſmall portion could be afforded for analyſis; of the loſs, Vauquelin attributes the greateſt part to water of cryſtallization, and the reſt is probably alkali.

The euclaſe was found in Peru by Dombey, and all the ſpecimens in the cabinets of Europe were brought over by this naturaliſt.

EUCLEA, in *Botany*, is derived by Profeſſor Martyn from ευκλεια, *glory*, or *celebrity*, which ſeems in no reſpect applicable to this plant. We would rather explain it by ευ, *well*, and κλειω, *to ſhut up*, becauſe of the manifold coverings of the ſeeds, each of which is encloſed in an arillus, within the cell of a capſule, whoſe outſide moreover is protected with a covering of pulp. To all this indeed L'Heritier firſt adverted, and not Linnæus nor Thunberg, one of whom probably invented the name. Linn. Suppl. 67. Thunb. Nov. Gen. 84. L'Herit. Sert. Angl. 31. Schreb. 699, 700. Juſſ. 432. Claſs and order, *Dioecia Dodecandria*, or perhaps, as the Linnæan Syſtem now ſtands, *Polygamia Monoecia.* Nat. Ord. uncertain, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, ſmall, with five teeth, permanent. *Cor.* of one petal, larger than the calyx, in five deep, ovate, obtuſe, equal, ſpreading ſegments. *Stam.* Filaments about fifteen, ſhort, inſerted into the receptacle; anthers erect, ſquare, ſlightly downy, ſhorter than the corolla. *Piſt.* Germen ſuperior, ovate, ſomewhat pyramidal; ſtyles two, the length of the ſtamens; ſtigmas ſimple. *Peric.* Capſule with a pulpy coat, roundiſh, with three horns, three cells, and three valves. *Seeds* ſolitary, roundiſh, each encloſed in an arillus; one or two of them frequently proving abortive.

Eſſ. Ch. Calyx with five teeth. Corolla in five deep equal ſegments. Stamens 15. Styles two. Capſule ſuperior, of three cells, pulpy-coated. Seeds ſolitary, encloſed in an arillus.

Obſ. L'Heritier, from whom the above characters are taken, remarks that ſome flowers have an abortive germen, but he never ſaw any that were entirely female without ſtamens. Thunberg deſcribes diſtinct male and female flowers, and aſſerts that the former are moſt frequently five-cleft, the latter four-cleft. Linnæus does not advert to any ſuch difference.

Thunberg defines three ſpecies, all natives of the Cape of Good Hope, in his Prodromus, p. 85.

1. E. *lancea.* "Leaves lanceolate, flat."

2. E. *racemoſa.* "Leaves ovate, flat."—E. racemoſa; Linn. Suppl. 428. L'Herit. Sert. Angl. 32. Ait. H. Kew. v 3. 411. (Padus foliis ſubrotundis, fructu racemoſo; Burm. Afric. 238. t. 84. f. 1: and Euonymus foliis ſubrotundis integris, fructu corniculato; ibid. 260. t. 97. f. 1. E. africanus, foliis laurinis, fructu aculeato; Breyn, Ic. 31. t. 22. f. 3.) A ſmooth branching ſhrub, with alternate, obovate, thick, ſomewhat revolute *leaves*, about an inch long, on ſhort footſtalks. *Flowers* eight or ten in each axillary drooping cluſter, about as long as its correſponding leaf. *Petals* ſnow-white. *Fruit* red, the ſize of a pea.

3. E. *undulata.* "Leaves ovate, undulated."—Much like the laſt in general aſpect. Its red fruit is eaten by the Hottentots, who call the plant Guarri-boſches.

EUCLID, in *Biography*, a native of Megara, and founder of the Megaric or Eriſtic ſect, was diſtinguiſhed by his ſubtle genius, and early application to the ſtudy of philoſophy. Having acquired ſome knowledge of the art of diſputation from the writings of Parmenides, he was induced by the fame of Socrates to remove from Megara to Athens, where he became the auditor and diſciple of this eminent philoſopher. Notwithſtanding the terror of the decree which enacted, that any inhabitant of Megara who ſhould be ſeen at Athens ſhould forfeit his life, he frequently came to Athens by night, from the diſtance of about 20 miles, concealed in a long female cloak and veil, to viſit his maſter. He alſo frequently engaged in the buſineſs and diſputes of the civil courts, by which proceeding he offended Socrates, who deſpiſed forenſic conteſts; and this circumſtance ſeems to have occaſioned a ſeparation between them. Afterwards he put himſelf at the head of a ſchool in Megara, where his chief employment was to teach the art of diſputation. Although he was much addicted to vehement debates, he poſſeſſed ſo great a command of temper, that in a quarrel with his brother, who ſaid to him, "Let me periſh if I be not revenged upon you," Euclid replied, "And let *me* periſh, if I do not ſubdue your reſentment by forbearance, and make you love me as much as ever."

Averſe from the analogical method of reaſoning, Euclid was of opinion that legitimate argumentation conſiſts in deducing fair concluſions from acknowledged premiſes. He held, that there is one ſupreme good, which is called by the different names of Intelligence, Providence, God; and that evil, conſidered as an oppoſite principle to the ſovereign good, has no phyſical exiſtence. The ſupreme good he defined to be that which is always the ſame. Good he therefore conſidered abſtractedly, as reſiding in the Deity, and he ſeems to have maintained, that all things which exiſt are good by their participation of the firſt good, and that in the nature of things there is no real evil. When Euclid was aſked his opinion concerning the gods, he replied, "I know nothing more of them than this; that they hate inquiſitive perſons." Brucker's Hiſt. Phil. by Enf. v. i.

Euclid, known to every well educated youth by his "Elements," was, according to the teſtimony of Pappus and Proclus, a native of Alexandria, in Egypt, where he flouriſhed and taught the mathematics in the reign of Ptolemy Lagus, about 300 years before Chriſt. His was the firſt mathematical ſchool in that far famed city, where, till its conqueſt by the Saracens, moſt of the eminent mathematicians were either born, or ſtudied. To Euclid, and to thoſe immediately educated by him, the world has been indebted for Eratoſthenes, Archimedes, Apollonius, Ptolemy, &c. "The Elements," to which we have already referred, are not to be wholly attributed to Euclid, many of the invaluable truths and demonſtrations contained therein were diſcovered and invented by Thales, Pythagoras, Eudoxus, and others; but Euclid was the firſt who reduced them to regular order, and who probably interwove many theorems of his own, to render the whole a complete and connected ſyſtem of geometry. "The Elements" conſiſt of fifteen books, but the laſt two are ſuſpected to have been written 200 years after Euclid's death, by Hypſicles of Alexandria. The beſt edition publiſhed in this country is that printed at Oxford, in folio, in 1703; but the moſt common edition in our ſchools is that by the late learned Dr. Simſon. Euclid is ſaid to have been a perſon of agreeable and pleaſing manners, and admitted to habits of friendſhip and familiarity with king Ptolemy, who once demanded of the mathematician if he could not direct him to ſome ſhorter and eaſier way of acquiring a knowledge of geometrical truths, than that which he had exhibited in his "Elements," to which Euclid replied, that "there was no royal road to geometry."

Euclid, as a writer on muſic, has ever been held in the higheſt eſtimation by all men of ſcience who have treated of harmonics, or the philoſophy of ſound. As Pythagoras was allowed by the Greeks to have been the firſt who found out muſical ratios, by the diviſion of a monochord, or ſingle ſtring, a diſcovery which tradition only had preſerved, Euclid was the firſt who wrote upon the ſubject, and reduced theſe diviſions to mathematical demonſtration.

His "Elements" were firſt publiſhed at Baſil, in Swiſſerland, 1533, by Simon Grynæus, from two MSS. the one found at Venice, and the other at Paris. His "Introduction to Harmonics," (Εισαγωγη ἁρμονικη,) which in ſome MSS. was attributed to Cleonidas, is in the Vatican copy given to Pappus; Meibomius, however, accounts for this, by ſuppoſing thoſe copies to have been only two different MS. editions of Euclid's work, which had been reviſed, corrected, and reſtored from the corruptions incident to frequent tranſcription by Cleonidas and Pappus, whoſe names were, on that account, prefixed. It firſt appeared in print with a Latin verſion, in 1498, at Venice, under the title of "Cleonidæ Harmonicum Introductorium:" who Cleonidas was, neither the editor, George Valla, nor any one elſe pretends to know. It was John Pena, a mathematician in the ſervice of the king of France, who firſt publiſhed this work at Paris, under the name of Euclid, in 1557. After this, it went through ſeveral editions with his other works.

His "Section of the Canon," (Κατατομη κανονος,) follows his "Introduction;" it went through the ſame hands and the ſame editions, and is mentioned by Porphyry, in his Commentary on Ptolemy, as the work of Euclid. This tract chiefly contains ſhort and clear definitions of the ſeveral parts of Greek muſic, in which it is eaſy to ſee that mere *melody* was concerned; as he begins by telling us, that the ſcience of *harmonics* conſiders the nature and uſe of melody, and conſiſts of ſeven parts: ſounds, intervals, genera, ſyſtems, keys, mutations, and melopœia; all which have been ſeverally conſidered in the diſſertation.

Of all the writings upon ancient muſic, that are come down to us, this ſeems to be the moſt correct and compreſſed: the reſt are generally looſe and diffuſed; the authors either twiſting and diſtorting every thing to a favourite ſyſtem, or filling their books with metaphyſical jargon, with Pythagoric dreams, and Platonic fancies, wholly foreign to muſic. But Euclid, in this little treatiſe, is like himſelf, cloſe and clear; yet ſo mathematically ſhort and dry, that he beſtows not a ſyllable more upon the ſubject than is abſolutely neceſſary.

His object ſeems to have been the compreſſing into a ſcientific and elementary abridgment, the more diffuſed and ſpeculative treatiſes of Ariſtoxenus. He was the D'Alembert of that author, explaining his principles, and, at the ſame time, ſeeing and demonſtrating his errors. The muſical writings of Rameau were diffuſed, obſcure, and indigeſted; but M. D'Alembert, extracting the eſſence of his confuſed ideas, methodized his ſyſtem of a *fundamental baſe*, and compreſſed, into the compaſs of a pamphlet, the ſubſtance of many volumes. See Elemens de Muſique, ſuivans les Principes de Rameau.

According to Dr. Wallis, (Phil. Tranſ. No. 242, and Lowthorp's Abridg. v. i.) Euclid was the firſt who demonſtrated that an octave is ſomewhat leſs than *ſix whole* tones; and this he does in the 14th theorem of his "Section of the Canon." In the 15th theorem he demonſtrates that a fourth is leſs than two tones and a half, and a fifth leſs than three and a half; but though this proves the neceſſity of a temperament upon fixed inſtruments, where one ſound anſwers ſeveral purpoſes, yet he gives no rules for one, which ſeems to furniſh a proof that ſuch inſtruments were at leaſt not *generally* known or uſed by the ancients.

What Ariſtoxenus called a *half-tone*, Euclid demonſtrated to be a ſmaller interval, in the proportion of 256 to 243. This he denominated a *limma*, or *remnant;* becauſe giving to the *fourth*, the extremes of which were called *ſoni ſtabiles*, and were regarded as fixed and unalterable, the exact proportion of 4 to 3, and, taking from it two major tones $\frac{8}{9}\times\frac{8}{9}$, the limma was all that remained to complete the diateſſaron. This diviſion of the diatonic genus being thus, for the firſt time, eſtabliſhed upon mathematical demonſtration, continued in favour, ſays Dr. Wallis, for many ages. But this is further explained in other articles.

EUCOMIS, in *Botany*, from ευκομης, *having beautiful hair*, alluding to the leafy tuft of barren bracteas, which crowns the ſpike of flowers. See Coma.—L'Herit. Sert. Angl. 17. Ait. Hort. Kew. v. 1. 432. Schreb. 798. Willd. Sp. Pl. v. 2. 92. Mart. Mill. Dict. v. 2. (Baſilæa; Lamarck

Encycl. v. 1. 382. t. 239. Juſſ. 52. Venten. v. 2. 163. Fritillaria; Linn. Gen. 164.) Claſs and order, *Hexandria Monogynia*. Nat. Ord. *Coronariæ*, Linn. *Aſphodeli*, Juſſ.

Gen. Ch. *Cal.* none. *Cor.* of one petal, inferior, bell-ſhaped, regular, permanent, in ſix deep, equal, oblong, obtuſe, ſpreading ſegments. *Stam.* Filaments ſix, ſhorter than the corolla, awl-ſhaped, dilated at the baſe and united by that part into a concave nectary, attached to the bottom of the corolla; anthers oval. *Piſt.* Germen ſuperior, ovate, with three furrows; ſtyle awl-ſhaped; ſtigma ſimple. *Peric.* Capſule ovate, three-lobed, of three cells. *Seeds* numerous, ſmall, ovate.

Eſſ. Ch. Calyx none. Corolla inferior, in ſix deep, ſpreading, permanent, equal ſegments. Filaments united at their baſe into a concave nectary, attached to the corolla.

1. E. *nana*. Ait. Hort. Kew. v. 1. 432. Jacq. Hort. Schoenbr. v. 1. 47. t. 92. (Fritillaria nana; Linn. Mant. 223.) Stalk club-ſhaped. Leaves numerous, broad-lanceolate, crenate. Barren bracteas elliptical.—Native of the Cape of Good Hope, as are all the known ſpecies. *Bulb* ovate, rather large. *Leaves* radical, about eight, pale-green, ſpreading, recurved, obovato-lanceolate, ſomewhat acute. *Stalk* ſolitary, a ſpan high, green, ſwelling conſiderably upwards, bearing a ſhort ſpike of green drooping *flowers*, ſurmounted with a tuft, about as long as the ſpike, conſiſting of elongated, elliptical, barren *bracteas*. It is kept in the greenhouſe, and flowers in the ſpring, but is ſcarcely cultivated except for the ſake of curioſity.

2. E. *bifolia*. Jacq. Ic. Rar. v. 2. t. 449. Coll. v. 4. 215. Curt. Mag. t. 840. (Melanthium maſſoniæfolium; Andr. Repoſ. t. 368.)—Stalk club-ſhaped. Leaves two, elliptical, depreſſed. Bracteas all longer than the flowers, pointed, recurved.—The *leaves* are ribbed, entire, very broad. *Stalk* very ſhort, green. Barren and fertile *bracteas* uniform, and all longer than the *flowers*, which are ſeſſile and erect.

3. E. *purpurea*. (E. purpureocaulis; Andr. Repoſ. t. 369.) Stalk club-ſhaped. Leaves numerous, obovate, obtuſe, depreſſed. Fertile bracteas ſhorter than the flowers; barren ones linear-lanceolate.—Drawn by Mr. Andrews in the garden of G. Hibbert, eſquire.—The broad, depreſſed, numerous *leaves*; thick, violet *ſtalk*; and numerous, narrow, purple-edged leaves of the crown, readily diſtinguiſh this ſpecies.

4. E. *regia*. Ait. H. Kew. v. 1. 433. (Fritillaria regia; Linn. Sp. Pl. 435. Corona regalis, lilii folio crenato; Dill. Elth. t. 92, 93.)—Stalk cylindrical. Leaves tongue-ſhaped, crenate, depreſſed. Barren bracteas elliptical.—This moſt reſembles the firſt ſpecies in ſize, habit, colour, and the crenate edges of its *leaves*; but differs in its longer cylindrical *ſtalk*. It has been much longer cultivated than any other of the genus.

5. E. *undulata*. Ait. ibid. Curt. Mag. t. 1083. (E. regia; Redout. Liliac. v. 3. t. 175. Baſilæa; Lamarck f. 1.)—Stalk cylindrical. Leaves ovate-oblong, undulated, ſpreading. Barren bracteas almoſt as long as the ſpike.—Introduced in 1760 by Mr. Miller, who, from its bloſſoming in autumn, which is not invariable, named it *Fritillaria autumnalis*. *Stalk* taller than in the laſt. *Leaves* narrower and longer. Mr. Gawler obſerves that their undulations diſappear as they decay.

6. E. *punctata*. L'Herit. Sert. Angl. t. 18. Curt. Mag. t. 913. (Baſilæa; Lamarck f. 2.)—Stalk cylindrical. Leaves lanceolate, channelled, ſpreading. Spikes many times longer than the barren bracteas.—The long narrow *leaves*, *ſtalk* elegantly ſpeckled with violet, and eſpecially the great extent of the *ſpike*, which is about a foot in length, render this ſpecies very diſtinct. The *corolla* is of a very pale green. *Germen* violet. The baſes of the *leaves* are externally ſpotted like the ſtalk. It flowers in June or July, and is eaſy of cultivation.

EUCRASY, of ευ, *well*, and κρασις, *temperature*, an agreeable, well-proportioned mixture of qualities, whereby a body is ſaid to be in good order, and diſpoſed for a good ſtate of health.

EUCRYPHIA, in *Botany*, from ευ, *well*, and κρυφιος, *covered*, becauſe the flower-buds are concealed by a peculiar covering. Cavan. Ic. v. 4. 48. Claſs and order, *Polyandria Polygynia*. Nat. Ord. *Tiliaceæ*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, of five minute, ovate, equal, permanent leaves. *Cor.* Petals five, large, obovate, equal, ſpreading; covered before expanſion with a deciduous veil, ſeparating from the baſe into four ſegments. *Stam.* Filaments inſerted into the receptacle, numerous, awl-ſhaped, ſhorter than the petals; anthers roundiſh, of two cells. *Piſt.* Germen ſuperior, ovate, ſtriated; ſtyles about 12, ſhorter than the ſtamens; ſtigmas ſimple. *Peric.* Capſule ovate, with a woody furrowed bark, burſting at the top and bottom into as many cells as there are ſtyles, each remaining attached by two fibres to the receptacle. *Seeds* ſeveral, obovate, imbricated, each terminated by a ſmall membranous wing.

Eſſ. Ch. Calyx of five ſmall leaves. Petals five, covered before expanſion with a deciduous veil. Capſule of many cells, ſeparating at top and bottom. Seeds winged, imbricated.

1. E. *cordifolia*. Cavan. Ic. v. 4. 49. t. 372.—A fine tree gathered in Chili, by Louis Née, from whoſe herbarium Cavanilles deſcribed it. *Wood* red. *Branches* downy when young. *Leaves* oppoſite, on ſhort ſtalks, ovate, obtuſe, undulated and bluntly crenate, veiny, coriaceous; heart-ſhaped at the baſe; ſmooth above; downy and white beneath; ſcarcely two inches long. *Stipulas* none. *Flowers* axillary, ſolitary, each on a ſtalk about an inch long, with a few ſcales at its baſe. *Petals* white, turning red in drying. *Veil* of the flower externally downy.—It is commonly called in the country *Roble di Chile*, or Chili Oak.

EUDEMIA, in *Ancient Geography*, a ſmall iſland of the Ægean ſea, placed by Pliny in the Thermaic gulf.

EUDÆMON, John Andrew, in *Biography*, a learned Jeſuit, was a native of Candia, and went to Rome in purſuit of knowledge, where he entered himſelf a member of the ſociety of Jeſus. He was afterwards profeſſor of philoſophy, and then of theology in the univerſity of Padua. He was honoured with the eſteem and friendſhip of Pope Urban VIII. who appointed him the chaplain to his own nephew cardinal Barberini, when he was ſent papal legate into France. He died at Rome in 1625, leaving behind him in various publications many teſtimonials to his talents and learning. He was ſuſpected to be the author of a work entitled "Admonitio ad Regem Ludovicum XIII." which attacked the authority of the kings of France, in matters of an eccleſiaſtical nature. This treatiſe brought the ſociety, of which Eudæmon was a member, into great and general diſrepute; it was likewiſe cenſured by the faculty of the Sorbonne, and the aſſembly of the clergy at Paris, and condemned by the parliament. Moreri.

EUDEMUS, in *Biography*, a name, it would appear, common to ſeveral phyſicians in different ages, of whom little is known with any degree of certainty or preciſion. One Eudemus is mentioned by Galen as contemporary with Herophilus, in the 37th age, and is compared with the latter in reſpect to his anatomical ſkill, eſpecially relative to the nerves. Another Eudemus is ſaid to have ſuffered death for his crimes, in the year 31 of the Chriſtian era. And others of the ſame name, as Eudemus the vender of antidotes, Eudemus of Chio, are occaſionally mentioned. See Eloy. Dict. Hiſt.—Le Clerc Hiſt. de la Medecine.

Eudemus of Rhodes was a pupil of Ariſtotle. The Ethics of Ariſtotle are inſcribed to him, and ſome ſuppoſe them to have been written by him.

EUDES, duke of Aquitain, ſucceeded to his dukedom towards the cloſe of the ſeventh century. When Pepin Heriſtal laid claim to the royal authority in France, Eudes declared himſelf independent, and ſeized upon the remainder of Aquitain, and in a ſhort time by force of arms made himſelf maſter of all the country lying between the Loire, the Ocean, the Pyrenées, Septimania, and the Rhone. In 721 he defeated Zama, lieutenant of the Saracen caliph, who had invaded Gaul, under the walls of Toulouſe, but in a few years afterwards he found it neceſſary to make an alliance with Munuza, another Saracen general, to whom he gave his daughter in marriage. After this his country was completely over-run by the Saracens, over whom, by the aid of Charles Martel, he obtained, in 732, a complete victory, which delivered France from the Mahometan yoke. Eudes died in 735, leaving behind him three ſons by his wife Valtrude, who was the near relation of Pepin. Moreri. Univer. Hiſt.

EUDES, JOHN, born at Rye in Lower Normandy, in the year 1601, was brother of the celebrated hiſtorian Mezerai, and received his education at Caen, under the care of the Jeſuits, where he was afterwards entruſted with the ſuperiority of the houſe belonging to the congregation. In 1643 he quitted the duties of this inſtitution, and undertook the eſtabliſhment of another, of which he became the firſt ſuperior as well as founder. This was denominated "The congregation of Jeſus and Mary," and the principal object of it was to provide a ſeminary for the inſtruction of young perſons in piety and ſacred knowledge, and to form a body of religioniſts, influenced by greater fervour and exaltation in their devotional feelings, than was encouraged by the regulations of the ſociety of which he had been a member. He died in 1680, at the age of ſeventy-nine. He is deſcribed as having been an excellent and well meaning man, but myſtical and highly enthuſiaſtic. As a preacher and inſtructor of youth, he was very popular; but his writings evince little knowledge and leſs judgment, though they exhibit a devotional ſpirit, tinctured with large portions of ſuperſtitious credulity. The moſt remarkable of his pieces are (1) A treatiſe "On the Devotion and Office of the Heart of a Virgin; (2) "Man's contract with God;" and, (3) ſome particulars concerning a peaſant in Normandy, whom he regarded as under divine inſpiration, entitled "The life of Mary of the Vallies." Moreri.

EUDIOMETRY. This term is applied to thoſe proceſſes which have been employed to aſcertain the purity, or, in other words, the degree of oxygenation of any gaſeous mixture, and eſpecially of atmoſpherical air.

A conſiderable variety of methods have been uſed by chemiſts, all of which, though eſſentially different, agree in acting upon the oxygenous portion alone, the azot being in all caſes left as the unchanged reſidue. The following are the ſeveral methods employed.

Of nitrous gas as an eudiometer.—This was the firſt eudiometer uſed by Dr. Prieſtley in his original experiments on air, which immediately followed the diſcovery of oxygen by this illuſtrious philoſopher. If nitrous gas be mixed with *oxygen gas*, in a glaſs jar over water, in the proportions in which they ſaturate each other, to form nitric acid, the gaſes will totally diſappear, a ruddy fume is ſeen at the moment of mixture, and the water will riſe to the top of the jar, leaving unabſorbed only the unavoidable impurities of the gaſes. If, on the other hand, nitrous gas be mixed with *atmoſpherical air*, or any other admixture of oxygen and azot, the former alone of the two will be condenſed by and with the nitrous gas, and the azot will remain unaltered. Hence by meaſuring the reſpective quantities of the gaſes employed, and the quantity abſorbed, the purity of the atmoſpherical air may be aſcertained, (ſuppoſing it known by previous experiment what are the exact proportions in which nitrous gas and oxygen ſaturate each other, and become totally abſorbable by water.) Thus, for example, if 100 meaſures of nitrous gas be added to the ſame quantity of common air; and the two compleatly mixed, the bulk after ſuch mixture will not be 200 meaſures, but only about 108, and conſequently 92 meaſures will have been abſorbed; which laſt, therefore, conſiſt of all the oxygen of the air, with ſo much of the nitrous gas as has been employed to ſaturate it. This reſult Dr. Prieſtley was in habit of denoting, for brevity ſake, by the expreſſion that the air was of the purity of 108, by which he always meant that when 100 of nitrous gas, and 100 of the air to be examined were mixed, the reſidue after the mutual action of the airs was over, was of the number ſpecified. The quantity of the two airs abſorbed being known, the portion which is eſtimated to belong to the oxygen muſt therefore depend on the proportion in which nitrous and oxygen gaſes ſaturate each other, which requires another elementary experiment. Thus in the inſtance before us, if three parts of nitrous gas ſaturate one part of oxygen, the 92 parts which have diſappeared are compoſed of 69 of the former gas, and 23 of the latter, and hence the compoſition of the 100 parts of atmoſpherical air examined, will be 23 of oxygen, and the remainder unabſorbed reſidue chiefly azotic.

A number of valuable experiments by Fontana, Ingenhouz, and eſpecially by Mr. Cavendiſh, made on this ſubject, have ſhewn that different portions of the very ſame mixture of nitrous gas and oxygen will experience a prodigious difference of abſorption according to the width of the tube in which they are mixed, the order of mixture, the time of ſtanding together, the degree of agitation uſed, and other manipulations. Thus Mr. Cavendiſh obſerved, that if one meaſure of nitrous gas and as much common air be rapidly mixed, and immediately ſhaken, the abſorption will be nearly half the entire contents, but if the airs are ſuffered to remain in contact for about a fourth of a minute before they are ſhaken, the abſorption will be no more than about .8. The nature of the water alſo in which the experiment is made is found very materially to influence the reſult. By attending to every circumſtance of the kind, Mr. Cavendiſh, with that admirable accuracy which diſtinguiſhes all the reſearches of this eminent philoſopher, was enabled to obtain very ſatisfactory reſults as to the uniform nature of atmoſpherical air.

Still, however, the difficulties of employing this mode of analyſis with ſufficient preciſion in all admixtures of oxygen and azot have been found ſo great, and the apparent anomalies ſo numerous, that it has been long nearly abandoned by chemiſts, till of late the ſubject has been revived by Mr. Dalton, who has added ſome important obſervations, which require ſome notice in this place. (See the Mancheſter Tranſactions. New ſeries.)

Mr. Dalton gives the following experiments:

If 100 meaſures of common air be thrown up to 36 meaſures of nitrous gas in a tube only 3-10ths of an inch wide, and 5 inches long, and no agitation be uſed, in a few minutes the whole will be reduced to 79 or 80 meaſures, and exhibit no ſigns of either oxygen or nitrous gas, but will conſiſt entirely of azot.

If on the other hand 100 meaſures of common air be thrown up to 72 of nitrous gas, in a wide veſſel over water, ſuch as to form a thin ſtratum of air, and an immediate agitation be uſed, both the oxygen and the nitrous gas will, as before, totally diſappear, and the reſidue, as before, will alſo be 79 or 80 meaſures of azot.

If in the laſt experiment leſs than 72 meaſures of nitrous gas be uſed, there will be a reſiduum containing ſome oygen; if more, the reſidue will contain nitrous gas.

From theſe elementary experiments Mr. Dalton infers that the oxygen, contained in 100 parts of common air, may unite totally either with 36 parts of nitrous gas, or with 72, double that quantity, but with no intermediate portion. To inſure the former effect, the gaſes muſt be mixed in a narrow veſſel without agitation; to inſure the latter the veſſel muſt be large, and the points of contact between the ingredients muſt be increaſed by agitation. But in the ordinary circumſtances of the experiment, Mr. D. ſuppoſes that both theſe effects partially take place, ſo that one part of the oxygen unites with the nitrous gas in the ſmaller proportion, and another in the larger; and hence he accounts in a very ingenious and ſatisfactory manner for the greater part of the apparent anomalies which have been obſerved in the employment of nitrous gas in eudiometry. Therefore, he obſerves, to uſe nitrous gas for the purpoſe of eudiometry, we muſt attempt to form one or other of theſe combinations wholly, and he prefers that with the ſmalleſt proportion of nitrous gas, in the following way:

Take a narrow tube of the dimenſions above given, add 100 parts of common air to about 36 of nitrous gas, and when the diminution is complete, without agitation, transfer the reſidue to another tube and meaſure it; then 7-19ths of the loſs will be due to the oxygen preſent.

But a ſtronger objection ariſes againſt the employment of nitrous gas in its aeriform ſtate, owing to the difficulty of obtaining this gas of uniform purity. From a very elaborate ſeries of experiments on this ſubject, undertaken by Humboldt and Vauquelin, (Ann. Chem. tom. 28.) it appears that when nitric acid of any ſtrength is poured upon copper wire (which is the uſual mode of obtaining nitrous gas,) an efferveſcence more or leſs vehement takes place, and a gas is diſengaged, conſiſting of nitrous gas, but always mixed with more or leſs of azotic gas, and ſometimes nitrous oxyd, and it is this varying portion of azot which conſtitutes the chief difficulty and trouble in the employment of nitrous gas in eudiometry. The quantity of azot is found to depend largely on the ſtrength of the acid being from about one-tenth or leſs to nearly half the entire gas. According to Humboldt, the degree of ſtrength of acid which produces the pureſt nitrous gas, is that in which the ſpecific gravity is about 1.15 to 1.17, or from 17 to 21 of Beaume's areometer. Mr. Dalton finds that nitric acid diluted with an equal bulk of water poured on copper and mercury, without any artificial heat being uſed, gives a nitrous gas nearly pure, or with only from two to three per cent. of azot.

The proportion of azotic impurity in any mixture of this with nitrous gas, is moſt conveniently aſcertained by agitating the gas with a ſolution of green ſulphat of iron, which abſorbs the nitrous gas without materially affecting the other. This experiment was firſt made by Dr. Prieſtley, who found that the ſolution of iron acquired thereby a reddiſh or olive brown colour, and a very acid ſtyptic taſte. Other chemiſts have alſo found a certain quantity of ammonia in the ſolution.

To obviate the objections brought againſt the uſe of nitrous gas, in the gaſeous form, as an eudiometer, Mr. Davy has ingeniouſly applied to this purpoſe the ſolution of ſulphat or muriat of iron, ſaturated with nitrous gas as above-mentioned; and this, with a few precautions, is found to anſwer with great preciſion, and to be applicable with little trouble to all caſes of the analyſis of gaſes where oxygen is one of the ſubſtances ſought for. The mode of uſe in ordinary caſes is as ſimple as poſſible. The gas is put into a graduated eudiometer tube, ſome of the ſolution is poured in, and by very gentle agitation for about a minute, the whole of the oxygen is abſorbed. The chief precautions required are, not to uſe the ſame ſolution twice, to keep it in a well-ſtopped bottle, and particularly to remove it from the gas under analyſis as ſoon as the utmoſt degree of abſorption is produced, as after this time a ſmall increaſe of bulk is again obſervable in the reſidue, owing probably to ſome evolution of gas from the ſolution. It is alſo found that if the ſolution be very highly impregnated with the nitrous gas, and much haſty agitation be uſed, a little of the nitrous gas eſcapes in the gaſeous form into the eudiometer tube, which may be removed by the application of a little ſulphat or muriat of iron. One cubic inch of the impregnated ſolution of moderate ſtrength will abſorb about five or ſix cubic inches of oxygen gas.

Of the ſulphurets as eudiometers.—The eudiometer firſt employed by the illuſtrious Scheele, in his original experiments on the conſtitution of the atmoſphere, ſo early as the year 1779, was a mixture of iron filings and flowers of ſulphur, moiſtened with a little water. By confining a cup of this mixture under a jar of common air over water, this excellent chemiſt obſerved an abſorption ſoon to begin, the water gradually riſing in the jar for about eight hours, after which no further diminution took place, and the reſiduary gas conſiſts chiefly of azot.

This valuable elementary experiment has been employed in eudiometry with great advantage, but modified conſiderably, and a few precautions muſt be taken to avoid inaccuracies. In the firſt place it is to be obſerved that this mixture of iron filings and ſulphur is ſlow in its operation, and moreover, a quantity of hydrogen gas is given out towards the end, which mixes with the reſiduary azotic gas. To leſſen the duration of the experiment the liquid alkaline or earthy ſulphurets have been ſubſtituted to the mixture of iron filings and ſulphur, with great advantage. When atmoſpherical air, confined in a tube, is ſhaken for a few minutes with a little of the liquid ſulphuret of lime, potaſh, or ſoda, the whole of the oxygen is abſorbed in a few minutes.

Guyton has propoſed to haſten the abſorption by heating the ſolution, but it has been found that in this caſe there is ſome danger of expelling from it a portion of ſulphurated hydrogen gas, which would impair the accuracy of the experiment.

A more important ſource of error has been mentioned by Marti, (Journal de Phyſique, tom. 52.) which muſt be avoided. It appears from his experiments that liquid ſulphuret of lime, (and probably the other liquid ſulphurets,) when recently made, is capable of abſorbing a portion of azot as well as oxygen, which, though ſmall, is ſufficient to affect materially the reſult of a delicate experiment. Marti found that when one meaſure of common air was ſhaken with 20 meaſures of the liquid ſulphuret of lime, the entire abſorption amounted to as much as 26 per cent. of the air. But of theſe it is known that only about 21 can be oxygen, and conſequently about 5 of azot muſt have been abſorbed. The experiment being repeated with the ſame ſolution, only 21 per cent. were now abſorbed, ſo that the ſolution had been ſaturated with azot by the previous experiment. The ſame ſolution was then ſhaken with pure azot, but no abſorption took place, which confirmed the fact of the previous ſaturation of the ſulphuret with azot. On the other hand, when a perfectly freſh ſolution was uſed, which immediately after being prepared, had been allowed to cool in a well-cloſed bottle, and only a twentieth of its bulk of common air was confined with it, the latter in a few minutes had diminiſhed full one-half.

It is eaſy to avoid errors from this circumſtance. All that is neceſſary is, previouſly to uſing the liquid ſulphuret as an eudiometer, to ſhake it for a few minutes in a bottle of common air, and it is never neceſſary to uſe more than about two meaſures of the ſulphuret to one of common air. With theſe precautions, the ſulphuret proves a very uſeful and accurate eudiometer.

Of hydrogen gas as an eudiometer.—This ingenious method was propoſed and employed with great ſucceſs by the celebrated Volta. It conſiſts in mixing known proportions of pure hydrogen gas with the air to be examined in a very ſtrong glaſs tube, through which a metallic communication is made, and detonating the contents by the electric ſpark. After the ſhock, a ſudden diminution takes place, owing to the production of water by the detonation of the hydrogen with the oxygen contained in the air examined. The exact ſaturating proportion between the two gaſes has been variouſly given, but an exceſs of hydrogen ſhould be uſed. One hundred parts of oxygen require at the higheſt eſtimation ſomewhat leſs than 200 of hydrogen for ſaturation; ſo that when equal bulks of hydrogen and *atmoſpheric air* are uſed, there is an abundant allowance of hydrogen. Mr. Dalton finds 60 of the latter ſufficient for 100 of common air, and the diminution is very uniformly 60 parts with the above proportions; and hence, if common air contains 21 per cent. of oxygen, the ſaturating proportions of oxygen and hydrogen are 21 of the former to 39 of the latter.

The chief objection to the univerſal uſe of Volta's eudiometer is, that it requires an apparatus to give the electric ſpark, which cannot be always procured; and in all experiments of this kind it is particularly deſirable to employ one uniform mode of experimenting where general reſults are to be eſtabliſhed.

Of phoſphorus as an eudiometer.—Phoſphorus has two diſtinct modes of combuſtion in common air, according to the temperature to which it is raiſed. One of theſe is rapid, and attended with the evolution of a prodigious quantity of light and heat, and it occurs when phoſphorus is heated a little above its melting point, or in common language is ſet fire to. The other takes place in a temperature not exceeding from 90° to 100° at the utmoſt, and is that in which the phoſphorus emits copious fumes, white in the day-time but highly luminous in the dark, and without any ſenſible emiſſion of heat. In either caſe the phoſphorus is *conſumed*, or oxygenated; but it is the ſlow combuſtion without ſenſible heat that is alone employed in eudiometry. The whole apparatus required for the purpoſe is ſimple and convenient of application. Nothing more is neceſſary than to fix a ſtick of phoſphorus in a portion of glaſs tube run through a cork, which looſely fits the open end of the ſmall jar which is to contain the air to be analyzed, and confine it by water. If the temperature is very cold, the proceſs may be aſſiſted by the warmth of the hand. The phoſphorus is immediately ſurrounded by the white luminous fume, which ſlowly falls down to the ſurface of the water, during which time the oxygen of the air is gradually abſtracted by the vaporized phoſphorus, and in conſequence the bulk of the contained air is diminiſhed. The abſorption of oxygen is complete when the contained gas is no longer luminous, which, in a ſmall jar with a ſtick of phoſphorus that traverſes nearly its whole length, requires about half an hour at the heat of from 70° to 80°. The proceſs ſucceeds equally well at a lower temperature, though a longer time is required. The heat cannot be ſafely raiſed more than about 85° or 90°, without danger of kindling the phoſphorus, which may be avoided by obſerving that it melts and becomes gloſſy juſt before it catches fire.

The exact operation of the ſlow combuſtion of phoſphorus uſed in this experiment has been very happily explained by Goettling and Berthollet. When phoſphorus is expoſed to air at any temperature below that of rapid combuſtion, the firſt effect ſeems to be a ſolution of the ſurface in the azot of the ſurrounding air, and this phoſphorized azot inſtantly unites with the oxygen, becomes thereby luminous, and phoſphorus acid abſorbable by water is generated. Hence it is (ſtrictly ſpeaking) only that portion of phoſphorus which becomes diſſolved in the azot which is the eudiometrical ſubſtance; and in confirmation of this it may be added that phoſphorus incloſed in pure oxygen gas is not in any degree luminous, but remains perfectly inactive till the heat is raiſed to the point of ſtrong combuſtion. On the other hand, if the pureſt poſſible azot is paſſed into a jar full of water, and containing a ſtick of phoſphorus, the gas only becomes luminous for a very ſhort time, after which this appearance ceaſes, but the azot continues to ſaturate itſelf with phoſphorus. If now a bubble of common air or oxygen is let up into this phoſphorized azot, the luminous appearance immediately returns, and continues ſo till all the oxygen is exhauſted. Phoſphorus, therefore, furniſhes alſo an uſeful teſt of the purity of azot, by not becoming luminous in it, but by enabling it to become luminous as ſoon as a particle of oxygen is added.

One circumſtance of importance ſhould be added, which is, that azotic gas in ſaturating itſelf with phoſphorus is found to expand about 1-40th of its bulk, which accounts for the apparent difference in the compoſition of common air as determined by phoſphorus or by other eudiometrical ſubſtances. After all abſorption has ceaſed, when phoſphorus is uſed, the apparent loſs is not more than from 20 to 21 per cent. of the atmoſpherical air employed, whereas with all the other eudiometrical proceſſes the loſs is from 21 to 22 per cent., but this difference may be chiefly accounted for by the expanſion of the reſidual azot from its ſaturation with phoſphorus. It is therefore more accurate to diminiſh the bulk of the reſiduum by 1-40th, and this diminution muſt be thrown into the ſide of the oxygen abſorbed. In analyzing an air much more oxygenous than the atmoſphere, in proportion as the azotic ingredient diminiſhes, the operation of the phoſphorus in removing the oxygen becomes leſs rapid and powerful, and hence either a dilution with pure azot is adviſeable, or ſome other eudiometrical teſt ſhould be preferred.

The general reſults of all the operations of atmoſpherical air have eſtabliſhed it as an inconteſtible truth, that ſcarcely any difference exiſts in the proportion of oxygen, whatever be the height, ſeaſon of the year, climate, and temperature at which the experiment is made, and even where the greateſt changes would be expected from vitiation of air by the reſpiration of crowded aſſemblies of people, and the like, the loſs of oxygen is much leſs than would have been generally expected. Hence the utility of eudiometry as a meaſure of the purity of the atmoſphere has much diminiſhed ſince this fact has been eſtabliſhed, but the numerous and acute reſearches to which the ſubject has led, have been of high importance to this difficult part of chemical reſearch.

Several kinds of apparatus are uſed in eudiometrical experiments, ſome of which may be here deſcribed.

Dr. Hope's eudiometer is the following. (*Plate* X. *Chemiſtry, fig.* 1.) It conſiſts of two parts, the lower of which is a ſhort thick bottle, with an upper and a ſide opening, the latter cloſed by a glaſs ſtopper, and the other receiving a graduated tube cloſed at the top, and accurately fitted by grinding. To uſe it, take off the tube, and fill it quite full of the gas to be examined, and alſo fill the bottle with liquid ſulphuret of lime, and, without ſhaking, ſink it in water, and then immerſe the open end of the graduated tube in the ſame water, and ſlide it upon the bottle and thruſt it in. Then take out the bottle and tube, and ſhake them, to bring the ſulphuret thoroughly in contact with the contained gas, and immerſe the bottle from time to time in water, opening the ſide ſtopper to allow the water to ruſh in, and ſupply the vacuum made by the abſorption of oxygen. This will indeed ſomewhat dilute the eudiometrical liquor, but not ſo much as to prevent it from acting. When all abſorption is over, the quantity of reſidual gas is found by inſpection of the ſcale of the graduated jar.

The apparatus for detonating oxygen and hydrogen, which forms Volta's eudiometer, conſiſts of a very thick graduated glaſs tube, open at bottom, and towards the top are two ſealed holes, admitting the wires by which the electric ſpark is taken. A very uſeful improvement in this apparatus has been introduced by Mr. Pepys, to prevent the violence of the ſhock, either from breaking the glaſs (with moderate quantities) or from throwing out any of the mercury when confined by this fluid. In this improved apparatus, the thick graduated jar is fixed to a heavy iron ſtand, which has a ſtrong ſpring near the foot, that draws out in the manner of the ſteel-yard, when the concuſſion is given, and thus takes off the recoil. *Fig.* 2.

An improved and very uſeful apparatus for nice eudiometrical experiments, is given by Mr. Pepys in the Phil. Tranſ. for 1807, to which we ſhall refer our readers for a full deſcription. It conſiſts of a graduated tube, an elaſtic gum-bottle, furniſhed with a perforated glaſs ſtopper, cloſely fitting to the end of the tube, and another very ſmall tube with a ſurrounding jar for the purpoſe of meaſuring quantities leſs than the ſmalleſt ſubdiviſions of the larger graduated tube. The eudiometrical liquor is put into the elaſtic gum-bottle, and by preſſure is injected ſtrongly up into the larger tube, by which means the action is facilitated, and none of the liquor is ſpilled or waſted.

EUDOCIA, in *Biography*, a Roman empreſs, wife of Theodoſius the younger, was daughter of Leontius, an Athenian philoſopher. She was educated in the ſciences and religion of ancient Greece, and ſo great were her mental acquirements and perſonal beauty, that Leontius divided his property between his ſons, conceiving ſhe could ſtand in need of nothing to recommend her to a proper huſband. About the year 421 ſhe was married to Theodoſius, when ſhe renounced the errors of paganiſm, and received the baptiſmal name of Eudocia, having previouſly been called Athenais. She was reconciled to her brothers; and, having invited them to court, conferred upon them offices of rank and power. Upon the throne, as in a more humble ſtation, ſhe cultivated letters, and employed her talents in the ſervice of the religion to which ſhe was a convert. She put into verſe ſeveral of the books of the Old Teſtament, and wrote paraphraſes on ſome of the Jewiſh prophets. She lived for a conſiderable time in harmony with her conſort; and after the marriage of her daughter to the emperor Valentinian III. ſhe was permitted to pay her vows in a ſplendid pilgrimage to Jeruſalem; and at Antioch ſhe pronounced an oration to the ſenate from a throne of gold. After her return, ſuſpicions were excited of her fidelity in the breaſt of her huſband by his ſiſter Pulcheria, who had been the means of bringing them together by marriage. The object of theſe ſuſpicions was Paulinus, a handſome and accompliſhed man, who held high offices at court, and who was put to death on the occaſion. Eudocia was reduced to a private condition, and allowed to ſeek a retreat in the Holy Land, where ſhe had formerly obtained a high degree of credit by the magnificence of her preſents. Here ſhe devoted herſelf to religious and devotional ſtudies, and died in 460 at the age of 67. In her laſt illneſs, ſhe aſſerted in the moſt ſolemn manner her innocence of the crime for which ſhe had been dethroned and ſuffered baniſhment. Moreri. Gibbon's Hiſt.

EUDOCIAS, in *Ancient Geography*, an epiſcopal town of Aſia, in Pamphylia.—Alſo, an epiſcopal town of Aſia, in the ſecond Galatia.

EUDON, a river of Aſia, in Caria.

EUDOXIANS, a party or ſect of heretics in the fourth century, ſo denominated from their leader Eudoxius, a native of Arabiſſus in Armenia Minor, and patriarch of Antioch, to which he was advanced in 356, and Conſtantinople, to which he was promoted in 359, and which he retained till his death, in 370. He was a great defender of the Arian doctrine, though repreſented as ſomewhat fluctuating and unſteady in his principles. He is charged with being a bitter perſecutor of the Catholics. Of his works, no remains are extant, except ſome fragments of a treatiſe "De Incarnatione Dei verbi;" to which Cave (Hiſt. Lit.) has referred.

The Eudoxians adhered to the errors of the Arians and Eunomians, maintaining that the Son was created out of nothing; that he had a will diſtinct and different from that of the Father, &c.

EUDOXIOPOLIS, in *Ancient Geography*, an epiſcopal town of Aſia, in Piſidia.

EUDOXUS, the *Cnidian*, in *Biography*, was celebrated as an aſtronomer, a geometrician, a phyſician, and legiſlator, but was moſt particularly diſtinguiſhed in the firſt of theſe characters. His firſt preceptor was Archytas, by whom he was inſtructed in the principles of geometry and philoſophy: about the age of 23 he came to Athens. His knowledge of medicine is ſaid to have been obtained in this way. A phyſician, named Theomodonus, obſerving the ardent deſire which he manifeſted for ſtudy, notwithſtanding his extreme poverty, preſumed that he poſſeſſed talents which deſerved cultivation, and therefore took him to his houſe, and afforded him every means of accompliſhing his wiſhes, enabling him, as his own patrimony was ſmall, to attend the ſchools of the philoſophers, particularly that of Plato. Eudoxus afterwards went into Egypt, accompanied by a pupil, named Chryſippus, and here he was introduced by Ageſilaus to king Nectanebis II., and by him to the Egyptian prieſts. He is highly celebrated by the ancients for his ſkill in aſtronomy; but none of his writings on this or any other ſubject are extant. Aratus, who has deſcribed the celeſtial phenomena in verſe, is ſaid to have followed Eudoxus; to whom is attributed the honour of bringing the celeſtial ſphere and the regular aſtronomy from Egypt into Greece. Having left Egypt he taught aſtronomy and philoſophy with great applauſe at Cyzicus, on the Propontis; and he afterwards removed to Athens, where he opened a ſchool, and gained ſo high a degree of reputation, that he was conſulted on ſubjects of policy as well as ſciences, by deputies from all parts of Greece. His death is generally referred to the firſt year of the 107th olympiad, 352 years before Chriſt. See Le Clerc. Hiſt. de la Med. Eloy.

Eudoxus is ſaid by Fabricius (Bibl. Græc. lib. iii. c. 5.) to have written upon muſic, and he gathers from Theon of Smyrna, p. 94, that Eudoxus was the firſt who expreſſed the ratios of concords by numbers, and who diſcovered that grave and acute ſounds depend on the ſlow or quick vibrations of the ſounding body.

EUDRACINUM, in *Ancient Geography*, a town placed by the Itinerary of Antonine on the Alps, between Summus Penninus and Auguſta Prætoria.

EUDRAPA, Eder, or *Edir*, a town of Aſia, ſituated in Meſopotamia, W.S.W. from the town of Carmanda.

EUDROME, in the *Ancient Muſic*, the name of an air played by hautbois at the Sthenian games, inſtituted at Argos in honour of Jupiter. Hicorax the Argian was the inventor of this air.

EVE, the firſt woman, and mother of the human race. The hiſtory of her formation and other particulars is recorded in the Hebrew Scriptures (Gen. ii. iii. iv.); and it is needleſs to recite from Bayle and others the abſurd fables invented concerning her by the Jewiſh rabbis.

Eve. See Vigil.

EVEA, or Eva, in *Ancient Geography*, the ancient name of Byblos, a town of Phœnicia.

Evea, in *Botany*, Aublet Guian. v. 1. 100. t. 39. Juſſ. 208. See Callicocca, ſpec. 10.

EVECTION, in *Aſtronomy*, the moſt conſiderable of the lunar irregularities, and the firſt that was known to the ancient aſtronomers. It was diſcovered by Ptolemy. Its general and conſtant effect is to diminiſh the equation of the centre in the ſyzygies, and to increaſe it in the quadratures. If this diminution and augmentation were always the ſame, the evection would depend alone on the angular diſtance of the moon from the ſun; but the abſolute value of the evection depends likewiſe on the diſtance of the moon from the perigee of her orbit. After a number of trials and obſervations, it was found that this inequality could be repreſented very exactly by ſuppoſing it proportional to the ſine of double the angular diſtance of the moon from the ſun, *minus* the mean anomaly of the moon. The co-efficient to this proportion is 1° 20′ 30″.

The period of the evection differs but little from the periodic revolution of the moon: it is 27.178533 days. The evection is cauſed by the action of the ſun upon the moon, and may be explained by ſuppoſing a change to take place in the excentricity of the moon's orbit, and at the ſame time a motion in the apogee.

Ptolemy ſuppoſed the epicycle of the moon to be carried along in an excentric circle, and that it was nearer to us in the quadratures than in the conjunctions and oppoſitions; ſo that to explain this inequality at the ſame time with the equation of the centre, he imagined an excentric and an epicycle. It is curious to trace the progreſs of theſe diſcoveries, and the hiſtory of the firſt obſervations of the evection has been tranſmitted in the words of Ptolemy himſelf. (Almageſt. lib. v. cap. 1.)

In obſerving, ſays he, with care, the order of this inequality, we took notice that there was no other than the firſt and ſimple inequality in the conjunctions and oppoſitions, and even in the quadratures when the moon was in apogee or perigee, (meaning by the ſimple inequality the equation of the centre); but we may be aſſured that this is not ſufficient to calculate the particular motion of the moon in other aſpects. The ſecond inequality, (*i. e.* the evection,) is connected with the diſtance of the moon from the ſun, and is re-eſtabliſhed and diſappears in the conjunctions and oppoſitions, and is greateſt in certain quadratures. We diſcovered this inequality by the obſervations tranſmitted by Hipparchus, and by thoſe which we have made by means of an inſtrument conſtructed for the expreſs purpoſe of meaſuring the difference of longitude on the zodiac between the moon and the ſun.

Ptolemy found that there was a difference of $2\frac{2}{3}^\circ$ between the obſerved and the calculated place (when the firſt inequality or equation of the centre was only uſed) when the moon in quadrature was three ſigns from the apſide. (Almageſt. v. 3.) Then the ſun being in the apogee or perigee of the moon, the inequality, which ſhould have been 5°, was found $7\frac{2}{3}^\circ$; to explain which he ſuppoſed the epicycle as above-mentioned.

Copernicus, to explain the evection, employed two epicycles. The ſmall epicycle is ſuppoſed to deſcribe the circumference of the great one in the ſpace of an anomaliſtic revolution, and contrary to the order of the ſigns; while the moon deſcribes the ſmall epicycle contrary to the order of the ſigns in $14^d\ 18^h$, or in the ſpace of half a ſynodical revolution.

It was in this manner that the ſecond inequality of the moon, called now the evection, was explained till the time of Tycho. It was called by Ptolemy "προσνευσιν, epicycli quaſi annutum," by Copernicus "proſtaphæreſim ſecundi vel minoris epicycli," by Tycho "proſtaphæreſim excentricitatis," and by Bouillaud "evection," which name it ſtill retains.

The evection was explained in a different manner by Horrox about the year 1640; but his theory was not made known till 1673, when Flamſtead calculated his new tables of the moon, upon the principles and numbers given him by Horrox. Theſe tables were publiſhed in the poſthumous works of Horrox in 1673. This hypotheſis is the ſame with that of Arzachel, an aſtronomer who flouriſhed in Spain in 1080, when that country was poſſeſſed by the Arabians, and who applied it to the motion of the ſun. Let T be the centre of the earth (*Plate* XII. *Aſtronomy*, *fig.* 107.), C the mean place of the centre of the orbit which a planet is ſuppoſed to deſcribe; ſo that T C A may be the line of the apſides, and T C the excentricity of the planet. If the centre of the orbit, inſtead of being fixed in C, be ſuppoſed to deſcribe the circumference of a ſmall circle A C B, there will reſult a double effect: 1. The line of apſides T A will change its poſition, and inſtead of remaining conſtantly in the direction T C A, it will paſs, for example, into the poſition T G, and will make with the firſt poſition an angle A T G. 2. The excentricity, inſtead of being equal to the original quantity T C, will become T G, T B, &c. This hypotheſis was invented by Arzachel to explain a ſuppoſed diminution of the excentricity of the ſun's orbit, which he had inferred from ſome defective obſervations, and has not only been adopted by Horrox to deduce this inequality of the moon, but by Flamſtead, Halley, and Newton, for the ſame purpoſe.

Kepler had already announced that he employed an excentricity of the lunar orbit which varied every year; but Horrox was led likewiſe to this hypotheſis by obſervations of the diameter of the moon; for about this time the application of micrometers to teleſcopes enabled aſtronomers to determine the apogee and perigee of the moon much more exactly than formerly. From theſe obſervations he perceived that the apogee of the moon was about 25° more advanced when the diſtance from the ſun to the apogee of the moon was 45° or 225°, than when it was 135° or 315°: hence the motion of the apogee, inſtead of being uniform, ſeemed to have an annual libration of more than 12°. This variation in the motion of the apogee being once known, its connection with a change of excentricity was not difficult to be diſcovered. Both Halley and Newton employed the above hypotheſis. According to the method of Newton the centre A of the orbit of the moon (*fig.* 108.) deſcribes a circle A C B, the earth being at T. Thus T C expreſſes the mean excentricity of the moon; T A the greateſt excentricity, and T B the leaſt; T C being to C B as the mean excentricity is to its difference from the leaſt, or as the total ſine is to the ſine of 12° 18′, which is the greateſt equation of the apogee. It is likewiſe ſuppoſed that if the angle A C G be taken equal to double the annual argument, or the diſtance between the ſun and the mean apogee of the moon for a given time, the angle C T G will be the equation of the apogee, and T G the excentricity for the ſame time. Then in the triangle T C G, the two ſides and included angle being given, we have the ſum of T C, and C G is to their difference as the tangent of half A C G, (or the annual argument, whoſe double is A C G,) is to the tangent of half the difference of the unknown angles. This is reduced to a conſtant logarithm, which added to that of the tangent of the mean annual argument, gives the annal argument corrected; and this, added to the place of the ſun, gives the true place of the apogee of the moon. This is the form which Halley employed in his lunar tables.

It eſcaped the obſervation of Flamſtead, Halley, and Newton, that this equation might be calculated without ſuppoſing a variable excentricity and libration of the apogee. Euler employed this method, of which the following is the demonſtration.

Let L (*fig.* 109.) be the moon, T the earth, C the mean centre of the lunar orbit, G the centre for a given moment; C T the mean excentricity of the moon, C L T the half of the mean equation of the orbit, becauſe it is the double excentricity which produces the whole equation; G L T the half of the evection for the time given, and repreſented in Newton's method by an augmentation of excentricity; C L G is the difference of theſe two equations, or the effect which the change of excentricity, and the libration of the apogee, produce upon the half equation. To find by a ſimple operation this angle C L G, which is the half of the evection, it muſt be remembered that when this angle is the greateſt, or when L C is perpendicular to C G, the angle C L G is 40′, that is, the conſtant relation between C L and C G is ſuch, that the value of L can only be 40′ when it is the greateſt, or 1° 20′ for the whole evection. When the angle L C G is oblique, the angle C L G will diminiſh, and that in the ratio of the perpendicular G D to the line C G, or as the ſine D C G to radius. Hence the evection will be 80′ ſin. D C G; but the angle D C G = A C L − A C G is the mean anomaly of the moon, minus twice the diſtance of the ſun from the moon's apogee, or what is the ſame, twice the diſtance of the moon from the ſun, minus the mean anomaly of the moon, which forms the argument of evection.

The half evection, or angle G L C, is equal 40′ ſin. (2 diſt. ☾ ☉ — m. anom. ☽.) This is the form in which it is uſually found in the lunar tables.

When we come to treat of the theory of the moon, and the lunar inequalities, we ſhall have occaſion to reſume this ſubject, and to ſhew how correctly this equation is derived from the law of univerſal gravitation; we ſhall confine ourſelves at preſent to a very general explanation of the phyſical cauſe of this phenomenon.

When the ſun correſponds to the apogee or perigee of the moon, that is, when the line of apſides of the moon coincides with the line of the ſyzygies, the central force of the earth upon the moon, which is the weakeſt in the ſyzygy apogee, receives the greateſt diminution, and the central force, which is the ſtrongeſt at the ſyzygy perigee, there receives the leaſt diminution, therefore the difference between the central force perigee and the central force apogee will then be the greateſt, and the difference of the diſtances will be augmented, that is, the excentricity will become greater, and obſervation ſhews that the equation is then 7° 40′, whereas it does not exceed 5° when the line of the quadratures coincides with the line of the apſides.

The formula for the evection in the lateſt tables is 1°20′28″ ſin (2 diſt. ☾ ☉ — mean anomaly ☽); from which it is eaſy to follow the ſucceſſive variations of this equation, for it is only requiſite to conſider the different values which its argument can take. If it be required, for inſtance, to determine when it arrives at its maximum, we have only to inveſtigate the caſe in which the angle 2 diſt. ☉ ☽ — m. anom. ☽ becomes equal to 90°, or 270°, or its ſine equal to unity, the evection will then be equal 1° 10′ 21″: the firſt of theſe values will happen in the quadratures, when the mean anomaly is equal 90°, for then 2 diſt. ☾ ☉ = 180° 2 diſt. ☉ ☽ — m. anom. ☽ = 180° − 90° = 90°; on the contrary, the evection will diſappear, when the argument is zero or 180°, this will happen in the ſyzygies when the moon is either perigee or apogee, for then the diſtance of the moon from the ſun is equal 0° or 180°, and the ſame of the mean anomaly. But by the various combinations of the two angles which form the argument of evection, the greateſt and leaſt values will arrive, even in ſeveral other points of the orbit. In general, in the conjunctions, the evection will have a contrary ſign to the equation of the centre, for its argument is reduced to — mean anom. ☽, which gives a negative ſign if the anomaly is leſs than 180°, and a poſitive ſign if it is greater; but in the firſt caſe the equation of the centre is additive, and in the ſecond it is ſubtractive. It is eaſy to comprehend that it will be the ſame in the oppoſitions, hence it follows that in the ſyzygies the evection is ſubtractive from the equation of the centre, on the contrary it is additive in the quadratures. Thus the firſt obſervers that examined the theory of the moon's motion only by means of eclipſes, and with no other view but to predict thoſe phenomena, always found the equation of the centre too ſmall, by the quantity of the evection in the ſyzygies.

It is not difficult to find the period of the evection from the variations of the value of the angle on which it depends; it is ſufficient to calculate the variations of this angle in a given time; and to conclude, by a ſimple proportion, the number of days neceſſary for it to vary 360°.

The ſynodical motion of the moon in one century is 445267° 6′ 55″.46, multiplying this by two, we have 890534° 13′ 50″.92 for the double of the diſtance of the moon from the ſun, after a hundred Julian years. If from this we take the anomaliſtic motion of the moon, in the ſame interval, or 477198° 41′ 30″.6; the difference 413335° 32′ 20″.3 will be the value of the argument of evection, after 100 Julian years; from whence it appears, that this argument increaſes 360° in a number of days expreſſed by 360.36525, or 27.178533 days; this is the period of the evection, after which period it ſucceſſively takes again the ſame values.

From this it appears, that ſubſtituting, inſtead of theſe angles, their values calculated as above, the argument may be put in the form of a quantity proportional to the time;

for example, if we name the number of days elapſed ſince a given epoch as that of the tables t. The angle 2 diſt. ☽ ☉ —m. anom. ☽ will become $\frac{t \,.\, 360}{27.178533}$, and the evection may be repreſented under this form 1° 20′ 28″ $\left(\frac{360 \,.\, t}{27.178533}\right)$ or ſimply 1° 20′ 28″ ſin. m. t. making $m = \frac{360}{27.178533}$.

EVEILLON, James, in *Biography*, was born at Angers in the year 1542; he was diſtinguiſhed at a very early age for his literary acquirements, and obtained conſiderable eccleſiaſtical preferment, in the place of his birth, till at length he was made grand-vicar to the biſhop. Eveillon was looked up to for his ſuperior knowledge of the rights and uſages of the church; and of every ſubject connected with the councils, the fathers, and the canon law. He was not unfrequently employed in matters relating to church diſcipline, the reformation of breviaries, rituals, and monaſtic inſtitutions. His principal works were entitled "De Proceſſionibus Eccleſiaſticis, in quo earum Inſtitutio, Significatio, Ordo, et Ritus explicantur."—"De recta Pſallendi Ratione;" and "A Treatiſe on Monitions and Excommunications," which has borne a high character in the Catholic communion. Eveillon died at the age of 79, in the year 1621. He was a man of extenſive benevolence, having obtained the title of father to the friendleſs, and the poor, to whoſe relief he devoted the whole of a liberal income, excepting what was abſolutely neceſſary for his own ſupport. Moreri.

EUELPIDIUM, a kind of fluid collyrium.

EUELPISTI, a plaſter deſcribed by Scribonius Largus.

EVELYN, John, in *Biography*, the ſon of Richard Evelyn, eſq. was born at Wotton, in Surrey, in 1620. He received the early part of his education at Lewes, from thence he went to Chriſt church, Oxford. During the civil wars he ſpent his time on the continent, particularly in France and Italy. He married in the year 1647 the only daughter of ſir Richard Browne, the king's miniſter at Paris, and returned to England about the year 1651, where he employed himſelf in literary occupations, chiefly in tranſlating from the French and Latin. He was much inclined to a life of learned leiſure; and in his zeal to forward a ſimilar plan for others he formed a ſcheme for the erection of a college, where perſons might live together in philoſophical retirement, and in the purſuit of common ſtudies. In 1657 he publiſhed a favourable account of the king's character, with a view of preparing his countrymen for the reſtoration of monarchy, and on the return of the exiled Charles, he was graciouſly received, and introduced into public life, though without abandoning his literary purſuits. In 1662 he publiſhed a curious and learned work, containing much uſeful and important information, entitled "Sculptura, or the Hiſtory and Art of Chalcography, or Engraving on Copper." This piece was reprinted in 1755, with additions. Mr. Evelyn practiſed the art himſelf, and is introduced by Mr. Walpole into his catalogue of Engliſh engravers. On the inſtitution of the Royal Society, he was nominated among the firſt fellows and members of the council, and he ever after continued a zealous and truly active member of that learned body. At ſome of the early meetings of the ſociety was read his diſcourſe on foreſt trees, which was the baſis of the treatiſe entitled "Sylva, or a Diſcourſe of Foreſt Trees, and the propagation of Timber in his Majeſty's Dominions, to which is annexed Pomona, or an Appendix concerning Fruit Trees, in relation to Cyder, &c." As a ſequel to this work, he afterwards publiſhed his "Terra, a Philoſophical Diſcourſe of Earth, relating to the Culture and Improvement of it for Vegetation, and the Propagation of Plants." Both theſe works have been reprinted ſeveral times. The edition of the Sylva by Dr. Andrew Hunter, of York, is with plates of all the trees, in which their parts of fructification are accurately diſplayed according to the Linnæan ſyſtem. Mr. Evelyn was appointed, at the deſire of the king, in 1664, one of the commiſſioners of the ſick and wounded ſeamen, and likewiſe a commiſſioner for rebuilding St. Paul's cathedral. How well fitted he was for the latter office was ſhewn by a work which he publiſhed, entitled "A Parallel of the Ancient Architecture with the Modern," tranſlated from the French of Roland Freart, ſieur de Chambray; with additions from Alberti and others. He reſided at this period at his houſe of Sayes-court, near Deptford, which he had in right of his wife; here he cultivated a garden, and was regarded as a great improver of the art of horticulture, and celebrated for the pains which he took in the introduction of exotics into this country. During the reign of Charles, a board of trade was formed, and Mr. Evelyn was appointed one of its members. On this occaſion he drew up a ſmall treatiſe on the origin and progreſs of navigation and commerce, with an aſſertion of the king's title to the dominion of the ſea. Among the papers which he communicated to the Royal Society is a curious letter, given at length in the Biographia Britannica, deſcribing the miſchiefs done to his garden by the ſevere winter of 1683—4. This letter will be read with intereſt, as affording information of the perennials at that time chiefly cultivated in England, and as ſtating the dire effects of rigorous froſt. We ſhall give the concluding paragraph:

"The vines have eſcaped, and of the eſculent plants and ſallads, moſt, except artichokes, which are univerſally loſt; and what I prefer before any ſallad whatever, eaten raw when young, my ſampier is all rotted to the very root. The arboreſcent and other ſedums, aloes, &c. though houſed, periſhed with me, but the yucca and opuntia eſcaped. Tulips, many are loſt, and ſo the Conſtantinople-narciſſus, and ſuch tuberoſæ as were not kept in the chimney corner, where was a continual fire. Some anemonies appear, but I believe many are rotted. My tortoiſe, which by his conſtant burying himſelf in the earth at the approach of winter, I looked upon as a kind of plant animal, happened to be obſtructed by a vine-root from mining to the depth he was uſually wont to inter, is found ſtark dead, after having many years eſcaped the ſevereſt winter. Of fiſh I have loſt a few, and the nightingales, which for being a ſhort winged bird, and ſo exceedingly fat at the time of the year, we commonly ſuppoſe them to change the climate, whereas indeed they are then hardly able to fly an hundred yards, are as briſk and frolic as ever; nor do I think they alter their ſummer ſtations whatever may become of them all the winter."

In the reign of James II. Mr. Evelyn was, during the abſence of the earl of Clarendon in Ireland, made one of the commiſſioners for executing the office of lord privy ſeal, and after the revolution he was appointed treaſurer of Greenwich hoſpital. In 1697 he publiſhed a diſcourſe on medals, entitled "Numiſmata, &c." and his laſt work was "Acetaria, a Diſcourſe of Sallets," in which he treats of the nature and properties of all plants which have been employed as ſallad herbs. This diſcourſe was inſcribed to lord chancellor Somers. The dedication, which is written with much elegance, was intended to procure, if poſſible, a public eſtabliſhment for the Royal Society. Mr. Evelyn died in Feb. 1706 in his 86th year, having paſſed his days in uſeful and elegant purſuits, and diſtinguiſhed by benevolence, piety, and integrity. Biog. Brit.

Evelyn, John, ſon to the former, was born Jan. 14, 1654, at his father's houſe at Deptford. He was at a very early age admired for his rapid progreſs in knowledge, ſo that in the year 1666 he was ſent to Oxford under the ſpecial care of Dr. Bathurſt, till he could be admitted a gentleman commoner, which was in the Eaſter term, 1688. It does not appear that he took his degrees there, but returned to his father's houſe, where he proſecuted his ſtudies with much diligence and ſucceſs. During his reſidence in Trinity college, he is ſuppoſed to have written the elegant Greek poem which is prefixed to the ſecond edition of the Sylva. He became deeply learned in the ancient and modern languages, and cultivated poetry, of which there is evidence by a tranſlation "Of Gardens, firſt written in Latin by Renatus Rapinus." This was publiſhed when the tranſlator was a youth of nineteen years of age only. He afterwards tranſlated Plutarch's life of Alexander the Great from the Greek; and from the French he gave a tranſlation of "The Hiſtory of the Grand Viziers, Mahomet, and Achmet Coprogli." He was likewiſe author of ſeveral poems, two of which have been chiefly admired, the one "On Virtue," and the other was entitled "The Remedy of Love," and have been inſerted in Dryden's Miſcellanies. Mr. Evelyn was a man of buſineſs as well as a cultivator of literature, and was appointed one of the commiſſioners of the revenue of Ireland. He died in the prime of life, in London, March 24, 1698, in the forty-fifth year of his age, leaving behind him two ſons and three daughters. Biog. Brit,

EUE'MBOLOS, (from *ευ. well*, *εν*, *in*, and *βαλλω*, *to caſt*,) a perſon ſkilful in ſetting bones.

EVEN Foot, in *Poetry*. See Foot.

Even *number*, is that which may be divided into two equal parts or moieties. See Number.

EVENELADS, in *Geography*, a river of England, in the county of Oxford, which runs into the Iſis, about 5 miles W. of Oxford,

EUENES, a town of Norway, 18 miles N. of Drontheim.

EVENING Star, in *Aſtronomy*. See Vesper.

Evening *iſland*, in *Geography*, a ſmall iſland in the Pacific ocean. N. lat. 2° 46'. W. long. 133° 17'.

EVENLY *even number*, is that which is exactly diviſible by an even number taken an even number of times; ſuch is 32, ſince it is diviſible by 8, taken four times.

Evenly *odd number*, is that which an even number meaſures by an odd one; as 30, which is meaſured by 6, taken five times.

EVENUS, in *Ancient Geography*, a river of Aſia Minor, according to Pliny, who ſays that the towns of Lyrneſſa and Miletus were built upon its banks. The inhabitants of Adramyttium drew water from this river by means of canals. Strabo.

Evenus, *Fidari*, a river of Greece, in Ætolia, which took its riſe towards the north-eaſt in mount Pindus, on the frontiers of Theſſaly, and paſſing through the territories of the Bomiæi, Ophienſes, and Apodoti, watered Calydon, and diſcharged itſelf into the ſea; to the weſt is the town called Chalcis. It was on the banks of the Evenus that Hercules, according to the fable, ſlew the centaur Neſſus.

EVERARD'S *ſliding rule*. See Sliding.

EVERBODE, in *Geography*, a town of France, in the department of the Dyle; 5 miles N. of Dieſt.

EVERDINGEN, Cæsar Van, in *Biography*, a painter of hiſtories, portraits, and landſcapes, born at Alkmaer in 1606. The maſter under whom he ſtudied, Van Bronkhorſt, ſoon obſerved and encouraged his ſuperior talents from among the reſt of his diſciples. He had a lively invention, and painted with freedom and firmneſs, and a good force of colouring.

Many of his pictures are ſpoken of in terms of praiſe; but the one ſelected as his principal performance is the repreſentation of the victory of David over Goliath. It was painted on the folding doors of the organ in the great church at Alkmaer; and the ſketch of it was preſerved in the council chamber of that city; it was painted in 1648. He died in 1679, aged 73.

Everdingen, Aldret Van, a landſcape painter, whoſe merit was very conſiderable. He was the nephew of Cæſar Van Everdingen, and was born in the ſame city, Alkmaer, in 1621. Having firſt attended to the inſtructions of Roland Savery, he afterwards greatly improved by thoſe of Peter Molyn; whom at laſt he ſurpaſſed in ſkill. He delighted moſt in the grand ſcenes of nature, or rather her more romantic features, ſuch as rocks, torrents, and cataracts, which he executed with great freedom and variety of touch. In his time he had no ſuperior, but Jacob Ruyſdael followed him immediately, was indeed partly contemporary with him, and in his own ſtyle left him far behind in the brilliancy and force of his colours and execution, and the choice of his forms. However, Everdingen is highly deſerving of great praiſe for the care which he took to make himſelf acquainted with the effects of nature, and the truth with which he marked them. He made a voyage up the Baltic, and was much gratified by and made much uſe of the ſcenery, which the romantic coaſts of that ſea, and of Norway, (which he alſo viſited) afforded him. He died in 1675, and left behind him a great number of drawings, both of real views and compoſitions, which are very freely wrought. He was thought not to ſucceed ſo well in large works as in ſmaller ones, thoſe coming more within the management of the neatneſs of pencilling, which characterizes his ſtyle of execution. The latter are very highly and very deſervedly valued in Flanders and Holland.

Everdingen, in *Geography*, a town of Holland, in Guelderland; three miles W. of Culemburg.

EVERET'S Bridge, a place of Nanſemond county, in Virginia; where is a poſt-office; 266 miles from Waſhington.

EVERGEM, a town of France, in the department of the Eſcaut, and chief place of a canton in the diſtrict of Gand. The place contains 6878, and the canton 13,176 inhabitants, on a territory of 67½ kiliometres and four communes.

EVERGETÆ, in *Ancient Geography*, a people of Aſia, placed by Strabo in the vicinity of Drangiana.

EVERGETES, Ευεργετης, a Greek term, ſignifying *benefactor*, being formed of ευ, *bene*, *well*, and εργον, *opus*, *work*. It is ſtill retained in our language by way of addition or epithet given to two princes or kings of Syria and Egypt, who ſucceeded Alexander. Thus we ſay Ptolemy Evergetes, king of Egypt, Antiochus Evergetes king of Syria.

EVERGREEN Thorn, in *Gardening*. See Mespilus *Pyracantha*.

Evergreen *Trees*, are ſuch trees, whether of tall or ſhrubby growth, as conſtantly retain their leaves during the whole year. There is a great number of this ſort of plants,

plants, which will be particularly deſcribed under their proper genera.

Theſe kinds of trees, ſhrubs, &c. are increaſed in different modes, according to their particular nature, as by ſeeds, layers, cuttings, ſuckers, &c. which is fully ſhewn under the culture of the different ſorts, but principally in the ſpring ſeaſon, though occaſionally in the ſummer, and frequently in the early autumn.

The proper ſeaſons for planting them out are the early autumn or latter ſpring months, according to the nature of the ſoil. Where the ſoils are of the more ſtiff, retentive, moiſt kind, the more advanced ſpring months are the beſt; but where they are of the light, dry, looſe deſcription, the beginning of the autumn is the moſt proper period; as in the former caſe the plants will be in no danger of being injured by ſtagnant moiſture in the winter, and in the latter there will be no riſk of their being deſtroyed by the heat and dryneſs of the ſummer, before they become perfectly eſtabliſhed in the ground.

In the planting of evergreen trees, it is ſeldom neceſſary to put them into any great depth, as they are very liable to be deſtroyed by deep planting. There is likewiſe another circumſtance that ought to be regarded, which is that of having the mould in which they are to be ſet ſufficiently fine, and the roots well bedded in it, without being too much cut in or retrenched. In all caſes the looſe mould ſhould be well trodden in about them; and the more tall growing kinds well ſupported with ſtrong ſtakes, ſo as to keep them perfectly ſteady in their ſituations. Numbers of trees of this, as well as other ſorts, are deſtroyed for want of attention in this reſpect, as when once they get looſe they ſoon die by the motion which takes place. The pruning or cutting in of this ſort of trees, where it is neceſſary, ſhould be performed either in the more advanced ſpring ſeaſon, or the latter part of the ſummer, but never in the winter ſeaſon, as they are liable to much injury from cold. This is equally neceſſary to be regarded in the clipping of hedges conſtituted of plants of this ſort.

Many of theſe ſorts of trees and ſhrubs are ſufficiently hardy to admit of being planted in moſt ſorts of ſoils and ſituations. The tall-growing kinds are well adapted for affording ornament and variety in mixture with thoſe of the deciduous claſs in extenſive plantations, and ſuch as are of a ſhrubby growth in the borders, clumps, and other parts of ornamented grounds. In theſe ſituations they ſhould be ſuffered as much as poſſible to take their natural growth, eſpecially the fir kinds, and in the others only very little cut in, and the dead wood removed from them.

In the forming of hedges various plants of this ſort are employed; but the beſt are thoſe of the holly, yew, evergreen privet, and box kind; though the common laurel and lauruſtinus may be the moſt adviſeable, where they are required to be lofty. Theſe are likewiſe capable of being trained ſo as to cover naked walls, palings, or other unpleaſant objects. Hedges formed of theſe plants ſhould be clipped once or twice during the ſummer ſeaſon, ſo as to keep them in perfect neat order.

Various ornamental devices were formerly made with theſe and other ſorts of evergreens in gardens; but theſe are at preſent little in uſe, as a better and leſs troubleſome taſte prevails.

It has been remarked by the author of "The Philoſophy of Gardening," that in theſe ſorts of trees and ſhrubs the buds riſe in the boſoms of the leaves, which, as they are not ſhed in the autumn, continue to oxygenate the juice of the plants, and ſupply nutriment to the buds during the fine days in the winter and ſpring ſeaſons, ſurviving till nearly the middle of ſummer, when the new buds have expanded leaves of their own. It is hence conjectured, that evergreens provide no ſtore of nouriſhment in their roots, or alburnum in the ſummer for the ſupport of their enſuing vernal buds, and of courſe have probably no bleeding ſeaſon, as is the caſe with thoſe of the deciduous kind.

And there is another circumſtance which has been ſtated by Dr. Milne, in his botanical dictionary, to take place in reſpect to evergreen trees, which is, that when they are engrafted on thoſe of the deciduous ſort, it determines the latter to retain their leaves. This is aſſerted to be confirmed by repeated experience, in grafting the laurel, (*lauro-ceraſus*) an evergreen, on the common cherry, (*ceraſus*), and the (*ilex*), an evergreen oak, on the common oak. And it is probable that many other facts of the ſame kind may exiſt, though they have not been noticed by common gardeners.

EVERLASTING. See Gnaphalium.

Everlasting *Pea*. See Lathyrus.

Everlasting *Pea*, in *Agriculture*, is the common name of a perennial plant of the vetch kind, which grows naturally in ſome ſituations in this country; and is capable of being cultivated with great care and advantage as a green food for cattle or other ſtock, where the ſoils are inclined to be of the more heavy loamy kinds; as it affords a large produce of the moſt nutritious ſort of fodder. Where it is ſuffered to ſtand till the ſeeds are formed, it has been found in the few trials that have been made with it to poſſeſs a highly fattening property when conſumed by animals.

EVERRIATOR, derived from *ex* and *verro*, *I cleanſe*, in *Antiquity*, an officer who was obliged in a ſolemn manner to cleanſe ſuch houſes as were defiled by dead bodies, called *domus funeſtæ*.

EVERRICULUM, (from *everro*, *to ſweep away*,) a kind of inſtrument, in *Surgery*, reſembling a ſpoon, and uſed for taking away any ſmall fragments of the ſtone, which may remain behind in the bladder, in the operation of lithotomy.

EVERS, in *Rural Economy*, a term ſometimes provincially applied to thoſe ſtiles which open; in which caſe the top rail has a bolt of iron driven through it at one end, the other falling into a notch in the oppoſite poſt, by which contrivance an opening can occaſionally be readily made.

EVERSBERG, in *Geography*, a town of Germany, in the kingdom of Weſtphalia; 34 miles N. of Cologn.

EVERY Year's-Land, in *Agriculture*, is a term applied to ſuch lands as have been cropped with what are termed brown and white crops, or pulſe and grain crops, in alternation or ſucceſſion for a very great length of time, without the intervention of any ſort of fallow. Mr. Marſhall has remarked that extenſive common fields in Glouceſterſhire have been conducted under this ſort of management for "perhaps centuries:" and the ſame is the caſe in ſome other countries.

EVES-Droppers, in *Law*. See Eaves-droppers.

EVESHAM, or Esam, in *Geography*, is a borough and market town, pleaſantly ſituated upon a riſing ground, above the banks of a navigable river, named the Warwickſhire Avon, in the hundred of Blakenhurſt, and county of Worceſter, diſtant from London ninety-ſix miles. This place claims high antiquity, and is not leſs notable for its ſubſequent celebrity. The firſt notice of it upon record, like the origin of moſt towns referable to the Saxon period, is the account of Egwin, biſhop of Worceſter, having founded a monaſtery here in the year 709: and amply endowed it by the aſſiſtance of Kenred, ſon of Wulpher, king of Mercia. This was one of the mitred abbies; its abbot ſat in the houſe of peers as a baron of the realm; its privileges were numerous and extenſive, and the revenues on the diſſolution were valued at the annual ſum of 1183*l.* Of the building, which from records appears to have been immenſe, few veſtiges remain. The large elliptical arch, decorated with rich but mutilated imagery, is ſtill ſtanding; and the tower noticed by Leland. "Clement Lichfeild the laſt abbot of Eveſham ſave one, did very much coſt in buildinge of the abbey and other places longing to it.—He made a right ſumptuouſe and high ſquare towre of ſtone in the cemitery of Eoveſham. This tower had a great bell in it, and a goodly clocke, and was as a gateway to one piece of the abbey." Itinerary, vol. iv. p. 108. This tower is a regular and beautiful ſtructure, twenty-two feet by twenty-two, and one hundred and ſeventeen in height; and is generally conſidered the laſt monaſtic building erected under papal influence in England. Though the churches have towers, this ſtill continues the ſtation for the clock and bells.

In that part of the town called Bengeworth, which may be viewed as a ſuburb on the eaſtern ſide of the river, over which the communication is formed by a handſome ſtone bridge of ſeven arches, ſtood an ancient caſtle, probably erected ſoon after the Norman conqueſt. For in the year 1152, abbot William de Audville gained this fortreſs from lord William de Beauchamp, who held it for king Stephen, razed it level with the ground, and converted the ſite into a place of interment.

Eveſham is a very ancient borough, enjoying numerous privileges, both by preſcription and charter. It was one of the towns ſummoned by writ to ſend members to parliament, in the twenty-third year of king Edward the Firſt's reign, when he baſely pretended to reſtore the Saxon conſtitution; and was one of the eight boroughs which had their elective franchiſe reſtored in the time of James the Firſt. That monarch at the ſame time granted a charter to the town to be governed by a mayor, ſeven aldermen, twelve burgeſſes, and twenty-four aſſiſtants, recorder, chamberlain, who are alſo of the common council, and other ſubordinate officers. The mayor and four ſenior aldermen are juſtices of the peace, form a *quorum*, and have power to hold a ſeſſions of *oyer* and *terminer*, and gaol delivery, to puniſh all crimes, except high treaſon, and execute felons within their liberty.

The town is much altered ſince Leland viſited it; the houſes, which then were what are called *half-timbered*, that is, timber frames, having the open parts filled up with wattle and dab, are moſtly well built with brick, the ſtreets are wide and ſpacious, and the ſalubrity of the air, with the beauty of the ſituation, induce many genteel families to take up their reſidence here. In the town are three pariſh churches, two in the part uſually called Eveſham, and one in Bengeworth; a well endowed free grammar ſchool, charity ſchool, and alms-houſe. The market, held on Mondays, is well ſupplied, and four annual fairs are held Febuary the ſecond, the firſt Monday after Eaſter, Whit-Monday, and the twenty-firſt of September. From the late returns to government under the Population act, the number of houſes appear to be 616, and of inhabitants 2837. The richneſs of the ſoil in the vicinity has been long an inducement to turn many of the fields into garden ground, and the peculiar fineneſs of the vegetable productions of this place has rendered Eveſham gardeners proverbial for unrivalled ſkill. They not only ſupply the neighbourhood, but alſo the city of Worceſter, fourteen miles diſtant; Birmingham, thirty; and during the aſparagus ſeaſon Bath and Briſtol, more than fifty. Tindal's Hiſtory and Antiquities of Eveſham.

Evesham, *Vale of.* The fine tract of land comprized under this denomination, unrivalled in fame or fertility, is ſituated on the eaſtern and weſtern banks of the river Avon, extending for ſeveral miles in various directions into Warwickſhire, where it is bounded by the high land of the Ridgeway, and into Glouceſterſhire, where the Cotſwold hills form a terminating barrier; and the ſouth is waſhed by the river Severn.

It is deſcribed in Monaſtic hiſtory as having derived the name, which it gives to the town already deſcribed, from *Eoves*, a Saxon, ſwine-herd to Egwin biſhop of Worceſter, in the latter end of the ſeventh century: this ham having been Egwin's property till he was dethroned by the pope, and his eſtates confiſcated. Previouſly to this it was called Heth-holme, or Heath-field.

To thoſe who wiſh to ſee what "ſun and ſoil," unaſſiſted by art, can do, parts of this diſtrict will furniſh ſtriking ſpecimens. And to the admirers of agriculture other portions will evince what wonders may be effected from aiding the efforts of nature by the application of art. The ſoil is principally a deep heavy loam, or rich loamy clay, of inexhauſtible depth, equally calculated for corn, or paſturage. And whether it be placed under an arable, or a grazing ſyſtem, the produce and the profits alike exceed analogical belief. The vale of Eveſham, ſays Leland, "is, as it were, for ſuch an angle, the horreum of Worceſterſhire, it is ſo plentiful of corn;" and juſtly has he characterized this prolific ſpot. For the abundance of herbage is not equalled by the famous Tilney ſneeth in the hundred of Marſhland and county of Norfolk; nor can the crops of corn be ſurpaſſed, except by thoſe deſcribed in Brydone's Tour as produced in the vales of Sicily. The rent of lands in the farms of this diſtrict is equal to that of accommodation lands in moſt other parts of the kingdom; yet perſons who have occupied eſtates in ſome others, at an exceeding low rate on a compariſon of the net proceeds from both, do not heſitate in deciding in favour of the higher rental. In this vale, about a mile diſtant from the town of Eveſham, was fought the moſt memorable battle recorded in the annals of Engliſh hiſtory, between Simon de Montfort, the powerful earl of Leiceſter, and prince Edward, afterwards king Edward the Firſt; in which the earl was completely defeated, and the refractory barons, with moſt of their adherents, taken or ſlain. He has been not unaptly compared to the Roman conſpirator Catiline, for, like him, he verified in his conduct the remark of Tiberius, recorded in Tacitus Ann. l. iv. c. 18. "Beneficia eo uſque lata ſunt, dum videntur exſolvi poſſe." "Favours are only ſo long properly beſtowed as there appears a probability, or at leaſt a capability of return." After king Henry the Third had conferred upon him an accumulation of honours and emoluments, and even permitted him to marry the princeſs, his ſiſter; he experienced from the earl the moſt ungrateful requital. He purſued the monarch with the moſt inveterate hatred; and by inflammatory ſpeeches, and other overt acts, excited the moſt perplexing commotions, and diſtreſſing inteſtine warfare, the kingdom ever experienced; under a pretence of reſtraining the prerogative, reforming the government, and aſcertaining and ſecuring the liberties of the ſubject. The conteſt, however, was productive of good, intended by neither of the parties. The prince, when he had aſcended the throne, determined to ſtill further curtail the enormous power of the barons; and by his writs ſummoned together, as his adviſers, repreſentatives from numerous cities and boroughs, as well as counties; the battle of Eveſham therefore may be conſidered "as the origin of our preſent houſe of commons."

Evesham, a townſhip of America, in Burlington county, New Jerſey, ſituated between the forks of Moore's creek, which runs north-weſterly to Delaware-river; 16 miles E. of Philadelphia.

EVESPERIDES, in *Ancient Geography*, a people of Africa, in the maritime part of Libya, to the weſt of the Auſchiſes: whoſe country, according to Herodotus, was ſingularly fertile; whence it has been ſuppoſed that the famous garden of the Heſperides was found in their territory. This name, in its grammatical acceptation, ſignifies Occidentals.

EVESPERIS, a town on the coaſt of Africa, which afterwards took the name of Berenice.

EVEST, in *Geography*, a river of Ruſſia, which runs into the Dwina, near Kreutzburg.

EUEXIA, from ευ, *well*, and εξις, *habit*, in *Medicine*, a good ſound habit of body.

EUFEMIA, St., in *Geography*, a town of Naples, in the province of Otranto, two miles N.N.E. of Aleſſano. —Alſo, a town of Naples, in Calabria Ultra, ſituated on a bay of the Mediterranean, to which it gives name. N. lat. 39° 2′. E. long. 16° 30′.

EUFRA, a town of South Finland; 12 miles N.N.E. of Abo.

EUGALENUS, Severinus, in *Biography*, a phyſician of Doccum, in Frieſland, known chiefly as the author of a treatiſe on the ſcurvy, which once maintained a conſiderable character, and paſſed through many editions. Its title is "De Scorbuto Liber, cum Obſervationibus quibuſdam, brevique et ſuccinctâ cujuſque curationis indicatione, 1604." But the treatiſe of Dr. Lind, on the ſame ſubject, in which the abſurdities and ignorance of Eugalenus are pointed out, has ſuperſeded it. Eloy. Mangeti Bibl. Script. Med.

EUGANEI, in *Ancient Geography*, a people of Italy, towards the Alps.

EUGANO, in *Geography*, a mountain of Italy, in the weſt part of the Paduan, bordering on the Vicentin.

EUGENE, Francis, of Savoy, in *Biography*, generally denominated prince Eugene, grandſon of Charles-Emanuel, duke of Savoy, was born at Paris in 1663, and deſtined for the church. His mother, on account of her ill-conduct, was obliged to leave Paris. She retired to Bruſſels, and young Eugene being deprived of her ſupport, and having been diſappointed in his expectations of preferment, went as volunteer to ſerve in Germany againſt the Turks. He, with other French volunteers, was recalled on pain, in caſe of diſobedience, of perpetual baniſhment. He ſet the order at defiance, and ſo much diſtinguiſhed himſelf in his firſt campaign, that the emperor gave him a regiment. After the ſiege of Vienna was raiſed, he ſerved in Hungary under the command of the duke of Lorrain and the elector of Bavaria. From this time his reputation increaſed, with every action in which he engaged, till, in the year 1697, he was appointed to the command of the imperial army. In the autumn of this year he entirely defeated the Turks at the battle of Zeuta, in which the grand vizier and more than 20,000 men were left on the field, and the grand ſeignior was obliged to make a precipitate retreat with the broken relics of his army. Eugene had hazarded this engagement contrary to the expreſs orders of the imperial court; but he ſo completely juſtified his conduct, that Leopold gave him a written authority to act thenceforth according to his own judgment. He was now oppoſed by all the great French generals, but in every battle his exertions and proweſs were crowned with ſucceſs, and on returning to Vienna the emperor created him preſident of the council of war, and entruſted the military cheſt to him; but that cheſt was frequently ill ſupplied, which occaſioned him more trouble than the moſt vigorous oppoſition in the field. He was ſtrictly united with the duke of Marlborough, and by their talents and concert they obtained a deciſive ſuperiority over the French in Germany. At the celebrated battle of Blenheim, Eugene commanded the imperial part of the army, and had no ſmall ſhare in the ſucceſs. In 1705, he was defeated in Italy, but in the following campaign he regained his reputation by marching acroſs Lombardy in the face of the French army, and attacking the French in their intrenchments at Turin, over whom he obtained a complete victory, which ſecured the duke of Savoy and reſtored all the Milaneſe to the emperor. In 1707, he invaded France, but without obtaining any deciſive advantage, and in 1708 he was with the duke of Marlborough at the battle of Oudenard, and the capture of Liſle. He commanded the centre at the bloody battle of Malplaquet, where he was grievouſly wounded, but refuſed to retire from the field, ſaying, "Of what uſe will it be if we are to die here;—if we are to ſurvive it will be time enough in the evening to be dreſſed." When the politics of England took a turn and peace was determined on, Eugene carried on the war alone, till it was concluded by the peace of Radſtadt in 1714. Shortly after this he was called on to contend again with the Turks, whom he ſignally defeated in the year 1716. In the following year he undertook the ſiege of Belgrade, when the Turks came to its relief, and inveſted him in his camp. He ſuffered them to approach very near, and then ſuddenly quitting his lines fell upon them with ſo much vigour, that he killed 20,000 men, and poſſeſſed himſelf of their cannon and camp equipage. Belgrade immediately ſurrendered, and an advantageous peace was the reſult of this important victory. Eugene now retired to Vienna covered with glory, and juſtly conſidered as the ſaviour of the empire, and the greateſt benefactor to the houſe of Auſtria. He was great in retirement, as he had been heroic and magnanimous in war. In the year 1733 he attempted new exploits, in conſequence of the diſputed election to the Poliſh crown; but he was no longer the great, the enterprizing Eugene. He died in 1736 at Vienna, aged ſeventy-three. As a man he was cold and reſerved in his manner, and ſerious in his aſpect: as a friend he was liberal, free from pride, faithful to his promiſes, and ever ready to do a kind action. As a general he was regarded by thoſe under him in the character of a father and protector: in his military capacity he was enterpriſing, full of reſources, and though he ſometimes committed faults, he rarely failed to redeem his credit by new and brilliant ſucceſſes. Moreri. Modern Univerſal Hiſt. Hiſt. of England. See alſo the article Churchill in this Dictionary.

EUGENIA, in *Botany*, ſo named by Micheli in compliment to the heroic prince Eugene of Savoy, who ſent him from Germany almoſt all the plants deſcribed by Cluſius, and who had a celebrated botanic garden. Mich. Gen. 226. t. 108. Linn. Gen. 247. Sm. Tr. of Linn. Soc. v 3. 280. Schreb. 333. Willd. Sp. Pl. v. 2. 959. Mart. Mill. Dict. v. 2. Juſſ. 324. (Syzygium; Gærtn. t. 33.). Claſs and order, *Icoſandria Monogynia*. Nat. Ord. *Heſperideæ*, Linn. *Myrti*, Juſſ.

Gen. Ch. *Cal.* Perianth ſuperior, in four deep, oblong, obtuſe, concave, permanent ſegments, the orbicular centre between them elevated, and ſomewhat downy. *Cor.* Petals four, twice as large as the ſegments of the calyx, oblong or roundiſh, obtuſe, concave. *Stam.* Filaments numerous, inſerted into the elevated ring of the calyx, about as long as the corolla; anthers ſmall, roundiſh. *Piſt.* Germen inferior, turbinate; ſtyle ſimple, the length of the ſtamens;

ſtigma ſimple: *Peric.* Berry roundiſh or angular, crowned with the calyx, of one cell. *Seed* ſolitary, roundiſh, ſmooth and even.

Eſſ. Ch. Calyx ſuperior, in four deep ſegments. Petals four. Berry of one cell, with one ſeed.

Obſ. The number of petals, and ſegments of the calyx, is frequently five, in one inſtance eight. The germen has, in ſome ſpecies at leaſt, two cells, though one of them becomes obliterated as the fruit ripens.

This is an extenſive genus, chiefly from the Eaſt and Weſt Indies, whoſe ſpecies are as difficult to define as the roſes in our European gardens. Their habit is akin to the myrtle, but often more ſtout and arboreſcent. *Leaves* ſimple, oppoſite, ovate or elliptical, entire, without ſtipulas, moſt frequently ſmooth, paler beneath, evergreen. *Flowers* either terminal or axillary, white or reddiſh. *Fruit* not unwholeſome, but ſcarcely ever very grateful to the palate; in ſome caſes highly fragrant. Willdenow has 30 ſpecies, a number far ſhort of what are known, and yet two of them (*acutangula* and *racemoſa*), are ſcarcely true *Eugeniæ*. There is alſo ſome confuſion between this genus and *Plinia*, the original *E. uniflora*, Linn. Sp. Pl. 673, being not only *Myrtus braſiliana*, ibid. 674, but alſo *Plinia rubra*, Linn. Mant. 243; as well as *P. pedunculata*, Linn. Suppl. 253; under which laſt name it is figured in Curt. Mag. t. 473, with a wrong quotation of Linn. Mant. Whatever the *Plinia* of Plumier may be, this plant is the original *Eugenia* of Micheli's figure, and is well known in the Braſils and Weſt Indies, its fruit reſembling an indifferent cherry in ſize, taſte, and colour, though different in being externally furrowed. This fruit ſometimes ripens in ſtoves in England, but the plant is no general favourite, being a meagre repreſentative of the common myrtle.

E. *Jambos*. Linn. Sp. Pl. 672. (Malacca Schambu; Rheede Hort. Mal. v. 1. t. 17.), is much celebrated for the fragrance of its fruit, which reſembles that of a roſe, or rather roſe-water. It is alſo of an extremely fine yellowiſh colour with a roſy tint, and though not pleaſant to the taſte, is frequently brought to table in the Indies, for the ſake of its perfume.

E. *malaccenſis*. Linn. Sp. Pl. 672. Sm. Exot. Bot. t. 61, a beautiful Eaſt Indian ſpecies, is eſteemed for the elegance of its red cluſtered flowers, as well as the flavour and cooling quality of its fruit.

EUGENIUS I. in *Biography*, pope, was born at Rome, and raiſed to the higheſt dignity in the church in the year 634, on the depoſition of pope Martin. He owed his elevation to the choice of the Roman people and clergy, and their choice was confirmed by the emperor Conſtans. At this period the weſtern and eaſtern churches were furiouſly contending with each other upon the queſtion whether Chriſt poſſeſſed one will or two. Eugenius, after his promotion, took pains to quiet the minds of the diſputants. A compromiſe was entered into between the parties, but it was not of that nature to command general approbation: it was unſatisfactory to the Roman people and clergy, who oppoſed the admiſſion of the patriarch Peter's confeſſion of faith. Peter had taken the other ſide of the queſtion, and in his confeſſion he took no notice of the will and operations in Chriſt. So vehement was this party that they refuſed to permit the pope to perform divine ſervice in the church of St. Mary, until he had publicly declared his condemnation of it. We have no other particulars relating to this pope, who died in the year 657, but he was commended by his contemporaries and ſucceſſors for piety, mildneſs, humanity, and generoſity. Moreri. Bower.

Eugenius II. pope, was a Roman by birth, and from being archprieſt of St. Sabina, was made biſhop of Rome in the year 824. This election was oppoſed by the people, who made choice of a different perſon for pope. The double election excited conſiderable diſturbances at Rome, which occaſioned the interference of Lewis the Debonnaire, who decided for Eugenius, and confirmed him in his high office. The monarch took this opportunity of reviving ſeveral ancient cuſtoms and laws, declaratory of the dependence of the biſhops of Rome on the imperial power, and determining the limits of the ſubmiſſion and obedience which were paid to them. Eugenius, to ſecure his own power, took the oath of fidelity to Lewis and his ſon Lotharius, in which was included their ſolemn engagement that no future pope ſhould be conſecrated with their conſent, but in the preſence of the emperor's deputy, and after the exaction of a ſimilar oath to what was at that time adminiſtered. During the pontificate of Eugenius, a council was aſſembled in France under the auſpices of Lewis and the Greek emperors Michael and his ſon Theophilus, to examine the doctrine of the Greek church, in relation to images. This was in the year 825, and at the concluſion of the council the biſhops wrote a letter to Lewis, giving ſentence againſt both parties, *viz.* the churches of Conſtantinople and Rome; the former for breaking images, whence they were denominated "Iconoclaſtæ," and the latter for worſhipping them, whence they obtained the title of "Iconolatræ," declaring at the ſame time that it was a far greater crime to worſhip than to break images. The emperor was alſo exhorted by the council to interfere with the pope, and to intreat him to aboliſh the ſuperſtitious worſhip of images, which was the cauſe of much offence to all good men. Lewis wrote to the pope, and deputed two biſhops to reaſon with him on the ſubject, but to little or no purpoſe; he continued not only to promote, but to juſtify the practice of image worſhip. In the following year Eugenius held a council at Rome, in which a number of decrees were paſſed, intended to reform the ſtate of eccleſiaſtical diſcipline, and to encourage the progreſs of literature both ſacred and profane, but he died in the year 827, before he could carry his plans into effect. He was highly ſpoken of by Catholic writers, and applauded for his humility, his beneficence, and the humane policy of his government. He is repreſented as excelling in mental and corporeal endowments. As a writer, two of his epiſtles, and eleven of his decrees, are extant in the ſeventh volume of the "Collectio Conciliorum." It has been reported, and not greatly to the credit of Eugenius, that he was the inſtitutor of the ordeal by cold water. See Ordeal. Moreri. Bower.

Eugenius III. pope, ſo called upon his elevation to the popedom, from his uſual name Bernard, was a native of Piſa, and a diſciple of St. Bernard. On the death of Lucius II. in the year 1145, Bernard was unanimouſly fixed on by the cardinals as the new pope, and was enthroned with the uſual ceremony under the title of Eugenius III. The people, who had been long ſtruggling to wreſt from the popes the ſovereignty which they had acquired over them in temporal matters, would not ſuffer Eugenius to be conſecrated, unleſs he reſigned all pretenſions to dominion, otherwiſe than as connected with his ſpiritual rank, and would be contented with the revenue to be derived from tithes, and the voluntary contributions of the faithful. Unwilling to make theſe conceſſions, he privately withdrew to the Benedictine monaſtery of Farſa in Sabina, whither he was followed by the cardinals, and conſecrated. Not daring to return to Rome, he removed from Farſa to Viterbo, where he continued for ſome months. During his abode there embaſſadors arrived from the Cruſaders in the Eaſt, to implore aſſiſtance from the pope and the weſtern princes againſt the Turks, who had gained ſome important advantages over them. Eugenius ſupplicated the aſſiſtance of Lewis VII. king of France, ſtrongly urging him to march in perſon to the relief of the Chriſtians in the Holy Land, and conferring on thoſe who ſhould attend him the privileges which his predeceſſors had granted to ſuch as engaged in the holy war. Lewis embarked, and Eugenius now took meaſures to reduce the Romans to ſubmiſſion, which he effected in a ſhort time, and forced them to acknowledge him as their temporal as well as ſpiritual lord. His triumph was of no long duration, for an inſurrection obliged him to ſeek for perſonal ſafety in flight. He went to Treves, where he held a council in the year 1146. In the following year he was reſpectfully entertained at Paris by the king; and here he was allowed to hold a council, in which William, archbiſhop of York, was depoſed from his dignity. From Paris he went to Rheims, where, in 1148, he held that council before which the fanatic Eon was examined. See Eon. He next returned to Italy, and, with the aſſiſtance of the king of Sicily, once more ſubdued the people of Rome, in the year 1149. Shortly after this he was obliged to retire into Campania, where he remained till the year 1152. During this period he was not inactive, but ſent a legate into Ireland, by whom he eſtabliſhed the four archbiſhoprics in that kingdom. He was now permitted to return to Rome, where he lived in peace till his death in 1153. His virtues have been highly commended by his contemporaries. By ſome writers his chief merit ariſes from his zeal and ſufferings in promoting the intereſts of the holy ſee, and in combating the errors of heretics: by more modern hiſtorians his memory has been held in abhorrence on account of the active part which he took in promoting the Cruſades, by which great calamities overwhelmed Europe and the eaſtern world. Moreri. Bower. See Croisade.

Eugenius IV. pope, was a native of Venice, and of plebeian rank, though deſcended from an ancient family. His original name was Gabriel Condelmerio, and while he was very young he accompanied a nephew of pope Gregory XII. to Rome, where he took the Celeſtine habit. He was afterwards made treaſurer to the pope himſelf, and then biſhop of Sienna. In 1408 he was advanced to the office of cardinal preſbyter of St. Clement. While Martin V. was pope he was ſent delegate into the Marche of Ancona, and afterwards to Bologna, and performed the duties repoſed in him with great ability and reputation. On the death of Martin in 1431, he was elected to the papal ſee, when he aſſumed the name of Eugenius IV. Immediately upon his elevation he involved himſelf, and the city of Rome, in the moſt alarming difficulties, by attempting to ſeize upon treaſures ſaid to have been left by his predeceſſors; and no ſooner was he extricated from the dangers reſulting from this conduct, than he drew upon himſelf freſh troubles with the council of Baſil, which he determined to diſſolve on account of their conciliating meaſures with the Huſſites of Bohemia. His legate, cardinal Cæſarini, whom he empowered to act on the occaſion, a man of much diſcretion, forewarned him of the troubles he was likely to bring on himſelf by the act. Eugenius had, however, made up his mind, and in 1431 iſſued his bull, declaring the council of Baſil to be diſſolved, and appointing another to be convened in eighteen months at Bologna. The emperor urged the pontiff to revoke his decree, ſetting forth in ſtrong and very preſſing terms the evils into which he would otherwiſe plunge the Chriſtian world; and he added that he was ſure the aſſembled biſhops would not ſubmit to be diſappointed of the object of their meeting, and that he, as protector of the church, was bound to afford them his ſupport. Eugenius was immoveable, and the council were alike determined to ſet his power at defiance. After confirming the decrees of the council of Conſtance, which declared the papal power to be ſubordinate to that of a general council, and bound by its ſtatutes and mandates, they voted that no power on earth could diſſolve them without their conſent, and that none ſhould withdraw from them without their leave; and they went ſo far as to ſummon the pope to appear in perſon before them within a limited time, or to ſend legates with full authority to act in his name. The firmneſs of the council, after much altercation, brought the pope to ſubmiſſion, and in the year 1433 he iſſued a bull, declaring null and void whatever had been done by him, or in his name, in derogation of the council-general of Baſil. In the ſame year Eugenius received the emperor Sigiſmond at Rome with great magnificence, and crowned him there. Shortly after this he was attacked by Philip duke of Milan, who laid waſte the territory of Rome, and when the inhabitants laid their complaints before the pope, he referred them to the cardinal his nephew, who, regardleſs of every thing that did not contribute to his own eaſe and pleaſure, treated their ſufferings with neglect and contempt. Enraged at this behaviour they took up arms, and produced a temporary revolution at Rome. It was with the utmoſt difficulty that Eugenius eſcaped from their fury, and took refuge at Florence; a reconciliation was effected, which was farther confirmed through the mediation of the council of Baſil, who diſpatched ſome of their body to offer friendly advice on the occaſion. In 1437 freſh diſſenſions aroſe between the council and the pope, which terminated in their final rupture, and a new council was appointed to meet at Ferrara, whoſe firſt act was to declare the congregation of Baſil an unlawful aſſembly, and themſelves the only oecumenical council lawfully aſſembled, and they ordered all biſhops who ſtill remained at Baſil to withdraw from that city within thirty days, on pain of excommunication, and the forfeiture of their dignities and benefices. The council of Baſil, on the other hand, paſſed a decree or ſentence of ſuſpenſion againſt Eugenius from papal juriſdiction, forbidding all eccleſiaſtics, on pain of excommunication, to obey him. Early in the year 1439, a contagious diſorder breaking out at Ferrara, the pope tranſlated the council to Florence, where a pretended union was effected between the Greek and Latin churches, which, being violently oppoſed at Conſtantinople, was rendered null and void. In the mean time the council of Baſil, after declaring the ſuperiority of councils over the pope to be an article of the Catholic faith, proceeded to depoſe Eugenius from the papacy, as diſobedient to the commands of the church, a contemner of the canons, a diſturber of the unity of the church, and an obſtinate heretic; and they diſpatched nuncios to the different courts of the Chriſtian princes to acquaint them with the meaſures which had been adopted. Eugenius thundered out his excommunications againſt the fathers at Baſil, but they held his decrees in deriſion, and raiſed to the papal throne Amadeus, duke of Savoy, who aſſumed the name of Felix V. The rival popes and rival councils anathematized each other, laying claim to the true apoſtolic powers. Eugenius was ſupported by France, Italy, Spain, Portugal, Hungary, and England, but Felix was defended by the people of Savoy, by the Swiſs, and by the dukes of Bavaria and Auſtria. The German princes choſe to preſerve a neutrality till the year 1447, when they declared for Eugenius, determining that he was the only true vicar of Chriſt upon earth. In the midſt of the public rejoicings on this occaſion, he died in his ſixty-fourth year. His character as a pope is eaſily gathered from what has been ſaid; he was ambitious, intriguing, and a decided enemy to reform. In his laſt illneſs he is ſaid to have been painfully affected with reflections on his paſt life; "Oh Gabriel," exclaimed the dying pontiff, "how much better had it been for thy ſoul's ſafety, hadſt thou never been promoted to the dignity of cardinal or pope!" He was a patron of literature and learned men, though he had no pretenſions to learning himſelf; his epiſtles and bulls are to be found in volumes xii. and xiii. of the "Collectio Conciliorum." He was a handſome man, of a venerable aſpect, and always looked downwards when he appeared in public. He was frugal and temperate in his own perſon, but was liberal and hoſpitable; and at his table there was a princely magnificence. In this reign the cardinals began to indulge in the ſports of the field, and to abandon themſelves to all kinds of luxury. Bayle. Moreri. Bower.

Eugenius, Catholic biſhop of Carthage, was raiſed to that ſituation in the year 481, at the requeſt of the emperor Zeno, who had entered into a treaty of peace with Hunneric, at that time the reigning monarch. In the year 483, he was ſummoned, with the other Catholic biſhops, by the king, to Carthage, to maintain a public debate in defence of their principles againſt the Arian biſhops, whom he patronized. Eugenius undertook to draw up a treatiſe, explanatory of the Catholic faith, which was approved by all the biſhops of his party, and preſented to Hunneric, and he offered to defend the principles contained in it by an appeal to the ſacred writings, as well as to the ſentiments of the fathers. He alſo delivered a petition to that prince, in the form of an apology, the deſign of which was, to obtain peace for the Catholics. It was, however, of no avail; the biſhops of that party were all ſentenced to baniſhment, and Eugenius was ſent into exile, amidſt the dreary deſerts of Tripoli. In the following year Hunneric died, and Eugenius was permitted to return to Carthage, but was again baniſhed, on the acceſſion of Thraſamund, and ſent into Gaul. He died at Albi, in the year 505. His principal works are, "Expoſitio fidei Catholicæ," "Apologeticus pro fide;" "Altercatio cum Arianis;" and a letter to his people, exhorting them to conſtancy in the orthodox faith. Moreri.

Eugenius, biſhop of Toledo, in the ſeventh century, was attached to the monaſtic life, but compelled, by order of the prince, to accept of the epiſcopal dignity in the year 646. He filled that ſee ſeveral years, and made a figure at the councils of Toledo, which were held in the years 653, 655, 656. He was author of a treatiſe "On the Trinity," and two books on miſcellaneous ſubjects. He reviſed and improved Dracontius's work on the creation of the world, which was publiſhed at Paris, together with his "Opuſcula," in the year 1619. Moreri.

EUGHTGUR, in *Geography*, a town of Hindooſtan, in the circar of Kitchwara; 15 miles E. of Ougein.

EUGIA, in *Ancient Geography*, a ſmall country of the Peloponneſus, in Arcadia.

EUGMO, in *Geography*, a ſmall iſland on the eaſt ſide of the gulf of Bothnia. N. lat. 63° 49′. W. long. 22° 42′.

EUGUBIO. See Gubbio.

EUHYDRIUM, in *Ancient Geography*, a town of Greece, in Theſſaly, according to Livy.

EVIAN, in *Geography*, a town of France, in the department of the Leman, on the coaſt of the lake of Geneva, containing two pariſhes and two convents. The place includes 1502, and the canton 12,911 inhabitants, on a territory of 280 kiliometres, and in 19 communes. Near Evian are ſome mineral waters, which render it in ſummer a place of reſort. It is ſituated 23 miles N. E. from Geneva. N. lat. 46° 25′. E. long. 6° 24′.

EVICTION, from *evinco*, *I overcome*, in *Law*, ſignifies a recovery of lands or tenements by law.

EVIDENCE, a quality in things whereby they become viſible and apparent to the eyes, either of the body or the mind.

The ſchoolmen diſtinguiſh evidence into *formal* and *objective*. The former is the act of the intellect, conſidered as clear and diſtinct; the latter conſiſts in the clearneſs and perſpicuity of the object; or it is the object itſelf ſo conſtituted as that it may be clearly and diſtinctly known.

Others divide evidence into *moral*, *phyſical*, and *metaphyſical*. A thing is ſaid to be *morally evident*, ſo far as we have a diſtinct notion or knowledge thereof, by unexceptionable witneſſes; *phyſically*, ſo far as natural ſenſe and reaſon, pointing out any thing, convince us thereof; *metaphyſically*, when we enter fully and clearly into the eſſence of any thing.

Evidence is the eſſential and infallible character or criterion of truth, and is that in effect which with us conſtitutes truth.

If evidence ſhould be found in propoſitions that are falſe, we ſhould be compelled into error, ſince the aſſent we give to evidence is neceſſary: whence would follow this impious poſition, that God who made us is the author of our errors, as he has conſtituted us ſo as to put us under a neceſſity of falling into them.

It may be added that as we neceſſarily love truth and hate error, it ſeems inconſiſtent with the nature of a beneficent being to form us with a love of what we could not obtain, or not know whether we did obtain it or not; beſides, that if we ſhould err in things that are evident, as well as in thoſe that are not ſo, we ſhould ſometimes find contradictions in evident propoſitions, as we commonly do in things that are obſcure.

Evidence, therefore, muſt be allowed the mark of truth; and thoſe things muſt be allowed true which carry with them ſuch a degree of evidence as obliges us to aſſent to them. Whatever we ſee evidently agreeable to things whereof we ſpeak, that we muſt acknowledge to be true.

The Epicureans allow of no other evidence but that of ſenſe, or that ariſing from ſenſe, it being a fundamental principle with them, that ſenſe is the firſt and primary criterion of all truth. By evidence of ſenſe, they mean that ſpecies or image exhibited by the ſenſe or phantaſy; which, when all impediments to a juſt judging, as diſtance, motion, medium, &c. are removed, cannot be contradicted or gainſaid; wherefore, the queſtion being put, whether or not a thing be ſuch as it appears; the anſwer is not to be given, till it has been tried and examined in all the ways, and by all the ſenſes, of which it can be an object. See Error.

There are certainly other ſuperior and leſs fallible ſources or grounds of evidence than ſenſe: ſuch is that inward conſciouſneſs by which we learn what belongs to the mind, or that which Mr. Locke calls reflection; of which ſuch are intelligence, intuition, and common ſenſe, principally relating to thoſe abſtracted, or other propoſitions that carry their own evidence with them, and admit no doubt about them; whence we derive our aſſent to propoſitions called axioms and maxims: ſuch is alſo reaſoning, whereby we infer one truth from others by natural and juſt methods of argument, whence reſults ſcience: ſuch is likewiſe the teſtimony of others, on which we found the evidence of Faith (ſee alſo Testimony): to which we may alſo add inſpiration, or that impreſſion made on the mind by God himſelf, which gives a convincing and indubitable evidence of the truth of any propoſition, and atteſted to others, either by prophecy or miracles. Watts's Logic, part ii. chap. ii. § 9.

By thus conſidering the various ſources whence our perception and belief of any truth are derived, we may be led to diſtinguiſh evidence into intuitive and deductive, and that founded on teſtimony. Intuitive evidence comprehends that of pure intellection, of conſciouſneſs, and of common ſenſe, under the laſt of which that of memory is included. (See INTUITIVE.) Deductive evidence is divided into ſcientific and moral; the latter of which includes thoſe kinds of evidence that are deduced from experience, analogy, and teſtimony, to which may be added a mixed ſpecies, derived from the calculation of chances. (See DEDUCTIVE.) See alſo each of the above-mentioned ſubjects. See Campbell's Phil. of Rhet. book i. chap. 5.

The evidences of the Chriſtian religion are diſtinguiſhed into two kinds, the direct and collateral: the direct evidences are external and internal; the external are miracles and prophecy; the internal evidence is deduced from its excellence, conſidered in reference to the main and principal end of Chriſtianity. Whatever does not either belong to its excellence conſidered in this light, or fall under the head of miracles wrought on purpoſe to atteſt it, or of prophecies fulfilled, and yet affords a proof or any real preſumption of its truth and divinity, is a collateral evidence for it. All the collateral evidences of the truth of Chriſtianity are in one ſenſe internal evidences, becauſe they all ariſe from ſome particulars in the nature of this religion, from ſome circumſtances which have attended its reception, or ſprung from it, or from ſome remarkable facts connected with it, and related in the goſpel hiſtory. Of this kind is the argument deduced from its great efficacy at its firſt appearance, in baniſhing polytheiſm, idolatry, ſuperſtition, and the arts of magic; in ſoftening the rigour of deſpotiſm, introducing moderation into government, excluding many inconvenient civil laws once generally prevalent, giving riſe to others of a very happy tendency, reſiſting the laws of war, humanizing the manners, and improving the cuſtoms of nations, and reforming the temper and conduct of thoſe who embraced it.

Another claſs of collateral arguments for the truth of the Chriſtian religion, ariſes from particulars in its nature or effects produced by it, or from facts in the Goſpel hiſtory, which cannot be at all accounted for but on the ſuppoſition of a Divine original; or which are, at leaſt, moſt naturally explicable on that ſuppoſition. To this claſs may be referred thoſe preſumptive arguments deduced from the character of Jeſus, ſo exalted, and yet ſo uniformly ſupported; the nature of his laſt diſcourſes with his diſciples; the character of ſome of his apoſtles; that of Judas the traitor; the controverſies among Chriſtians in the apoſtolic age; and the method uſed by Chriſt and his apoſtles, of referring their claims to the impartial inquiries of men. Other collateral arguments have an affinity to the external evidences of Chriſtianity: ſuch are thoſe derived from the miraculous converſion of the apoſtle Paul and his ſubſequent conduct; from the character of the man of ſin foretold by Paul; from the quick and extenſive propagation of the Goſpel; from the continuance and preſent ſtate of the nation of the Jews. Some of theſe arguments have an immediate relation to the proof of Chriſtianity from prophecies; others are related to the proof from miracles. Other arguments have an equal relation to the internal and external evidence of Chriſtianity; ſuch is that deduced from the manner in which Chriſt and his apoſtles propoſed the evidences of their miſſion, and the advantage they have gained in conſequence of the oppoſition and ſcrutiny of unbelievers. See on this ſubject Lord Lyttelton's Obſervations on the Converſion and Apoſtleſhip of St. Paul, Duchal's Preſumptive Arguments for the Truth of the Chriſtian Religion, and Gerrard's Diſſertation on the genius and evidences of Chriſtianity.

EVIDENCE, in *Law*, is any proof, whether by teſtimony of men on oath, or by writings and records; the former called *parol evidence*, that is, by word of mouth, and the latter *written evidence*.

It is thus called, becauſe the point in iſſue is hereby made evident to the jury. Evidence in the trial by jury includes not only that which is given in proof, but that which the jury may receive by their own private knowledge; for an account of which ſee the ſequel of this article.

With regard to parol evidence, or witneſſes, we may obſerve in general, that all witneſſes, whatever be their religion or country, that have the uſe of their reaſon, are to be received and examined, except ſuch as are *infamous*, or ſuch as are *intereſted* in the event of the cauſe. All others are competent witneſſes; though the jury from other circumſtances will judge of their credibility. Infamous perſons are ſuch as may be challenged as jurors, *propter delictum*; and, therefore, never ſhall be admitted to give evidence to inform that jury, with whom they were too ſcandalous to aſſociate. Intereſted witneſſes may be examined upon a *voir dire*, if ſuſpected to be ſecretly concerned in the event; or their intereſt may be proved in court. A party intereſted in a ſuit, or a wife for or againſt her huſband, a huſband againſt his wife, except in caſes of treaſon, an alien infidel, perſons *non ſanæ memoriæ*, thoſe that are attainted of conſpiracy, or in a præmunire upon ſtat. 5 Eliz. cap. 1. popiſh recuſants convict on ſtat. 3 Jac. I. cap. 5. (See contra 1 Hawk. P. C. c. 12. § 6.) perſons convicted of felony, perjury, &c. thoſe who by judgment have ſtood on the pillory, or been whipped, whilſt the judgment is in force, are diſabled from giving evidence: but kinſmen, though ever ſo near, tenants, ſervants, maſters, attornies for their clients, but not againſt them, becauſe they are obliged to keep their ſecrets, one of the jurors upon trial, and all others that are not infamous, who want not underſtanding, or are no parties in intereſt, may give evidence in a cauſe, though the credit of ſervants is left to the jury. (2 Rol. Abr. 685. 1 Vent. 243.) If after a man hath ſtood in the pillory, &c. he be pardoned, he may be an evidence; and though judgment of the pillory infers infamy at common law, by the civil and canon law it imports no infamy, unleſs the cauſe for which the perſon was convicted was infamous; and, therefore, ſuch may be a good witneſs to a will, if not convicted of any infamous act. (3 Lev. 426, 427.) It has been held, that it is not ſtanding in the pillory which diſables a perſon for giving evidence; but ſtanding there upon a judgment for an infamous crime, as forgery, &c. If for a libel, a man may be a witneſs. (5 Mod. 74. 3 Nelſ. Abr. 557.) Perſons excommunicated cannot be witneſſes; but perſons outlawed may be witneſſes, becauſe the outlawry has no influence on their credibility. (Bull. N. P. 292, 3.) A man convicted of felony, and afterwards pardoned, may be a good evidence. (Raym. 369.) Burning in the hand is ſaid to reſtore a perſon to his credit. (Ibid. 330.) A perſon condemned to be hanged for burglary, but having a pardon for tranſportation, hath been allowed to be a good evidence. (5 Mod. 108.) One outlawed for treaſon and pardoned may be an evidence. (State Trials, vol. iii. 515.) Perſons acquitted, or guilty of the ſame crime, while they remain unconvicted, may be evidence againſt their fellows. (Kel. 17.) Although no evidence ought to be given of what an accomplice hath ſaid, who is not in the ſame indictment; (State Trials, vol. ii. 414.) an informer may be a witneſs, though he is to have part of the forfeiture, where no other witneſſes can be had. (Wood's Inſtit. 598.) If an action is brought againſt many perſons for taking of goods, one of them may be admitted as an evidence againſt the reſt. (Comberb. 367. 1 Mod. 282.) In criminal caſes, as of robbery on the high way, in action againſt the hundred; in rapes of women, or where a woman is married by force, &c. a man or a woman may be an evidence in their own cauſe. (1 Vent. 243.) And in private enormous cheats, a perſon may give evidence in his own cauſe, where nobody elſe can be a witneſs of the circumſtances of the fact but he that ſuffers. (1 Salk. 286.) Upon an information on the ſtatute againſt uſury, he that borrows the money, after he hath paid it, may be an evidence, but not before. (Raym. 190.) Although an alien infidel may not be an evidence, a Jew may, and be ſworn on the Old Teſtament. (1 Inſt. 6.) A quaker ſhall not be an evidence in any criminal cauſe unleſs he will take an oath: though on other occaſions his affirmation ſhall be accepted inſtead of an oath. Stat. 7 and 8 W. III. c. 34. See QUAKER.

The oath of a Gentoo, ſworn according to the circumſtances of his religion, has been admitted in a civil matter. (1 Atk. 21.) And by Willes C. J. an infidel in general is an admiſſible witneſs, for the term does not imply that he is an atheiſt; but whenever it appears that a witneſs hath no idea of a God or religion, he ſhall not be permitted to give his teſtimony. (1 Atk. 40. 45.) When perſons that are competent witneſſes are ſerved with a writ of *ſubpœna ad teſtificandum*, they are bound to appear at the trial on pain of 100*l.* to be forfeited to the king, to which the ſtat. 5 Eliz. cap. 9. has added a penalty of 10*l.* to the party aggrieved, and damages equivalent to the loſs ſuſtained by want of their evidence: but no witneſs, unleſs his reaſonable expences be tendered him, is bound to appear at all; nor if he appears, is he bound to give evidence till ſuch charges are actually paid him, except he reſides within the bills of mortality, and is ſummoned to give evidence within the ſame. In a criminal cauſe, if a witneſs refuſe to appear, and give evidence, being ſerved with proceſs, the court will put off the trial, and grant attachment againſt him; and as refuſing to give evidence is a great contempt, the party may be committed and fined. (1 Salk. 278.) Preventing evidence to be given againſt a criminal is puniſhable by fine and impriſonment; and perſons diſſuading a witneſs from giving evidence, &c., and jurors or others, diſcloſing evidence given, are likewiſe offences puniſhed in the ſame manner. (2 Hawk. P. C. c. 22.) Members of either houſe of parliament may be witneſſes on impeachments. (State Trials, vol. ii. 612.) A perſon who hath a legacy in a will, is not a good witneſs to prove the will; but if he releaſe his legacy, he may be a good evidence. (Skin. 704.) Thus alſo, a perſon who claims any benefit by a deed, may not be an evidence to prove that deed; and a perſon concerned in the ſame title of land in queſtion will not be admitted as evidence. (Ibid. 705.) If a legatee is permitted to be ſworn and examined, the counſel cannot afterwards except againſt his evidence. (1 Lord Raym. 730.) To obviate all difficulties, it is enacted by ſtat. 25 Geo. II. c. 6. that any deviſe to a perſon being witneſs to any will or codicil ſhall be void, and ſuch perſon ſhall be admitted as a witneſs; and that any creditor atteſting a will or codicil, by which his debt is charged upon land, ſhall be admitted as a witneſs to the execution, notwithſtanding ſuch charge: the credit of every ſuch witneſs being left to the conſideration of the court and jury. The ſon of a legatee is no witneſs to a will in the ſpiritual court; but it is held he may be a good evidence to prove a nuncupative will, within the intent of the ſtatute of frauds. (1 Lord Raym. 85.) See WILL.

One credible witneſs is ſufficient evidence to a jury of any ſingle fact in all civil actions, though the concurrence of two or more corroborates the proof; but in caſes of high-treaſon, petit-treaſon, and miſpriſion of treaſon, by ſtatutes 1 Edw. VI. cap. 12. 5 and 6 Edw. VI. cap. 11. and 1 and 2 Ph. and Mar. cap. 10. *two* lawful witneſſes are required to convict a priſoner, except in caſes of coining and counterfeiting the ſeals, or unleſs the party ſhall willingly and without violence confeſs the ſame: and by ſtat. 7 W. III. cap. 3. the confeſſion of the priſoner muſt be in open court; and both witneſſes muſt be to the ſame overt-act of treaſon, or one to one overt-act, and the other to another overt-act of the ſame ſpecies of treaſon. Baron Monteſquieu, indeed, lays it down for a rule, Spirit of Laws, book xii. chap. 3. that thoſe laws which condemn a man to death *in any caſe*, on the depoſition of a ſingle witneſs, are fatal to liberty.

All evidence is to be given in open court, in the preſence of the parties, their attornies, the counſel and all by-ſtanders, and before the judge and jury: many advantages attend this way of giving teſtimony, *ore tenus*, a method familiar among the ancient Romans, as may be collected from Quintilian, Inſt. Orat. lib. v. cap. 7. and it was continued as low as the time of Adrian; but the civil law, as it is now modelled, rejects all public examination of witneſſes.

No witneſs is bound to give any anſwer by which he confeſſes or accuſes himſelf of any crime. The court in criminal caſes is to examine the witneſſes, and not the priſoner or proſecutors. A witneſs ſhall not be permitted to read his evidence, but he may look at his notes to refreſh his memory. A witneſs may not recite his evidence to the jury, after having gone from the bar, and he hath given his evidence in court; if he does, the verdict may be ſet aſide. (Cro. Eliz. 159.) One that is to be an evidence at a trial, ought not to be examined before the trial, but by the conſent of both parties, and a rule of court for that purpoſe. No evidence ought to be produced againſt a man, in a trial for his life, but what is given in his preſence. State Trials.

Poſitive proof is always required whenever the nature of the caſe poſſibly admits of it.

Sometimes violent preſumption will be admitted for evidence without witneſſes; as where a perſon is run through the body in a houſe, and one is ſeen to come out of the houſe with a bloody ſword, &c. but on this the court ought not to judge haſtily, 1 Inſt. 6. 673; and though preſumptive and circumſtantial evidence may be ſufficient in felony, it is not ſo in treaſon. State Trials.

Though all preſumptive evidence of felony ſhould be admitted cautiouſly, for the law holds that it is better that ten guilty perſons eſcape, than that one innocent ſuffer. (See PRESUMPTION.) Sir Matthew Hale lays down two rules, moſt prudent and neceſſary to be obſerved. 1. Never to convict a man for ſtealing the goods of a perſon unknown, merely becauſe he will give no account how he came by them, unleſs an actual felony of ſuch goods be proved: and, 2. Never to convict any perſon of murder or manſlaughter, till at leaſt the body be found dead; on account of two inſtances, which he mentions, where perſons were executed for the murder of others, who were then alive, but miſſing. 2 Hal. P. C. 200.

Evidence by writings and records, is where acts of parliament, ſtatutes, judgments, ſines, and recoveries, proceedings of court, and deeds, &c. are admitted as evidence. The printed ſtatute-book is good evidence upon a general act of parliament, which need not be pleaded; but in the caſe of a private act, it is otherwiſe; for there it muſt be pleaded and examined by the records of parliament before it can be admitted in evidence. Records and enrolments prove themſelves; and a copy of a record or enrolment, ſworn to, may be given as an evidence. (Co. Litt. 119. 262.) A record of an inferior court has been rejected in evidence; and the proceedings in county-courts, courts-baron, &c. may be denied, and then tried by a jury. But court-rolls of a court-baron, when ſhewn, are good evidence; and, in many caſes, copies of the court-rolls are allowed as evidence. An ancient deed of thirty years ſtanding proves itſelf; but modern deeds, and other writings, muſt be atteſted and verified by parol evidence of witneſſes. The counterpart of a deed is no evidence, when the original is in being, and can be procured; though it may be, when the original cannot be procured. (Co. Litt. 225. 10 Rep. 92.) The counterpart of an ancient deed hath been admitted as evidence. (Mod. Caſ. 225.) In caſe of a fine, a counterpart is good evidence of itſelf. (1 Salk. 287.) Although a witneſs ſwear to the hand and contents of a letter, if he never ſaw the party write, it will not be good evidence. If all the witneſſes to a deed are dead, continual and quiet poſſeſſion is preſumptive evidence of the truth of it; yet it may receive farther credit by compariſon of hands and ſeals. (Wood's Inſt. 599.) When witneſſes to deeds are dead, their hand-writing muſt be proved. (2 Inſt. 118.) If one of ſeveral witneſſes ſurvive, a ſubpœna muſt be taken out againſt the living witneſs, and ſtrict inquiry made after him, and affidavit made that he cannot be found, before the hand-writing of the deceaſed witneſſes is to be proved. (1 Litt. 556.) And a ſhop-book may not be given in evidence for goods ſold, &c. by 7 Jac. I. cap. 12. after one year, before the action brought, except there be a bill, &c. for the debt; unleſs between merchant and merchant in the uſual intercourſe of trade. In order to make books evidences, if the ſervant who was accuſtomed to make entries in it be dead, his hand muſt be proved; and this, when accompanied with other collateral proofs of fairneſs and regularity, is the beſt evidence that can then be produced. In debt, a releaſe may be given in evidence; ſo may any matters of fact, tampering with witneſſes, or fraud.

In order to prove a leaſe for years, nothing ſhall be admitted but the very deed of leaſe itſelf, if in being; but if that be poſitively proved to be burnt or deſtroyed, then an atteſted copy may be produced, or parol evidence given of its contents. No evidence of a diſcourſe with another will be admitted, but the man himſelf muſt be produced: yet in ſome caſes, as in proof of any general cuſtoms or matters of common tradition or repute, the courts admit of *hearſay* evidence, or an account of what deceaſed perſons have declared in their life-time; but ſuch evidence will not be received of any particular facts. The probate of a will, when it concerns merely perſonal eſtate, may be given in evidence; but where title of lands is claimed under a will, the original will muſt be ſhewn, not the probate, though if the will be proved in the Chancery, copies of the proceedings there will be evidence. (2 Rol. Abr. 687. Trials per pais, 234. 1 Salk. 286. Raym. 335.) In ſome caſes the ledger-book of the eccleſiaſtical court in which the will is entered is ſufficient evidence, being a roll or record of the court. (Bull. N. P. 245, 6.) Depoſitions of witneſſes in Chancery between the ſame parties may be given as evidence at law, if the witneſſes are dead, and the bill and anſwer proved. Depoſitions before a coroner are admitted as evidence, the witneſſes being dead, or gone beyond ſea. (1 Lev. 182. 2 Nelſ. Abr. 760.) The confeſſion of a priſoner before a magiſtrate, &c. may be given in evidence againſt him. (See 2 Hawk. P. C. c. 46.) See Baron Gilbert's Treatiſe of Evidence, or the Introduction to the Law of Niſi Prius, 4to. 1767.

From this treatiſe the following rules of evidence are extracted. 1. In general, the beſt evidence muſt be given that the nature of the thing will admit of. 2. No perſon intereſted in the queſtion can be a witneſs. To this rule there are ſome exceptions; as, 1. A party intereſted may be admitted in a criminal proſecution in moſt inſtances. 2. He may be admitted for the ſake of trade in the common uſage of buſineſs, as porters, apprentices, &c. 3. Where no other evidence is reaſonably to be expected. 4. Where he acquires his intereſt by his own act, after the party who calls him as a witneſs has a right to his evidence. 5. Where the poſſibility of intereſt is very remote. 3. The third general rule is that hearſay is no evidence. 4. In all caſes where a general character or behaviour is put in iſſue, evidence of particular facts may be admitted; but not where it comes in collaterally. 5. In every iſſue the affirmative is to be proved. 6. No evidence need be given of what is agreed by the pleadings, &c. &c. See PLEADING.

Sir Thomas Smith reſtrains evidence to authentic writings of contracts, written, ſealed, and delivered. De Rep. Ang. lib. ii.

EVIDENCE, *demurrer to.* See DEMURRER.

EVIDENCE, *exception to.* See EXCEPTION.

EVIL, MALUM, in *Ethics*, a privation or abſence of ſome proper or neceſſary good, or of ſome meaſure or degree thereof.

Evil is either *natural* or *moral;* between which there is this relation, that moral evil produces natural.

EVIL, *moral*, is defined a deviation from right reaſon; a diſcernment of right from wrong, being given us as a guide of our actions; or it is the diſagreement between the actions of a moral agent and the rule of thoſe actions, whenceſoever it is derived, and howſoever made known; and no action can be morally evil unleſs the agent be properly ſuch, intelligent and free, and capable of diſtinguiſhing, chooſing, and acting for himſelf. This the philoſophers call *inhoneſtum*, and *turpe*, as ſtaining the image of God, and ſullying our original beauty; likewiſe *malum culpæ*.

EVIL, *natural*, is a want of ſomething neceſſary to the *bene eſſe*, or perfection of a thing, or to its anſwering all its purpoſes; ſuch are defects of the body, blindneſs, lameneſs, hunger, diſeaſes, death. This ſpecies is denominated *triſte*, *injucundum*, *noxium*, and *malum pœnæ*.

Good and evil, ſays a learned writer, are oppoſites, and ariſe from the relations which things have to each other: for ſince there are ſome things which profit, and others which prejudice one another; and ſince ſome things agree, and others diſagree; we call the former good and the latter evil. Whatever, therefore, is incommodious or inconvenient to itſelf or any thing elſe; whatever becomes troubleſome or fruſtrates any appetite implanted by God; whatever forces any perſon to do or ſuffer what he would not, that is *evil.* Theſe inconveniencies appear to be of three kinds: thoſe of imperfection; thoſe that are natural; and thoſe that are moral. By the evil of imperfection we may underſtand the abſence of thoſe perfections or advantages which exiſt elſewhere, or in other beings; by natural evil, pains and uneaſineſſes, inconveniencies and diſappointments of appetites ariſing from natural motions; and by moral evils, vicious elections, that is, ſuch as are hurtful to ourſelves, or others. This opinion is otherwiſe ſtated in the following manner: all evil is inconveniency, but ſome inconveniencies ariſe from the ſeries of natural cauſes without our conſent, and ſometimes our knowledge; theſe we call natural evils: but others happen from the abuſe of elections, when an undue choice occaſions them; and in this caſe, beſides the natural evil that ariſes from them, there is likewiſe an obligation on the perſon that makes the choice to anſwer for the hurt he has done by it. Now theſe choices that bring inconveniencies are called moral evils; and the difference between natural and moral evil is not their both bringing inconveniencies and injury to ourſelves or others, for this conſtitutes the nature of their evil, but that the ill effects of the one proceed from the choice, thoſe of the other from natural cauſes; and hence the author of that choice is anſwerable for the one, but nobody for the other. Moral evil, therefore, is natural evil, with choice ſuperadded. See archbiſhop King's "Eſſay on the origin of Evil," by Law, vol. i. and ii. Sherlock, alſo, in his "Treatiſe on Judgment," p. 20, &c. diſtinguiſhes in a ſimilar manner between moral and natural good and evil; the only difference between them, he ſays, is this, "that moral good and evil is in the will and choice, natural good and evil is in the nature of things; that which is good or hurtful to ourſelves or others is naturally good or evil; to love, to chooſe, to do that which is good or hurtful to ourſelves or others, is morally good or evil, or is the good or evil of our choice or actions. If you will but recollect yourſelves, you will find that you have no other notion of good or evil but this; when you ſay ſuch a man has done a very good or very evil action, what do you mean by it? Do you not mean, that he has done ſomething very good or very hurtful to himſelf or others? When you hear that any man has done good or evil, is not the next queſtion, what good or what hurt has he done? And do not you mean by this, natural good or evil? which is a plain evidence that you judge of the moral good or evil of actions by the natural good or evil which they do."

The ingenious author of the "Enquiry into the Origin of our Ideas of Beauty and Virtue," gives the following ſtatement of the nature of moral good and evil, and of the difference between theſe and natural good and evil. Moral evil, according to this philoſopher, denotes our idea of a quality apprehended in actions which excites averſion and diſlike towards the actor, even from perſons who receive no diſadvantage thereby; as moral goodneſs denotes our idea of a contrary quality which procures approbation and love towards the actor, even in perſons unconcerned in its natural tendency. This notion ſuppoſes an univerſally acknowledged difference of moral good and evil from natural. Moral good, we all know, procures love towards thoſe we apprehend poſſeſſed of it; whereas natural good does not. How differently, for inſtance, are we affected towards thoſe we ſuppoſe poſſeſſed of honeſty, faith, generoſity, &c. when we expect no benefit from thoſe qualities, and thoſe poſſeſſed of the natural goods, as houſes, lands, gardens, health, ſtrength, &c. So whatever quality we apprehend morally evil, raiſes our hatred towards the perſon in whom we obſerve it; as treachery, cruelty, ingratitude, &c. whereas we love and pity many expoſed to natural evils, as pain, hunger, ſickneſs, &c.

The origin of theſe different ideas of actions has greatly puzzled the moraliſts: ſome make ſelf-intereſt, or ſelf-love, the ſource of them all; we approve the virtue of others as it has ſome ſmall tendency to our happineſs, either from its own nature, or from this general conſideration, that a conformity to nature and reaſon is in the general advantageous to the whole, and to us in particular; and on the contrary, diſapprove the vice of others, as tending at the long run to our particular detriment.

Others ſuppoſe an immediate natural evil in the actions called *vicious*, that is, that we are determined to perceive ſome deformity or diſpleaſure in ſuch actions, without reflecting on any diſadvantage that may any way redound to us from the action; and that we have a ſecret ſenſe of pleaſure accompanying ſuch of our own actions as are called *virtuous*, when we expect no farther advantage from them; but then they add, that we are excited to perform thoſe actions, even as we purſue or purchaſe pictures, ſtatues, landſcapes, &c. from ſelf-intereſt, to obtain the pleaſure which accompanies the action.

But the author juſt mentioned maintains that ſome actions have to men an immediate goodneſs, and others an immediate evil, *i. e.* we perceive pleaſure in ſome and pain in others, and are determined to love or hate the doers, without any view of natural advantage, without any view to future rewards or puniſhments, or even without any intention to obtain the ſenſible pleaſure of the good, but from a very different principle, *viz.* an internal moral ſenſe, or a natural determination of the mind to receive amiable or diſagreeable ideas of actions, when they ſhall occur to our obſervation, antecedently to any opinion of advantage or loſs to redound to ourſelves from them, even as we are pleaſed with a regular form or an harmonious compoſition, without any knowledge of the mathematics, or ſeeing any advantage in that form or compoſition different from the immediate pleaſure. But according to this account of Dr. Hutcheſon, however plauſible, moral good and evil ſignify nothing in the objects themſelves, to which they are applied, any more than agreeable and harſh, ſweet and bitter, &c. but only certain effects in us; and virtue is a mere affair of taſte; whereas it ſeems to be much more juſt to conclude, that right and wrong, or good and evil, are real qualities of actions, and not merely of our minds; and that the power whereby we perceive theſe qualities is not any arbitrary ſenſe but the underſtanding: or to ſuppoſe with another excellent writer, that moral good, conſidered as ſynonymous with virtue, denotes the doing good to mankind, in obedience to the will of God, and for the ſake of everlaſting happineſs, and moral evil or vice, the contrary. Price's Original of our Ideas, &c. p. 13, and p. 59, &c. Paley's Principles of Moral and Political Philoſophy, vol. i. p. 41. See farther under DEFORMITY, SENSE, GOOD, VIRTUE, and VICE.

The queſtion concerning the origin of evil has very much perplexed philoſophers and divines, both ancient and modern. Plato, for the ſolution of this queſtion, maintained, that matter, from its nature, poſſeſſes a blind and refractory force, from which ariſes in it a propenſity to diſorder and deformity; and that this is the cauſe of all the imperfection which appears in the works of God, and the origin of evil. Matter, he conceives, reſiſts the will of the ſupreme artificer, ſo that he cannot poſſibly execute his deſigns; and this is the cauſe of the mixture of good and evil, which is found in the material world. "It cannot be," ſays he, (Theæt. t. i. p. 176.) "that evil ſhould be deſtroyed, for there muſt always be ſomething contrary to good;" and again, "God wills, *as far as it is poſſible*, every thing good, and nothing evil." What is that property of matter which oppoſes the wiſe and benevolent intentions of the firſt intelligence, Plato has not clearly explained, but he ſpeaks of it as Ξύμφυτος ἐπιθυμία, an innate propenſity to diſorder, (Phileb.) and ſays, "that before nature was adorned with its preſent beautiful forms, it was inclined to confuſion and deformity, and that from this habitude ariſes all the evil which happens in the world." Plutarch ſuppoſes the Platonic notion to be, that there is in matter an unconſcious irrational ſoul; and this ſuppoſition has been adopted by ſeveral modern writers. But the writings of Plato afford no evidence, that he conceived the imperfection of matter to ariſe from any cauſe diſtinct from its nature. Such a notion is incongruous with Plato's general ſyſtem, and it is contrary to the doctrine of the Pythagorean ſchool, to which he was probably indebted for his notions on this ſubject; for the philoſophers of that ſect held, that motion is the effect of a power eſſential to matter. Some of the Stoics adopted the notion of the Platoniſts concerning the origin of evil, and aſcribed it to the defective nature of matter, which it is not in the power of the great artificer to change; aſſerting, that imperfections appear in the world, not through any defect of ſkill in its author, but becauſe matter will not admit of the accompliſhment of his deſigns. But it was perceived by others, that this hypotheſis was inconſiſtent with the fundamental doctrine of the Stoics concerning nature. For ſince, according to this ſyſtem, matter itſelf receives all its qualities from God, if its defects be the cauſe of evil, theſe defects muſt be ultimately aſcribed to him. No other way of relieving this difficulty remained, but to have recourſe to fate, and ſay, that evil was the neceſſary conſequence of that eternal neceſſity, to which the great whole, comprehending both God and matter, is ſubject. Thus, when Chryſippus was aſked, whether diſeaſes were to be aſcribed to divine Providence, he replied, that it was not the intention of nature that theſe things ſhould happen; nor were they conformable to the will of the author of nature and parent of all good things; but that, in framing the world, ſome inconveniences had adhered, by neceſſary conſequence, to his wiſe and uſeful plan. To others the queſtion concerning the origin of evil appeared ſo intricate and difficult, that finding themſelves unequal to the ſolution of it, they denied either that there is any God at all, or, at leaſt, any author or governor of the world. The Epicureans belonged to this claſs; nor does Lucretius allege any other reaſon for denying the ſyſtem of the world to be the production of a deity beſides its being ſo very faulty. Others again judged it to be more rational to aſſign a double cauſe of viſible effects than to aſſign no cauſe at all; as nothing, indeed, can be more abſurd than to admit actions and effects without any agent and cauſe. Theſe perſons, perceiving a mixture of good and evil, and being perſuaded that ſo many inconſiſtencies and diſorders could not proceed from a good being, ſuppoſed the exiſtence of a malevolent principle, or God, directly contrary to the good one; hence they derived corruption and death, diſeaſes, griefs, miſchiefs, frauds and villanies, whilſt from the good being they deduced nothing but good. This opinion was held by many of the ancients; by the Perſian magi, Manichæans, Paulicians, &c. &c. See theſe articles, and alſo ZOROASTER. Abſurd as this hypotheſis was, it very long and generally prevailed, not only in the Heathen but in the Chriſtian world; nor have the light and influence of Chriſtianity yet availed to its total extermination, ſo that no trace or remnant of it remains. Thoſe who wiſh to find a ſatisfactory refutation of it, may conſult "King's Origin of Evil," vol. i. and the annexed notes of the editor.

The excellent Dr. Clarke, in his "Demonſtration of the Being and Attributes of God," deduces from the poſſibility and real exiſtence of human liberty an anſwer to the queſtion, what is the cauſe and original of evil? "For liberty," he ſays, "implying a *natural* power of doing evil, as well as good; and the imperfect nature of finite beings, making it poſſible for them to abuſe this their liberty to an actual commiſſion of evil; and it being neceſſary to the order and beauty of the whole, and for diſplaying the infinite wiſdom of the Creator, that there ſhould be different and various degrees of creatures, whereof, conſequently, ſome muſt be *leſs perfect* than others; hence there neceſſarily ariſes a poſſibility of evil, notwithſtanding that the Creator is infinitely good. In ſhort thus: all that we call *evil*, is either an *evil of imperfection*, as the *want of certain faculties and excellencies which other creatures have*; or *natural evil*, as *pain*, *death*, and the like; or *moral evil*, as all kinds of *vice*; the *firſt* of theſe is not properly an evil. For every power, faculty, or perfection, which any creature enjoys, being the free gift of God, which he was no more obliged to beſtow, than he was to confer being or exiſtence itſelf; 'tis plain the want of any certain faculty or perfection in any kind of creatures, which never belonged to their nature, is no more an evil to them, than their never having been created or brought into being at all, could properly have been called an evil. The *ſecond* kind of evil, which we call *natural evil*, is either a neceſſary conſequence of the former; as *death*, to a creature on whoſe nature immortality was never conferred; and then 'tis no more properly an evil than the former; or elſe 'tis counterpoiſed, in the whole, with as great or greater good; as the *afflictions and ſufferings of good men*; and then alſo it is not properly an evil; or elſe, laſtly, 'tis a *puniſhment*; and then 'tis a neceſſary conſequent of the *third* and laſt ſort of evil, *viz. moral evil*. And this ariſes wholly from the abuſe of *liberty*, which God gave to his creatures for other purpoſes, and which 'twas reaſonable and fit to give them for the perfection and order of the whole creation: only they, contrary to God's intention and command, have abuſed what was neceſſary for the perfection of the whole, to the corruption and depravation of themſelves. And thus all ſorts of evils have entered into the world, without any diminution to the infinite goodneſs of the Creator and Governor thereof.

EVIL, or *King's* **EVIL**, the appellation formerly given to *ſcrofula*, in conſequence of the ſuppoſed power poſſeſſed by the kings of England and France of curing this diſeaſe by *touching* the ſick.

The origin and firſt exerciſe of this royal faculty are not agreed upon by hiſtorians; thoſe of France are diſpoſed to maintain, that it was originally inherent in their kings, ſome aſſerting that St. Louis, others that king Robert, was the firſt who was thus gifted; but by moſt other writers it is aſſigned as an earlier prerogative of the Engliſh crown. Edward the Confeſſor is generally mentioned as the firſt poſſeſſor of this miraculous power: and it was diſputed in the days of Malmſbury, who lived not long after his reign, whether this faculty were a peculiar reward from heaven for that king's ſanctity, or hereditarily reſident in the Engliſh crown. Polydore Virgil has noticed this gift to Saint Edward, and its continuance in the line of his ſucceſſors; and Dr. Harpsfield, in his Eccleſiaſtical Hiſtory of England, after deſcribing the miracles of the Confeſſor, obſerves, "quam ſtrumoſos ſanandi admirabilem dotem in poſteros ſuos Anglorum reges, ad noſtra uſque tempora transfudiſſe et perpetuaſſe, merito creditur." The practice was long continued, and ſeems to have reached its greateſt height in the reign of Charles II. to whom multitudes flocked to receive the benefits of the royal touch; inſomuch, that after his reſtoration, he is ſaid to have laid his hands upon more than ſix thouſand perſons in one year. His majeſty was therefore obliged to make ſome reſtrictions with regard to the times of healing, and the number of patients. All perſons were obliged to go to the king's ſurgeon, whoſe duty it was to examine their certificates from the miniſter and church-wardens of their pariſh, to determine whether they were proper objects, to give them tickets of admiſſion to the royal preſence, and to introduce every one to the king's ſacred hand to be touched. The king uſually gave public notice of the day of healing; in the winter the ceremony was always held at Whitehall; in the ſummer ſometimes at Whitehall, and ſometimes at Windſor.

The following curious paragraphs were made public in 1660.

"The kingdom having been for a long time troubled with the evil, by reaſon of his majeſty's abſence, great numbers have lately flocked for cure. His ſacred majeſty, on Monday laſt, touched 250 in the Banqueting houſe; among whom, when his majeſty was delivering the gold, one ſhuffled himſelf in, out of an hope of profit, which had not been ſtroked, but his majeſty quickly diſcovered him, ſaying, this man hath not yet been touched. His majeſty hath for the future appointed every Friday for the cure, at which 200, and no more, are to be preſented to him, who are firſt to repair to Mr. Knight, the king's ſurgeon, &c. Parliamentary Journal, July 2—9, 1660.

"Saturday being appointed by his majeſty to touch ſuch as were troubled with the evil, a great company of poor afflicted creatures were met together, many brought in chairs and flaſkets; and being appointed by his majeſty to repair to the Banqueting-houſe, his majeſty ſat in a chair of ſtate, where he ſtroked all that were brought to him, and then put about each of their necks a white ribbon, with an angel of gold on it. In this manner his majeſty ſtroked above ſix hundred; and ſuch was his princely patience and tenderneſs to the poor afflicted creatures, that though it took up a very long time, his majeſty, who is never weary of well-doing, was pleaſed to make inquiry whether there were any more that had not yet been touched. After prayers were ended, the duke of Buckingham brought a towel, and the earl of Pembroke a baſon and ewer, who, after they had made obeiſance to his majeſty, kneeled down till his majeſty had waſhed." Mercurius Politicus, June 21—28, 1660.

An exact regiſter was at that time kept of the number of caſes that came for relief, and the whole amount is very great. From 1660 to 1664 incluſive, a period of five years, 23,601 perſons were touched by Charles II.: and from May 1667 to May 1684, the number of perſons touched amounted to 68,506; making all together 92,107. For the intervening years, 1665 and 1666, no regiſter was made, the king having removed from the metropolis on account of the plague.

This ſuperſtitious practice was dropped by the preſent royal family, "who obſerved (ſays Hume) that it could no longer give amazement, even to the populace, and was attended with ridicule in the eyes of all men of underſtanding." Rapin indeed remarks, that "the late king William III. of glorious memory, was ſo perſuaded he ſhould do no injury to perſons afflicted with this diſtemper, by *not* touching them, that he refrained from it all his reign." The practice continued in vogue in the reign of queen Anne; it is recorded of Dr. Johnſon, that he was touched by that princeſs, but without effect.

It is extraordinary that this belief in the efficacy of the royal touch in the cure of this ſevere diſeaſe was by no means confined to the vulgar, nor to perſons unacquainted with the nature and cure of diſeaſes. Dr. Johnſon's mother is ſaid to have been inſtigated by the advice of a celebrated phyſician, ſir John Floyer, to bring her ſon to London for the purpoſe of receiving the remedy. And Wiſeman and Browne, eminent ſurgeons of their day, and ſurgeons to the king (Charles II.) have given their ſtrongeſt teſtimony in favour of the ſuperiority of the royal remedy, over any which their art poſſeſſed. "I muſt needs profeſs," ſays Wiſeman, "that what I write will do little more than ſhew the weakneſs of our ability, when compared with his majeſty's, who cureth more in any one year, than all the chirurgeons of London have done in an age. However, that this attempt may not ſeem to want precedent, give me leave to tell you, that it is no more than the French kings' chirurgeons have done before me, or than old Mr. Clows did in queen Elizabeth's days, and all other general writers in chirurgery have done more or leſs." And he affirms that he had been "a frequent eye-witneſs of many cures performed by his majeſty's touch alone, without any aſſiſtance of chirurgery; and thoſe many of them ſuch as had tired out the endeavours of able chirurgeons before they came thither."

The other ſurgeon royal juſt mentioned has left us the moſt circumſtantial account of this royal healing, in a publication, entitled "Adeno-choiradelogia; or, an Anatomick-Chirurgical Treatiſe of Glandules and Strumæs, or King's-evil-ſwellings, together with the Royal Gift of Healing, or Cure thereof, by Contact or Impoſition of Hands, performed for above 640 years by our kings of England; continued with their admirable effects and miraculous events; and concluded with many wonderful examples of Cures by their ſacred touch. All of which are ſuccinctly deſcribed by John Browne, one of his Majeſty's Chirurgeons in Ordinary, and Chirurgeon of his Majeſty's Hoſpital, London, 1684." His offices evince that the author was a man of character, and his book is approved, as was the cuſtom of his time, by the preſident and ſeveral fellows of the College of Phyſicians. Like Wiſeman, he ſeems to have been a ſtaunch loyaliſt, and a vehement defender of the divine right of kings; he deteſted all diſſenters, and confidently aſſerts that the uſurper, Cromwell, tried in vain to exerciſe this royal prerogative, "he having no more right to the healing power, than he had to the regal juriſdiction." The third part of the treatiſe of Browne, which is devoted to the hiſtory and nature of the royal gift, is entitled *Chariſma Baſilicon*. Beſides an hiſtorical view of this prerogative, it contains rules for the meaneſt capacity to find out the diſeaſe, which were deemed expedient to prevent poor people from unneceſſary journeys; and ſixty admirable cures, performed with or without gold, are circumſtantially detailed, as well as ſeveral caſes of ſcrofulous tumours and ſores, which diſappeared on being touched with handkerchiefs dipped in the blood of Charles I.

Some ſhrewd ſuſpicions had, indeed, been thrown out, that the piece of gold, given by the king on the occaſion, was the moſt efficacious remedy employed; and the above mentioned writers are anxious to refute ſuch a ſlander on the royal qualifications. The author of a late treatiſe tells the following ſtory, which may, in ſome degree, account for the numbers regiſtered at Whitehall. "An old man, who was witneſs in a cauſe, had by his evidence fixed the time of a fact, by queen Anne having been at Oxford, and touched him while a child, for the cure of the *evil*. When he had finiſhed his evidence, the relator had an opportunity of aſking him whether he was really cured. Upon which he anſwered, with a ſignificant ſmile, that he believed himſelf never to have had a complaint, that deſerved to be conſidered as the *evil*; but that his parents were poor, *and had no objection to the bit of gold*." See Wiſeman's Chirurgical Treatiſes, book iv. chap. 1. Browne above cited. Edin. Med. and Surg. Journal, vol. iii. p. 185.

With reſpect to the nature of the diſeaſe, vulgarly called *King's Evil,* and the practice now adopted for its cure, ſee Scrofula.

Evil, *falling,* in *Horſes.* See Falling-*evil.*

Evil, *hungry.* See Hungry and Bulimy.

EVIRATUA, in *Geography,* a town of Braſil, on the river of the Amazons, 36 miles W. of Fort Rio Negro. S. lat. 2° 50′.

EVIT'S Creek, a river of America, in Maryland, which runs into the Potomack. N. lat. 39° 38′. W. long. 78° 44′.

EUKSINEH, a town of Aſiatic Turkey, in Natolia; 10 miles N. E. of Eregri.

EULÆUS, in *Ancient Geography.* See Choaspes.

EULBACH, or Eulenbach, in *Geography,* a town of Germany, in the county of Erbach; 3 miles N. E. of Erbach.

EULE, a town of Bohemia, in the circle of Kaurzim; 12 miles S. of Prague. N. lat. 49° 55′. E. long. 14° 31′.

EULENBERG, a town of Moravia, in the circle of Olmutz; 14 miles N. of Olmutz.

EULENBURG, a town of Saxony, in the circle of Leipſic, ſituated on an iſland in the Mulda, and containing three churches. Beer is the principal article of trade. It is 12 miles N. E. of Leipſic. N. lat. 51° 27′. E. long. 12° 38′.

EULEPA, in *Ancient Geography,* a town of Cappadocia. Itin. Anton.

EULER, Leonard, in *Biography,* a great mathematician, was born at Baſil in the year 1707, where he was educated. He performed his academical taſks with ſo much rapidity, that he had a good portion of time left at his own command, which he conſecrated to the ſtudy of the mathematics. In the purſuit of this kind of knowledge, he was aſſiſted by John Bernouilli, who was regarded as one of the chief mathematicians of Europe, and whoſe diſtinguiſhed attention and eſteem he obtained, by his early proficiency and unwearied application. In 1723, M. Euler was admitted to the degree of M. A. on which occaſion he obtained great applauſe by delivering a Latin diſcourſe, wherein he drew a compariſon between the philoſophy of Newton and the Carteſian ſyſtem. In compliance with his father's deſire, he applied himſelf to theology and oriental literature, in which he made no inconſiderable progreſs, but his predominant bias ſtill leading him to the mathematics, his father allowed him to follow the bent of his inclination. In the courſe of his ſtudies under Bernouilli, he contracted an intimate friendſhip with his two ſons, Nicholas and Daniel, which proved to be of the higheſt advantage to him in after life. Thoſe two celebrated mathematicians having been invited to Peterſburgh, in the year 1725, by Catharine I. for carrying into execution the project of Peter the Great, for the eſtabliſhment of an academy of ſcience, promiſed Euler to uſe their endeavour to find him a ſituation in that city. By their advice he applied himſelf diligently to the ſtudy of natural knowledge, and attended the lectures of all the eminent profeſſors of Baſil. While engaged in theſe purſuits he compoſed a diſſertation "On the nature and propagation of Sound;" and alſo an anſwer to a prize queſtion, "Concerning the maſting of Ships," which obtained the ſecond prize. By this circumſtance his attention was early drawn to the curious and important ſtudies of naval architecture and navigation, which he contributed greatly to enrich in the ſubſequent periods of his life. He now joined his friends the Bernouillis at Peterſburgh, and was appointed with them a joint profeſſor in the univerſity of that city. In this ſituation his talents and genius were ſo far called into exerciſe as to entitle him to rank among the moſt eminent mathematicians. He contributed many memoirs to the academical collection, which excited a noble ſpirit of emulation between him and his two friends, unalloyed by the leaſt mixture of envy or jealouſy, and ſuch as produced no alteration in their friendſhip. The integral calculus he carried to new degrees of perfection; invented the calculation of ſines; ſimplified analytical operations, and in this way threw new light on all the branches of mathematical ſcience. In 1730, M. Euler was appointed profeſſor of natural philoſophy; and, in 1733, he ſucceeded his friend Daniel Bernouilli, in the mathematical chair. In 1735, the academy propoſed an intricate and important problem for ſolution, which Euler completed in three days, though it was ſuppoſed to be the labour of many months. The exertion on this occaſion was ſo violent that it produced a fever which endangered his life, and deprived him of the uſe of one of his eyes. In the year 1740, the Academy of Sciences at Paris propoſed for ſolution the important ſubject of "The flux and re-flux of the ſea." To this Euler applied the force of his genius, and produced a memoir, which was allowed to be a maſter piece of analyſis and geometry. He had, however, as competitors, Daniel Bernouilli, and our countryman, Colin Maclaurin, with whom he ſhared the prize. In 1741, Euler, at the expreſs invitation of the king of Pruſſia, repaired to Berlin, where his induſtry and talents appeared to great advantage. He furniſhed many eſſays for the memoirs of the Pruſſian academy, without withholding his contributions from the academy of Peterſburgh, which was now encouraged by the patronage and munificence of the empreſs Elizabeth. In 1742, he obtained a penſion from the academy at Peterſburgh, and in 1766, by permiſſion of the king of Pruſſia, he returned to that city, to ſpend the remainder of his days, when the munificence of Catharine II. liberally rewarded him for the preference which he exhibited towards his Peterſburgh connections. Shortly after his return he loſt the ſight of the other eye, yet in this deplorable ſituation he dictated to his ſervant, an unlettered youth, and who was entirely unacquainted with mathematical knowledge, his "Elements of Algebra," a work of high merit, and which has been tranſlated into the Engliſh language. At this period he was elected one of the very few foreign members of the Academy of Sciences at Paris. After this he received from them the prize for his diſſertations "Concerning the inequalities in the motions of the planets:" alſo two prizes for queſtions propoſed relative to "A more perfect theory of the moon." He next reviewed his whole theory with the aſſiſtance of his ſon, and Meſſrs. Krafft and Lexell; and purſued his reſearches till he had conſtructed the new tables which appeared with the great work in 1772. "This work alone," ſays his biographer, "would be ſufficient to render his name immortal, and when it is conſidered that it was completed after he was totally blind, and at a time in which he was embarraſſed in his domeſtic circumſtances by a dreadful fire, that had conſumed great part of his ſubſtance, and forced him to quit the ruined houſe; it is impoſſible not to be ſtruck with admiration and aſtoniſhment at the powers of his genius and memory, and the perſeverance, fortitude, and tranquillity of mind which he muſt have poſſeſſed." Some time after this he underwent the operation of couching, which reſtored to him his ſight; but either too eager to benefit by the organ, or by the negligence of his ſurgeon, he was a ſecond time deprived of his ſight, and the relapſe was attended with much tormenting pain. Still he was active in the purſuit of ſcience, and in the courſe of ſeven years tranſmitted to the academy of Peterſburgh ſeventy diſtinct memoirs, and left behind him two hundred more, which were afterwards reviſed and completed. In the beginning of September, 1783, he was ſeized with ſeveral attacks of a vertigo; theſe, however, did not prevent his calculating the motion of air-balloons, which then began to engage the attention of the philoſophical world; but on the 7th of the ſame month, while he was amuſing himſelf with his grand-children, an apoplectic fit terminated his illuſtrious career, at the age of 76. Beſides being foreign member of the Royal Academy of Sciences at Paris, M. Euler was member of the Imperial Academy of Peterſburgh, ancient director of the Royal Academy of Berlin, and fellow of the Royal Society of London. His works were very numerous; his knowledge was not conſined to his favourite ſtudies of the mathematics and aſtronomy, of which he has ſecured to himſelf an imperiſhable fame. He had made much progreſs in medical, botanical, and chemical ſcience. He alſo poſſeſſed, in a high degree, what is generally called erudition. He had read with attention and taſte the moſt eminent Latin claſſics, and was familiarly acquainted with the civil and literary hiſtory of all ancient and modern nations. His uncommon memory ſeemed to retain every idea that was conveyed to it either from reading or from meditation. The Æneid of Virgil he could repeat from the beginning to the end, and point out to his hearers the firſt and laſt line of every page in the edition which he uſed. He enjoyed a vigorous conſtitution, and a ſurpriſing ſhare of health, conſidering the intenſity and ardour of his application. His manners were unaffected and pleaſing, his temper lively and cheerful, and his converſation both inſtructive and entertaining. The evening of his days was calm and ſerene, ſweetened in no ſmall degree by the fame that follows genius, the univerſal eſteem and reſpect that were due to his exemplary virtues, and the ſatisfaction which he received from the kind offices of friendſhip, and the endearments of domeſtic felicity.

This great geometrician had beſtowed much meditation, early in life, on harmonics, or the philoſophy of ſound; for in 1739, at the age of 32, he publiſhed at Peterſburgh, in Latin, a work in 4to. under the title of "Tentamen novæ Theoriæ Muſicæ ex certiſſimis harmoniæ principiis dilucidé expoſitæ, auctore Leonardo Eulero." This work, being written in Latin, and requiring in the reader, beſides that language, a knowledge in geometry, algebra, and fluxions, was little noticed by the public at large on its firſt appearance, and ſtill leſs underſtood by muſicians, for whoſe uſe it muſt have been chiefly intended. It, however, ſet mathematicians and men of ſcience to work, and ſtarted many curious ſubjects of meditation to ſuch as intereſted themſelves in the ſtudy of harmonics.

But we do not very well ſee how the author could with propriety call his treatiſe an attempt at a *new* theory of muſic. The ratios were all known ever ſince the time of Euclid. Indeed he has followed the proportions which Zarlino tried to eſtabliſh in his "Inſtitutioni," which had been adopted by Des Cartes, Rameau, Tartini, &c.; and Des Cartes, and others after him, had accounted for the pleaſure which we receive from concords, by the ſimplicity of the ratios between the ſounds which form them There is a plate, p. 35, repreſenting, we thought, in a new and ingenious manner to the eye, the pulſations of two ſtrings; the one fixed to a given tone, and the other tuned progreſſively to all the conſonant intervals, which clearly ſhews the coincidences of vibration, upon the frequency of which the degree of ſweetneſs and perfection in concords depends. We believe, however, that this was done in the 17th century, but in a leſs elegant manner, by our countryman lord keeper North, in a quarto pamphlet of only twenty-five pages, intitled, "A Philoſophical Eſſay of Muſick directed to a Friend;" London, 1677.

In this little tract the vibrations of each conſonance are repreſented to the eye, and the coincidences with the fixed tone, its baſe or principal, in the ſame manner as in the work of the great geometrician Euler, who has puſhed ratios as far as our perception and appreciation can go, extending the whole compaſs of our muſical ſyſtem to eight octaves. See COMPASS.

The degrees of ſuavity in conſonance from the ſimplicity of ratios and frequency of coincidence, had, we believe, been ſettled before the year 1739, when this treatiſe was publiſhed.

The following is a tranſlation of the titles of the ſeveral chapters of this work. After a preface of twenty pages,

Chap. I. treats of ſound, and the auditory ſenſe.
II. Of the ſweetneſs and principles of harmony.
III. Of muſic in general.
IV. Of concords.
V. Of concords in ſucceſſion.
VI. Of a ſeries of concords.
VII. Of intervals, and their names.
VIII. Of the genera of muſic.
IX. Of the diatonico-chromatico genus.
X. Of other more compounded genera.
XI. Of the concords in the diatonico-chromatico genus.
XII. Of the modes or keys and ſyſtems in the diatonico-chromatico genus.
XIII. Of the ratio of compoſition in a given mode and ſyſtem.
XIV. Of the modes and ſyſtems in tranſpoſed keys.

In the 13th chap. on the laws of compoſition, and the poſſible combinations in any given mode, key, or ſyſtem, ſome of theſe combinations employ every note in the ſcale, ſeemingly at once, which would be extremely offenſive if heard together. The author probably means, that all theſe ſounds may be heard ſucceſſively in melody, provided they are in tune, and have a fundamental baſe.

Upon the whole, Euler ſeems not to have invented much in this treatiſe; and to have done little more than arrange and methodize former diſcoveries in a ſcientific and geometric manner. He may, indeed, not have known what antecedent writers had diſcovered before; and though not the firſt, yet to have imagined himſelf an inventor.

EULER's *Logarithms*, or *Binary Logarithms*, are a ſpecies of artificial numbers contrived by M. Euler to facilitate the calculation and compariſon of muſical intervals, which they do, by repreſenting each interval in *decimal parts* of the octave, which is 1 in this notation, the ſucceſſive octaves or powers of 2 being repreſented by 2, 3, 4, &c. as in the following table, for the firſt 10 numbers, *viz.*

1 = 0.000000
2 = 1.000000
3 = 1.584963
4 = 2.000000
5 = 2.321928
6 = 2.584963
7 = 2.807356
8 = 3.000000
9 = 3.169925
10 = 3.321928

By help of the primes which compoſe muſical ratios, and their binary logarithms in this table, the Euler's logarithm may be found, which anſwers to any interval: as the names of the ſeveral intervals occur, we ſhall give their binary logarithms.

EULISIA, in *Ancient Geography*, a country of Scythia, towards the Palus Mæotis.

EULOGIUS, in *Biography*, patriarch of Alexandria, was, at firſt, preſbyter of the church of Antioch, and diſtinguiſhed himſelf by his zeal for the Catholic doctrines in a letter which he wrote to Eutychius, patriarch of Conſtantinople, containing an expoſition of the true faith. He was elevated to the ſee of Alexandria in the year 581, and became very active in rooting out hereſy, not only by the allowable and fair weapons of reaſon and argument, but by expelling from their ſituation all eccleſiaſtics who were advocates for the doctrine of one nature in Chriſt. He lived in habits of intimacy with Gregory the Great, whoſe ſentiments and diſpoſition were congenial to his own. He died in 608. Of his works only fragments are remaining. Moreri.

Eulogius, elected archbiſhop of Toledo in the ninth century, was born at Cordova about the year 800. He was educated for the prieſthood, and diſcharged the duties of that office with zeal and activity till the year 844, when he was driven into exile by the Saracens for his boldneſs in maintaining the principles of the Catholic faith. After much ſuffering he ventured to return to Cordova, where, in the year 850, he was thrown into priſon on account of his religion. In the dungeon he employed himſelf in writing animating exhortations to the Chriſtians, to ſupport and conſole them under their perſecution, for conſcience ſake, and to encourage them to undergo the ſevereſt trials rather than diſgrace themſelves by apoſtacy. He was afterwards liberated, and by his perſonal labours, as well as writings, perſevered in fortifying his fellow Catholics againſt the arts and terrors of their enemies. As a reward for his exertions in this hazardous employment, he was choſen to fill the vacant ſee of Toledo; but he was put to death before he could receive the epiſcopal conſecration. The accuſation againſt him was the having converted a young Mahometan female to the Chriſtian faith: he was beheaded in 859. He was author of "Memoriale Sanctorum, ſive Libri III. de Martyris Cordubenſibus;" "Apologeticus pro Martyribus, &c.;" "Exhortatio ad Martyrium;" and ſome moral epiſtles. Theſe were collected and printed with notes by Ambroſius Moralis in 1554, and again in a more correct form by Poncius Leo in 1574. Moreri.

EULOGY, Eulogia, in *Church Hiſtory*. When the Greeks have cut a loaf, or piece of bread, to conſecrate it, they break the reſt into little bits, and diſtribute it among the perſons who have not yet communicated, or ſend it to perſons that are abſent; and theſe pieces of bread are what they call eulogies.

The word is Greek, ευλογια, formed of ευ, *bene*, *well*, and λεγω, *dico*, *I ſay*, *ſpeak*; q. d. *benedictum*, *bleſſed*.

The Latin church has had ſomething like eulogies for a great many ages; and thence aroſe the uſe of their holy bread.

The name eulogy was likewiſe given to loaves or cakes brought to church by the faithful to have them bleſſed.

Laſtly, the uſe of the term paſſed hence to mere preſents made a perſon, without any benediction. See the Jeſuit Gretſer, in his Treatiſe de Benedictionibus & Maledictionibus, lib. ii. cap. 22. 24, &c. where he treats of eulogies thoroughly.

From a paſſage in Bollandus, on the Life of S. Melaine, cap. 4. it appears, that eulogies were not only of bread, but any kind of meat bleſſed and hallowed for that purpoſe. And that almoſt every body bleſſed and diſtributed eulogies; not only biſhops and prieſts, but even hermits, though laymen, made a practice of it. Women alſo would ſometimes ſend eulogies.

The wine ſent as a preſent was alſo held an eulogy. Bollandus remarks farther, that the euchariſt itſelf was alſo called eulogy.

Eulogy, likewiſe, means an encomium on any perſon, on account of ſome virtue or good quality.

EUMARIDES, of ευμαρης, *eaſy*, among the *Ancients*, a kind of ſhoes common to men and women.

The eumarides were uſed for pomp and delicacy, being neat, and painted with various colours.

EUME, in *Geography*, a river of Spain, which runs into the ſea near Corunna.

EUMECES, in the *Writings of the Ancient Naturaliſts*, the name of a ſtone which Pliny tells us reſembled a flint, and was found in Bactria; the ancients had an idle opinion, that, if laid under the head, it occaſioned true and prophetic dreams, foretelling to the perſon the more remarkable future events of his life. Hiſt. Nat. lib. xxxvii. cap. 10.

EUMENES, in *Biography*, a captain under Alexander the Great, was a native of Cardiopolis, in the Thracian Cherſoneſe. His father was of a low ſtation, but one in a condition to have entertained at his houſe Philip king of Macedon, who became the patron of his ſon. So well did the youth approve himſelf as ſecretary to the monarch, that his ſon Alexander continued him in the ſame office, and gave him a command in the cavalry. According to Plutarch, Eumenes took every advantage that his ſtation afforded him of accumulating money, for his tent being ſet on fire by the private orders of his ſovereign, to whom he had refuſed the loan of three hundred talents; there was found to the value of more than one thouſand talents in melted gold and ſilver. After the death of Alexander, when the provinces were divided among the principal commanders, the government of Cappadocia, Paphlagonia, and the country bordering on the Euxine ſea, as far as Trapezius, which as yet were unconquered, were aſſigned to Eumenes. Eumenes attached himſelf to Perdiccas, who made him his chief miniſter, and gave directions to Antigonus and Leonatus to put him in poſſeſſion of his government. Antigonus paid no attention to the order, but Leonatus, pretending to comply, marched an army ſeemingly for the purpoſe, which Eumenes joined. His deſign was, however, to ſeize the kingdom of Macedon for himſelf; but upon making it known, Eumenes deſerted him by night, after ſeizing his treaſures, and repaired to Perdiccas. In reward for his fidelity, Perdiccas himſelf made an expedition in Cappadocia, and after defeating and killing the king Ariathes, left Eumenes maſter of the country. He was next appointed prefect of Aſia, between mount Taurus and the Helleſpont, and was entruſted with the care of oppoſing the army expected to march againſt him out of Greece under Antipater and Craterus. On the approach of theſe great commanders, Eumenes concealed from his army that they were about to contend with Craterus, for whom they entertained the moſt profound reſpect and veneration, and giving battle to him and Neoptolemus, he ſlew the latter with his own hand, while Craterus was mortally wounded, fighting at the head of his phalanx. Eumenes, who felt for him emotions of the ſincereſt friendſhip, graſped his hand as he was expiring, wept over his remains, and honoured him with a magnificent funeral. After the murder of Perdiccas by his own army, Eumenes was declared a public enemy, and Antigonus was ſent to conduct the war againſt him. Eumenes was routed, but able to retire to the impregnable caſtle of Nora, which he defended with great ability. He was abundantly ſupplied with corn, and though without any other kind of proviſions, he kept his men in good humour, by his affable and cheerful demeanour. Another ſcene opened itſelf for the ambition of Antigonus, and Eumenes was ſet at liberty. He inſtantly began to levy troops, and in a ſhort time was declared royal general of Aſia, and there was aſſigned to him a guard of Argyraſpidæ, or ſilver ſhields. To inſpire his troops with a ſort of religious enthuſiaſm in the cauſe, he pretended to have ſeen Alexander in a viſion, by whoſe direction he erected a royal tent, containing a throne of gold, with all the enſigns of majeſty, where the captains were to offer incenſe, and then deliver their orders in a common council. After this there were diſputes about the chief command, but when Antigonus approached all agreed that Eumenes was the only general, under whom they would fight. His ſituation was difficult and precarious, he was aware that many of the other commanders were deſirous of getting rid of him, as the chief obſtruction to their ambitious deſigns. From thoſe whom he moſt ſuſpected he borrowed large ſums of money, that by ſuch a pledge he might give them an intereſt in his ſecurity. The war was protracted with various ſucceſs to a ſecond campaign, when a battle enſued, in which Eumenes routed the enemies' infantry, but in the mean time his cavalry took poſſeſſion of the camp of Eumenes. This circumſtance occaſioned ſo much diſcontent in the army, that when Antigonus ſent an offer to reſtore the ſoldiers, their wives and property, on condition of their delivering Eumenes into his hands, the Argyraſpidæ ſurrounded him, ſeized his ſword, tied his arms behind him, and gave him up priſoner. Antigonus being aſked how he ſhould be kept? As you would keep a lion or a wild elephant, he replied. All the Aſiatic chiefs ſubmitted upon this event, and it remained only to determine the fate of the illuſtrious captive. This was ſo long kept in ſuſpence, that Eumenes expreſſed his ſurpriſe that Antigonus had neither the courage to put him to death, nor the generoſity to make him his friend by ſetting him at liberty. A party in the army, headed by Demetrius, favoured the laſt meaſure, but the majority urged Antigonus to remove ſo formidable a rival. This counſel prevailed, and orders were given to deprive him of food. He had ſuffered the pains of hunger two or three days, and was faſt approaching his end, when the army being ſuddenly obliged to decamp, an executioner was ſent to diſpatch him. His remains were treated with funeral honours, and his aſhes were encloſed in a ſilver urn, and ſent to his family. This was in the year 315 B. C. Eumenes had a fine perſon, was highly accompliſhed, and poſſeſſed the manners and ſentiments ſuited to an elevated ſtation; he was faithful to the cauſe of his deceaſed maſter, and it was not till after his death that the captains who divided the Macedonian empire among them openly aſſumed the ſtyle of independent ſovereigns. Eumenes periſhed in his forty-fifth year. Univer. Hiſt. Plutarch.

Eumenes II. king of Pergamus, ſucceeded his father Attalus in the year B. C. 197. He cultivated the friendſhip of the Romans, who were now beginning to extend their influence into Aſia, urging them to check the ambitious projects of Antiochus the Great, of which he feared he ſhould be the victim. Eumenes joined his fleet to that of the Romans, and by his perſonal bravery greatly contributed to a naval victory, which was gained over that king; nor was he leſs uſeful at the deciſive battle of Magneſia. On account of his important ſervices he was rewarded by an acceſſion to his dominions, of all the countries weſt of mount Taurus, which had belonged to Antiochus, and alſo of all the provinces lying between that mountain and the river Meander, except Lycia and Caria, which were given to the people of Rhodes. Eumenes, now one of the moſt potent princes in Leſſer Aſia, was involved in a war with Pruſias, king of Bithynia, in which he was defeated both by land and ſea. Peace was made, and another conteſt took place between Eumenes and Pharnaces; in this the latter was obliged to ſue for peace. Eumenes now made an alliance with Antiochus, ſon of his old enemy Antiochus the Great, and in conjunction with his brother Attalus placed that prince on the throne of Syria, from which he had been driven by an uſurper. Perſes, king of Macedon, by increaſing his military force, excited the jealouſy of his neighbours, and Eumenes took a journey to Rome, for the purpoſe of acquainting the ſenate with all he had diſcovered of his dangerous projects. On his return, Eumenes, going to offer ſacriſice at the temple of Delphi, had nearly loſt his life by aſſaſſins hired by Perſes to deſtroy him. He received ſo much injury that he was carried almoſt lifeleſs on board his ſhip, and it was generally believed that he was actually dead. Attalus his brother, giving credit to the news, aſſumed the royal enſigns, and even married the queen Stratonice. Eumenes, after his recovery, gave his brother a friendly reception, adviſing him not to marry his wife again till it was certain he was dead. From this period he was engaged in conteſts with the Romans, who began to regard him with ſuſpicion, and it is thought they encouraged Attalus to ſeize upon his brother's kingdom for himſelf. Eumenes died in the year 159 B. C. leaving an infant ſon to the protection of his brother and ſucceſſor Attalus. Eumenes was liberal, and even magnificent towards his friends. He was a patron of letters, and made conſiderable additions to the celebrated library of Pergamus. Univer. Hiſt.

Eumenes, an orator, was an Athenian by deſcent, but was born at Autun in Gaul, where he was for a conſiderable time profeſſor of rhetoric, and acquired great reputation. He was ſecretary to the emperors Maximian and Conſtantius, and was much eſteemed by Conſtantine the Great, whom he harangued in favour of the inhabitants of Autun in 311. He delivered an oration before the prefect of Lyoneſe Gaul, in favour of the reſtoration of the public ſchools in the province, towards which he nobly offered to contribute his own ſalary, as ſecretary, probably, as well as profeſſor. He died about the middle of the fourth century. Fragments of his orations are printed in the "Panegyrici Veteres." Moreri.

EUMENIA, in *Ancient Geography*, a town of Aſia, in the Greater Phrygia, ſeated on the Cludrus.—Alſo, a town of Aſia Minor, in Caria.—Alſo, a town of Thrace, on the confines of Lower Mœſia.

EUMENIDEIA, *Ευμενιδεια*, an annual feſtival obſerved in honour of the Furies. It was otherwiſe called *σεμνων ἑορτη*, becauſe the Athenians called the Furies *σεμναι θεαι*, *i. e. venerable goddeſſes.*

EUMENIDES, in *Antiquity*. See Furies.

EUMETRES Beli, in *Natural Hiſtory*, the name given by the ancients to a gem which the Aſſyrians held ſacred to their god, and which many other nations learned from them to ſuppoſe very powerful againſt magic. Many have ſuppoſed this to be the one we now call oculus Beli: but this is an error, ſince Pliny, in his account of the eumetres, ſays, that it was of a very fine green. It was probably a gem of the emerald kind, that ſtone having ever been in very high eſteem in the Eaſtern part of the world, as it is alſo to this day.

EUMINACUM, in *Ancient Geography*, a town of

Mœſia, marked in the Itinerary of Antonine; 24 miles from Viminiacum,

EUMMÉ FAREGGÉ, or *Omm Faredje*, a canal of Egypt, joining lake Manzaleh with the Mediterranean; ſuppoſed to be the mouth of that ancient canal, called the Tanitic or Saitic branch of the Nile.

EUMOLPIDES, in *Antiquity*, prieſts of Ceres, who had the power among the Athenians of initiating into the myſteries of this goddeſs, or excluding from them.

EUMOLPUS, in *Biography*, a diſciple of Orpheus, who, tracing the footſteps of his father Muſæus, wrote concerning the myſteries of Ceres.

EUNAPIUS, a native of Sardis, in Lydia, flouriſhed in the fourth century, and was a kinſman of the celebrated ſophiſt Chryſanthius, at whoſe requeſt he wrote the lives of the philoſophers of his time. This work has been characterized by Brucker "as a maſs of extravagant tales, diſcovering a feeble underſtanding, and an imagination prone to ſuperſtition;" beſides being a ſophiſt, he was an hiſtorian, and practiſed phyſic. In his writings he ſeems to have entertained a great prejudice againſt Chriſtianity, the martyrs to which he treats with a contempt that has given juſt offence to contemporary eccleſiaſtical writers. He wrote a hiſtory of the Cæſars from Claudius II. to Arcadius and Honorius, of which only a fragment, "De Legationibus," is remaining. The "Vitæ Philoſophorum" was publiſhed with a Latin tranſlation by Junius in 1596. Moreri.

EUNILAK, in *Geography*, a place of Eaſt Greenland. N. lat. 61° 4′. W. long. 46°.

EUNOFIUS, a name given by ſome authors to the ætites, or eagle-ſtone.

EUNOMIANS, in *Eccleſiaſtical Hiſtory*, a ſect denominated from Eunomius, biſhop of Cyzicus, who, in the fourth century, maintained moſt of the errors of Arius, and added others to them. He was a native of Dacora, a town of Cappadocia, and removing to Conſtantinople, gained his ſubſiſtence firſt as a notary, and afterwards as a ſchoolmaſter. At Alexandria he became a diſciple of Aetius, whoſe opinions he adopted and ſtrenuouſly defended. Having been ordained a deacon by Eudoxius, biſhop of Antioch, he was deputed to the court of the emperor Conſtantius for the purpoſe of defending Eudoxius againſt the accuſations of Baſil, biſhop of Ancyra; but in his way thither he was ſeized by the partizans of Baſil, and baniſhed to Myda, a city in Phrygia. In the year 360 he was ordained biſhop of Cyzicus; but boldly avowing his opinions, he became obnoxious to the orthodox party, and underwent various and ſevere perſecutions. At the command of the emperor Conſtantius, he was at length condemned and depoſed by Eudoxius. At Chalcedon, whither he retired, his enemies purſued him, and he was afterwards baniſhed by the emperor Valens to Mauritania. At the cloſe of the reign of this emperor, after he had been allowed to return to Conſtantinople, he was charged with diſturbing the peace of the church, and again baniſhed to the iſland of Naxos. When Valens died, he returned to Chalcedon, but was ſoon ſent into exile by the emperor Theodoſius. Wearied by inceſſant and grievous perſecution he obtained leave from the court to retire to the place of his nativity, where he died at an advanced age, about the year 394. He was the author of various works, moſt of which are now loſt. Thoſe that are extant are "Eunomius's Creed," preſented to the emperor Theodoſius in the year 383, and his "Apologeticus," or Defence of his Doctrine, in which, according to Dr. Cave, the ſly arch-heretic reaſons ſhrewdly. Fabricius has publiſhed this piece entire, and an Engliſh verſion of it may be ſeen in the 1ſt volume of Whiſton's "Primitive Chriſtianity revived." Socrates Hiſt. Eccleſ. Cave's H. L. Fabr. Bib. Græc. vol. viii. Lardner.

EUNOMIŒUPSYCHIANS, a ſect of heretics of the fourth century, mentioned by Nicephorus, lib. xii. cap. 30. being the ſame with thoſe called Eutychians by Sozomen, lib. vii. cap. 17. See EUTYCHIANS.

EUNUCH, Ευνουχος, a term applied in the general to all who have not the faculty of generating, either through imbecility or frigidity; but more particularly to ſuch as have been caſtrated, or have loſt ſome of the parts neceſſary for that purpoſe.

The word is formed of ευνην εχει, q. d. *lecti curam habet*, *guardian*, or *keeper of the bed.*

In England, France, &c. eunuchs are never made but on occaſion of ſome diſeaſe which renders ſuch an operation neceſſary; but in Italy they make eunuchs for the ſake of preſerving the voice; and in the Eaſt they make eunuchs to be guards or attendants on their women.

Great numbers of children, from one to three years of age, are yearly caſtrated in Italy to ſupply the operas and theatres, not only of Italy but other parts of Europe, with ſingers; though it is not one in three, that, after having loſt their virility, have a good voice for a recompence. See CONSERVATORIOS.

Tavernier aſſures us, that in the kingdom of Boutan, in the Eaſt Indies, there are every year made twenty thouſand eunuchs, and ſold thence into other countries.

The ſeraglios of the Eaſtern emperors are chiefly ſerved and guarded by eunuchs; and yet we have very good teſtimonies, that the rich eunuchs in Perſia and other countries, keep ſeraglios for their own uſe. This is a puniſhment of crimes in ſome countries. See ADULTERY.

By an arret of the grand chamber of Paris in 1665, it is adjudged that an eunuch could not marry, not even with the conſent of the woman, and all the parties on both ſides.

Claudian has a very ſevere ſatire againſt the eunuch Eutropius, who had been elected conſul of Rome. He repreſents him as an old woman, dreſſed up in the honours of the conſulate.

In the council of Nice thoſe were condemned who, out of an indiſcreet zeal, and to guard themſelves from ſenſual pleaſures, ſhould make themſelves eunuchs. Such as thus mutilated their bodies were excluded from holy orders; witneſs Leontius, biſhop of Antioch, who was depoſed for having practiſed this cruelty on himſelf; and the biſhop of Alexandria excommunicated two monks who had followed his example, on pretence of ſecuring themſelves from the impetuous motions of concupiſcence.

Several of the emperors made very ſevere prohibitions againſt the making of eunuchs, or people's caſtrating themſelves. See CASTRATION.

EUNUCHS, *Eunuchi*, in *Eccleſiaſtical Hiſtory*, is alſo the denomination of a ſect of heretics in the third century, who had the folly or madneſs to caſtrate not only thoſe of their own perſuaſion, but even all they could lay hands on.

They took their riſe from the example of Origen, who, upon a miſunderſtanding of our Saviour's words in St. Matthew, chap. xix. ver. 12. made himſelf an eunuch, by cutting off the offending part, as ſome ſay; or as others (particularly St. Epiphanius), by the uſe of certain medicines. Theſe heretics were alſo called *Valeſians*.

EVOCATI, among the Romans, ſoldiers, who having ſerved their time in the army, went afterwards volunteers at the requeſt of ſome favourite general.

EVOCATION, EVOCATIO, among the Romans, a religious ceremony always obſerved by them at undertaking the ſiege of a town, wherein they ſolemnly called upon the gods and goddeſſes of the place to forſake it and come over to them. Without the performance of this ceremony, they either thought that the place could not be taken, or that it would be a ſacrilege to take the gods priſoners.

The form of evocation uſed at taking the city of Carthage is related by Macrobius, Sat. III. 9.

They always took it for granted that their prayer was heard, and that the gods had deſerted the place and came over to them, provided they were able to make themſelves maſters of it. The ancients had alſo two other ſorts of evocation; one was a magical operation, which they uſed in order to call up departed ſouls. This cuſtom of raiſing the manes, or conjuring up ſouls departed, was ſo ancient, that its origin is traced as high as the earlieſt periods of time; and all the anathemas denounced by the ſacred authors againſt thoſe who conſulted familiar ſpirits are proofs of the antiquity of this practice. Among the different ſorts of magic prohibited by Moſes, that of calling up the dead is expreſsly ſpecified. (See Witch *of Endor.*) Prophane authors look upon Orpheus as the inventor of this art, in evidence of which it is alleged, that the hymns which are aſcribed to him are moſtly real pieces of conjuration, but it is probable that this practice was derived from the people of the Eaſt, and was carried into Greece with other religious ceremonies, by colonies which came and ſettled here. It is certain, however, that in the time of Homer, this ſort of conjuration was practiſed, as it is mentioned in ſome paſſages of the Iliad. At that time it was not reckoned odious or criminal, ſince there were perſons who made public profeſſion of conjuring up ghoſts, and there were temples where the ceremony of conjuration was to be performed. Pauſanias (in Bœot.) ſpeaks of that which was in Theſprotia, where Orpheus came to call up the ſoul of his wife Eurydice. Ulyſſes's travels into the country of the Cimmerians, whither he went to conſult the ghoſt of Tireſias, deſcribed by Homer in the Odyſſey (l. xi.) ſeems to indicate a kind of conjuration. Hiſtorians, as well as poets, have mentioned this ſpecies of conjuration. Another ſort of evocation was that which was uſed in calling up the gods. In order to underſtand this practice, it ſhould be recollected, that it was a doctrine of the Pagan theology, that the gods preſided in a peculiar manner over certain places, and that ſeveral of theſe places were under the protection of the ſame god; and as it was impoſſible for him to be in them all at the ſame time, it was neceſſary to uſe the ceremony of evocation, when his preſence was thought needful. They had hymns proper to this operation, which they called κλητικοι, ſuch as were moſt of thoſe aſcribed to Orpheus, and thoſe of the poet Proclus. When they thought the patron god was arrived, they celebrated the feſtival named επιδημιαι. As ſoon as the danger, which made them invoke the gods was paſſed, they gave them liberty to go any where elſe; and they had other hymns for celebrating their departure, which hymns were called αποπεμπτικοι.

EVOCATORIÆ Epistolæ, among the Romans, letters ſent by the emperors to command the attendance of any perſon; or letters granting licence to any one to wait on the emperor; every perſon not being allowed this privilege till they had deſired and obtained the evocatoriæ epiſtolæ.

EUODIA, in *Botany*, from ευωδια, *a ſweet ſmell*, Forſt. Gen. 7. t. 7. See Fagara.

EVOLI, in *Geography*, a town of Naples, in Principato Citra; 15 miles E.S.E. of Salerno.

EVOLVENT, in *Geometry*, a term which ſome writers uſe for the curve reſulting from the evolution of a curve: in contradiſtinction to the evolute, which is the curve ſuppoſed to be opened or evolved.

The evolute always both touches and cuts the evolvent at the ſame time: the reaſon is, that it has two of its infinitely ſmall ſides in common with the evolvent; or, rather exactly placed on two equal ſides thereof; one of them within-ſide that of the evolvent, *i. e.* on the concave ſide thereof; and the other on the convex ſide of its correſpondent ſide; ſo that the evolute touches the evolvent in two points; whence, inſtead of being a tangent, it is ſaid to oſculate the evolvent; and, hence, it is alſo called *oſculator*, and *circulus oſculator*.

There is one, and but one oſculator, to each point of the evolvent; but to the ſame point there is an infinity of other circles which only touch, and do not oſculate. The oſculator, and the evolute, make no angle in the place where they touch and cut; nor can any curve line be drawn between, as there may between a tangent and a curve.

EVOLUTE, Evoluta, in the *Higher Geometry*, a curve firſt propoſed by Mr. Huygens, and ſince much ſtudied by the latter mathematicians. See Curvature.

The evolute is a curve, ſuppoſed to be evolved, or opened; and which, in opening, deſcribes other curves.

To conceive its origin and formation, ſuppoſe a flexible thread, wound exactly over the convexity of any curve, as A B C G (*Plate* VI. *Analyſis*, *fig.* 1.) and ſuppoſe the thread fixed in G, and every where elſe at liberty, to A. Now, beginning to unwind the thread from the point, and continuing it to D, and, throughout, keeping it tight on the curve ſurface A B C G, when the thread is become quite ſtraight, and is only a tangent, F G, to the curve in the point G, it is evident the extremity A, in its progreſs to F, has deſcribed another curve line A D E F.

Here, the firſt curve A B C G is called the evolute; each of its tangents B D, C E, &c. comprehended between it and the curve A D E F, called the *involute*, is called a *radius of the evolute*, or *radius oſculi*, *radius oſculator*, or radius of curvature, of the curve A D E F, in the reſpective points D, E, &c. And the circles, whereof the oſculators B D, C E, &c. are radii, are called *circuli oſculatores* of the curve A D E F, in D, E, &c. And, laſtly, the new curve reſulting from the evolution of the firſt curve begun in A, is called the *curve of evolution*, or *curve deſcribed by evolution*.

Evolute, *the radius of the*, then, is the part of the thread comprized between any point where it is a tangent to the evolute, and the correſpondent point where it terminates in the new curve. Which appellation, *radius*, is the more proper, as one may actually conſider this part of the thread in every ſtep it takes, as if it deſcribed an arc of an infinitely ſmall circle, making a part of the new curve, which thus conſiſts of an infinite number of ſuch arcs, all deſcribed from different centres, and with different radii.

Every curve, therefore, may be conceived as formed by the evolution of another. And we are to find that, whoſe evolution formed it; which amounts to the finding of the radius of the evolute in any point; for, as it is always a tangent to the generating curve, it is, properly, no more than one of its infinitely ſmall parts, or ſides, prolonged; and all its ſides, whoſe poſitions are determined of courſe, are no other than the generating curve itſelf.

The ſame thread is alſo called *radius curvedinis*, or *radius oſculi*, becauſe a circle deſcribed hereby, from the centre G, is ſaid to oſculate, or kiſs it, as both touching and cutting at the ſame time, *i. e.* touching both the inſide and the out.

Hence, 1. The evolute B C F (*fig.* 35.) is the place of all the centres of the circles that oſculate the curve A M, deſcribed by evolution. 2. When the point B fall on A, the radius of curvature, or radius of the evolute, M C, is equal to the arc B C; or to the aggregate of A B, and the arc B C. 3. Since the element of the arc M m, in the curve deſcribed by evolution, is an arc of a circle deſcribed by the radius C M; the radius of the evolute C M is perpendicular to the curve A M, or to a tangent at the point M. 4. Since the radius of the evolute M C is always a tangent to the evolute B C F, curves by evolution may be deſcribed through innumerable points, if only tangents be produced in the ſeveral points of the evolute, till they become equal to their correſpondent arcs.

The finding of the radii of evolutes is a thing of great importance in the higher ſpeculations of geometry; and even, ſometimes, is of uſe in practice as the inventor of the whole theory, Huygens, has ſhewn, in applying it to the pendulum. (Horol. Oſcill. part 3.) The doctrine of the oſcula of evolutes is owing to M. Leibnitz, who firſt ſhewed the uſe of evolutes in the meaſuring of curves.

We ſhall here ſubjoin a brief account of the method of finding the radius of the evolute in different kinds of curves and equations expreſſing the nature of evolutes.

1. To form a general expreſſion for (B E) the radius of the evolute, or of curvature at any point B in the involute curve A B Y, whoſe axis is A X, and evolute D E, *fig.* 3.

With the radius E B deſcribe the circular arc B K, which will have the ſame curvature with the involute curve A B at the point B. Draw the radius E K parallel to the axis A X, and produce the ordinate B C to L, to which draw A N parallel: let the abſciſs A C be $= x$, the ordinate C B $= y$, radius E B or E K $= r$, K N $= a$, and N A $= b$; then L E $= r - a - x$. If the abſciſs x be ſuppoſed to increaſe uniformly, and B m to be a tangent at the point B; and $m\,n$ be drawn parallel to B C, and B N parallel to A X; B n, $n\,m$, and m B, which are the contemporary increments of the abſciſs, ordinate, and curve, will be as their fluxions reſpectively; or B n will be as $\dot x$, $n\,m$ as $\dot y$, and B m $(= \overline{\mathrm{B}n^2 + n\,m^2}|^{\frac{1}{2}})$ as $\overline{\dot x^2 + \dot y^2}|^{\frac{1}{2}}$.

Farther, the triangles B $n\,m$ and B L E are ſimilar; therefore B $n : n\,m ::$ B L : L E, *i. e.* $\dot x : \dot y :: y + b : r - a - x$; conſequently, $r\dot x - a\dot x - x\dot x = y\dot y + b\dot y$: the fluxion of which equation (ſuppoſing $\dot x$ invariable, and therefore, the direction of the curve A B continually approaching towards a parallelism with its axis, the fluxion of $\dot y$ as negative) is $-\dot x^2 = \dot y^2 - y\ddot y - b\ddot y$; and $\dot x^2 + \dot y^2 = \overline{b + y} \times \ddot y$.

Again, L B : B E :: n B : B m, *i. e.* $b + y : r :: \dot x : \overline{\dot x^2 + \dot y^2}|^{\frac{1}{2}}$; therefore $b + y = \frac{r\dot x}{\overline{\dot x^2 + \dot y^2}|^{\frac{1}{2}}}$, and ſubſtituting this expreſſion for $b + y$, the above equation will become $\dot x^2 + \dot y^2 = \frac{r\dot x\ddot y}{\overline{\dot x^2 + \dot y^2}|^{\frac{1}{2}}}$; conſequently, $\overline{\dot x^2 + \dot y^2} \times \overline{\dot x^2 + \dot y^2}|^{\frac{1}{2}} = r\dot x\ddot y$, *i. e.* $\overline{\dot x^2 + \dot y^2}|^{\frac{3}{2}} = r\dot x\ddot y$, and $\frac{\overline{\dot x^2 + \dot y^2}|^{\frac{3}{2}}}{\dot x\ddot y} = r =$ B E. In deducing this expreſſion, the increment of the ordinate y, or the velocity or fluxion with which it flows, is ſuppoſed continually to decreaſe, therefore its ſecond fluxion is negative: but when y increaſes with an accelerated motion, its ſecond fluxion will be affirmative; and the above expreſſion will be $\frac{\overline{\dot x^2 + \dot y^2}|^{\frac{3}{2}}}{-\dot x\ddot y}$. By ſubſtituting 1 for $\dot x$, which is invariable in theſe expreſſions, they will become $\frac{\overline{1 + \dot y^2}|^{\frac{3}{2}}}{\ddot y}$ and $\frac{\overline{1 + \dot y^2}|^{\frac{3}{2}}}{-\ddot y}$ reſpectively; the former taking place when the curve is concave, and the latter when it is convex towards the axis, and the ſign of $\ddot y$ ſhewing the poſition of the evolute and radius of curvature with reſpect to the curve and axis. By reducing theſe expreſſions from the nature and properties of the curve, and always ſubſtituting 1 for $\dot x$, we ſhall obtain the value of B E, or the radius required. The vertical diſtance or radius A D may be eaſily obtained by ſubſtituting for $\dot x$, 1, and for $\dot y$ its proper value in the expreſſion for the ſubnormal C H, which is evidently $\frac{y\dot y}{\dot x}$. *E. gr.* 1. To find the radius of curvature at any point B in the parabola A Y, *fig.* 4.

Let the parameter be $= a$, abſciſs A C $= x$, and ordinate C B $= y$: then, by the nature of the curve $a\,x = y^2$, and therefore $a\dot x = 2y\dot y$ (ſee FLUXION), and making $\dot x = 1$, $a = 2y\dot y$, and $\dot y = \frac{a}{2y} = \frac{a}{2 \times \overline{a\,x}|^{\frac{1}{2}}}$. But the fluxion of this equation will be $-\ddot y = \frac{-a^2}{4 \times \overline{a\,x}|^{\frac{3}{2}}}$, or $\ddot y = \frac{a^2}{4 \times \overline{a\,x}|^{\frac{3}{2}}}$, and $\dot y^2$ being equal to $\frac{a^2}{4\,a\,x} = \frac{a}{4x}$, we ſhall have, by ſubſtituting theſe values in the expreſſion $\frac{\overline{1 + \dot y^2}|^{\frac{3}{2}}}{\ddot y}$ for $\dot y^2$ and $\ddot y$,

$$\frac{\overline{1 + \frac{a}{4x}}|^{\frac{3}{2}} \times \overline{4 \cdot a\,x}|^{\frac{3}{2}}}{a^2} = \frac{4}{a^2} \times \frac{\overline{4x + a}|^{\frac{3}{2}}}{4x} \times \overline{a\,x}|^{\frac{3}{2}} = \frac{4}{a^2} \times \overline{\frac{4\,a\,x^2 + a^2 x}{4x}}|^{\frac{3}{2}} = \frac{4}{a^2} \times \overline{\frac{1}{4}}|^{\frac{3}{2}} \times \overline{4\,a\,x + a^2}|^{\frac{3}{2}} = \frac{4}{a^2} \times \frac{1}{8} \times \overline{4\,a\,x + a^2}|^{\frac{3}{2}} = \frac{\overline{4\,a\,x + a^2}|^{\frac{3}{2}}}{2\,a^2}.$$

Then if a ſemicircle be deſcribed through the point B, C n be biſected in H, and H r be made equal 2 A C, and r E be a perpendicular at r, produced till it meets a line B E, drawn from B through H, this line B E will be the radius of curvature required: for B C^2 = A C × C n, 35 E. 3. or $\frac{\mathrm{B\,C}^2}{\mathrm{A\,C}} =$ C n, *i. e.* $\frac{a\,x}{x} = a =$ C n, and C H $= \frac{1}{2}\,a$, and C $r = \frac{1}{2}\,a + 2\,x$; and by 47 E. 1. $\overline{\mathrm{C\,H}^2 + \mathrm{C\,B}^2}|^{\frac{1}{2}} =$ B H, *i. e.* $\overline{\frac{1}{4}\,a^2 + a\,x}|^{\frac{1}{2}} =$ B H; and by 4 E. 6. C H : H B :: C r : B E; *i. e.* $\frac{1}{2}\,a : \overline{\frac{1}{4}\,a^2 + a\,x}|^{\frac{1}{2}} :: \frac{1}{2}\,a + 2\,x : \frac{a + 4x}{a} \times \overline{\frac{1}{4}a^2 + a\,x}|^{\frac{1}{2}} = \frac{\overline{a^2 + 4ax}|^{\frac{3}{2}}}{2\,a^2} =$ B E as before. A D the vertical diſtance, or, $\frac{y\dot y}{\dot x}$, is in this caſe, putting $\frac{a}{2y}$ for $\dot y$, and 1 for $\dot x$, equal to $\frac{a}{2}$; and this likewiſe appears, by conſidering, that in the expreſſion for the radius when the radius becomes equal to the vertical diſtance, the abſciſs x vaniſhes, and it becomes $\frac{\overline{a^2}|^{\frac{3}{2}}}{2\,a^2} = \frac{a^3}{2\,a^2} = \frac{a}{2}$.

E. gr. 2. To find the radius of curvature at any point B in the cycloid A B D, *fig.* 5.

Put the radius O F or O D $= a$, abſciſs A C $= x$, ordinate C B = y, ſine I G = s, and arc F G = z. Now by 35 E. 3. I G = $\overline{\mathrm{DI} \times \mathrm{IF}}|^{\frac{1}{2}}$, that is, $s = \overline{2ay - y^2}|^{\frac{1}{2}}$; the fluxion of which equation is $\dot{s} = \frac{a\dot{y} - y\dot{y}}{\overline{2ay - y^2}|^{\frac{1}{2}}}$; and by the nature of the cycloid, arc D G = G B; and therefore, arc F G = G I + A C, or A C = arc F G − G I, that is, $x = z - s =$ (by ſubſtituting for s its above value) $z - \overline{2ay - y^2}|^{\frac{1}{2}}$; and the fluxion of this equation, making $\dot{x} = 1$, is $1 = \dot{z} + \frac{y\dot{y} - a\dot{y}}{\overline{2ay - y^2}|^{\frac{1}{2}}}$.

But $\dot{z} = \overline{\dot{s}^2 + \dot{y}^2}|^{\frac{1}{2}}$ = (by writing for $\dot{s}$ its above value), $\overline{\frac{\overline{a\dot{y} - y\dot{y}}|^2}{2ay - y^2} + \dot{y}^2}|^{\frac{1}{2}} = \frac{a\dot{y}}{\overline{2ay - y^2}|^{\frac{1}{2}}}$; which, ſubſtituted for $\dot{z}$, makes the above equation $1 = \frac{a\dot{y}}{\overline{2ay - y^2}|^{\frac{1}{2}}} + \frac{y\dot{y} - a\dot{y}}{\overline{2ay - y^2}|^{\frac{1}{2}}}$; that is, $1 = \frac{y\dot{y}}{\overline{2ay - y^2}|^{\frac{1}{2}}}$; therefore, $\dot{y} = \frac{\overline{2ay - y^2}|^{\frac{1}{2}}}{y}$; and the fluxion of this equation (the fluxion of $\dot{y}$ being negative), is $-\ddot{y} = \frac{\frac{ay\dot{y} - y^2\dot{y}}{\overline{2ay - y^2}|^{\frac{1}{2}}} - \dot{y} \cdot \overline{2ay - y^2}|^{\frac{1}{2}}}{y^2} = \frac{-a\dot{y}}{y \cdot \overline{2ay - y^2}|^{\frac{1}{2}}} =$ (by writing for $\dot{y}$ its equal), $-\frac{a}{y^2}$; that is, $\ddot{y} = \frac{a}{y^2}$. Now, by ſubſtituting $\frac{2ay - y^2}{y^2}$ for $\dot{y}^2$, and $\frac{a}{y^2}$ for $\ddot{y}$, we have $\frac{\overline{1 + \dot{y}^2}|^{\frac{3}{2}}}{\ddot{y}} = \frac{\overline{1 + \frac{2ay - y^2}{y^2}}|^{\frac{3}{2}} \times y^2}{a} = \frac{\overline{2ay}|^{\frac{3}{2}}}{ay} = \frac{\overline{2ay \times 2ay}|^{\frac{1}{2}}}{ay} = 2 \cdot \overline{2ay}|^{\frac{1}{2}}$ = B E, the radius of curvature required.

Conſtruction.—Make F H = G B; and through the point H draw the right line B E, making B H = H E = chord F G; then will B E be the radius of curvature at the point B; for a tangent to the point B is parallel to the chord D G, and the radius of curvature is always perpendicular to the tangent; therefore, becauſe by 31 E. 3. the ∠ D G F is right, B E muſt be parallel to the chord F G. Now, by 4 and 8 E. 6. D F : F G :: G F : F I, or C B, ∴ G F = $\overline{\mathrm{DF} \times \mathrm{CB}}|^{\frac{1}{2}} = \overline{2ay}|^{\frac{1}{2}}$, and 2 G F = $2 \cdot \overline{2ay}|^{\frac{1}{2}}$ = B E.

2. To form a general expreſſion for the radius of curvature in ſpirals, or curves whoſe ordinates are referred to a fixed or central point:

Let C B Y, (*fig.* 6.) be the curve, C the central point, or that from which all the ordinates iſſue; and B E the radius of the curvature at the point B, that is, let the point E be ſuppoſed in the evolute curve: conceive C b and E b indefinitely near to C B and E B, that is, let the points B and b be ſuppoſed indefinitely near to each other; and let C F and C f be perpendicular to E B and E b reſpectively, then will the points F and r be indefinitely near to a coincidence; and therefore B r and C r may be taken as equal to B F and C F. Now, if with the ordinate C B as a radius, the little circular arc B n be deſcribed and conſidered as a little right line perpendicular to C b, and the increment B b be conſidered as coinciding with the tangent to the point B, then the little right-angled triangle B n b will be ſimilar to the right-angled triangle B F C; (for ∠ C B n = ∠ E B b; and therefore ∠ E B n being common, the ∠ C B F = ∠ n B b; and, conſequently, the angles at F and n being right, ∠ B C F = ∠ B b n); therefore by 4 E. 6. b B : B n :: C B : B F; that is, (if we put the ordinate C B = y, B n = x', and n b = y', when, by 47 E. 1 B b will be = $\overline{x'^2 + y'^2}|^{\frac{1}{2}}$,) $\overline{x'^2 + y'^2}|^{\frac{1}{2}} : x' :: y : \frac{x'y}{\overline{x'^2 + y'^2}|^{\frac{1}{2}}}$ = B F or B r; and B b : b n :: B C : C F, that is, $\overline{x'^2 + y'^2}|^{\frac{1}{2}} : y' :: y : \frac{yy'}{\overline{x'^2 + y'^2}|^{\frac{1}{2}}}$ = C F or C r; the increment of which is rf; that is, ſuppoſing x' to be invariable) $\frac{\overline{y'^2 + yy''} \times \overline{x'^2 + y'^2}|^{\frac{1}{2}} - \frac{y'y'' \times yy'}{\overline{x'^2 + y'^2}|^{\frac{1}{2}}}}{x'^2 + y'^2} = \frac{x'^2y'^2 + y'^4 + yx'^2y''}{\overline{x'^2 + y'^2}|^{\frac{3}{2}}} = rf$. Again, the triangles E B b and E r f being ſimilar, B b − rf : B b :: (B E − r E, or) r B : B E; that is, $(\overline{x'^2 + y'^2}|^{\frac{1}{2}} - \frac{x'^2y'^2 + y'^4 + yx'^2y''}{\overline{x'^2 + y'^2}|^{\frac{3}{2}}} =) \frac{x'^4 + x'^2y'^2 - yx'^2y''}{\overline{x'^2 + y'^2}|^{\frac{3}{2}}} : \overline{x'^2 + y'^2}|^{\frac{1}{2}} :: \frac{x'y}{\overline{x'^2 + y'^2}|^{\frac{1}{2}}} : \frac{y \times \overline{x'^2 + y'^2}|^{\frac{3}{2}}}{x'^3 + x'y'^2 - yx'y''}$ = B E, or B E = $\frac{y \times \overline{\dot{x}^2 + \dot{y}^2}|^3}{\dot{x}^3 + \dot{x}\dot{y}^2 - y\dot{x}\ddot{y}}$; which is a general expreſſion for the radius of curvature of all curves referred to a fixed or central point, when x' or $\dot{x}$ is invariable.

Hence, if $\dot{x}$ be made = 1, the general expreſſion for the radius of curvature will be = $\frac{\dot{y} \times \overline{1 + \dot{y}^2}|^{\frac{1}{2}}}{1 + \dot{y}^2 - y\ddot{y}}$. Wherefore, if we put the equation of the given ſpiral into fluxions, making $\dot{x} = 1$, and put this fluxional equation into fluxions again; and from thence, or from the nature of the curve, find the values of $\dot{y}^2$ and $\ddot{y}$: then, if for $\dot{y}^2$ and $\ddot{y}$ we ſubſtitute theſe their values in this general expreſſion, we ſhall have B E the radius of curvature required.

Otherwiſe. Let A R B be the propoſed curve, (*fig.* 7.) P the point, or centre, to which its ordinates are referred. N O L the evolute, and R O the ray of curvature at R. Moreover, let P H be perpendicular to R O; and ſuppoſing the ordinate P R (y) to become variable by the motion of the point R along the curve, let the fluxions of A R and P H (p), expreſſing the celerities of the points R and H in directions perpendicular to R O, be denoted by $\dot{z}$ and $\dot{p}$ reſpectively: the fluxions of quantities being always as the celerities by which the quantities themſelves increaſe in magnitude. (See FLUXION).

Therefore the celerities of any two points, in a right line revolving about a centre, being as the diſtances from that centre, it follows that $\dot{p} : \dot{z} ::$ O H : O R; whence by diviſion (putting R H = v) we have $\dot{z} - \dot{p} : \dot{z} :: v$ (R H) : R O = $\frac{v\dot{z}}{\dot{z} - \dot{p}} = \frac{vp\dot{z}}{p\dot{z} - p\dot{p}}$. But $p\dot{z} = y\dot{y}$.

and therefore R O $= \frac{v y \dot{y}}{y\dot{y} - p\dot{p}}$; which, becauſe $y^2 - p^2$ is $= v^2$ (and therefore $y\dot{y} - p\dot{p} = v\dot{v}$) will alſo be $= \frac{v y\dot{y}}{v\dot{v}} = \frac{y\dot{y}}{\dot{v}}$.

E. G. 1. Let the given curve A R (*fig.* 7.) be the logarithmic ſpiral, whoſe nature is ſuch, that the angle P R Q (or R P H) which the ordinate makes with the curve, is every where the ſame.

Then (denoting the ſine of that angle by b, and the radius of the tables by a) we have R H (v) $= \frac{by}{a}$, and therefore R O $\left(\frac{y\dot{y}}{\dot{v}}\right) = \frac{ay\dot{y}}{b\dot{y}} = \frac{ay}{b}$; which being to P R ($y$) in the conſtant ratio of a to b, or of P R to R H, the triangles R O P and R P H muſt therefore be ſimilar, and ſo the angle P O H, which the ordinate P O makes with the evolute, being every where equal to P R Q, will likewiſe be invariable. Whence it appears that the evolute is alſo a logarithmic ſpiral, ſimilar to the involute; and that a right line drawn from the centre, perpendicular to the ordinate of any logarithmic ſpiral, will paſs through the centre of curvature.

E. G. 2. To find the radius of curvature at any point B the ſpiral of Archimedes, C B, &c *fig.* 8.

Put the circumference of the generating circle A F, &c. $= a$, and its radius C A $= b$, ordinate C B $= y$, arc A F $= z$. Let C f be ſuppoſed indefinitely near to C F, that is, let the ∠ F C f be ſuppoſed indefinitely ſmall; and with the ordinate C B as a radius deſcribe the little circular arc B n, which put $= x'$; alſo put F $f = z'$. Now, by the nature of the curve, $a : b :: z : y$, or $z = \frac{ay}{b}$, the fluxion of which equation is $\dot{z} = \frac{a\dot{y}}{b}$; and by the ſimilar ſectors C B n and C F f, $y : x' :: b : z' = \frac{bx'}{y}$, or, $\dot{z} = \frac{b\dot{x}}{y}$. Hence, $\frac{a\dot{y}}{b} = \frac{b\dot{x}}{y}$; that is, (making $\dot{x} = 1$) $\frac{a\dot{y}}{b} = \frac{b}{y}$; from which equation we have $\dot{y} = \frac{b^2}{ay}$; therefore $\dot{y}^2 = \frac{b^4}{a^2y^2}$, and $\ddot{y} = \frac{-ab^2\dot{y}}{a^2y^2} =$ (by writing for $\dot{y}^2$ its value), $\frac{-b^4}{a^2y^3}$; and if we ſubſtitute for $\dot{y}^2$ and $\ddot{y}$ theſe their values, we ſhall have $\frac{y \times \overline{1+\dot{y}^2}|^{\frac{1}{2}}}{1+\dot{y}^2 - y\ddot{y}}$

$$= \frac{y \times \overline{1 + \frac{b^4}{a^2y^2}}|^{\frac{3}{2}}}{1 + \frac{b^2}{a^2y^2} + \frac{b^4}{a^2y^2}} = \frac{\overline{a^2y^2 + b^4}|^{\frac{3}{2}}}{a^2y^2 + 2ab^4} = \text{B E},$$

the radius of curvature ſought.

Conſtruction.—Through the centre C draw the indefinite right line H v perpendicular to the ordinate C B; draw the tangent T B, perpendicular to which draw B H; produce B C to V, making B R = T H and R V = C H; with B V and B R as radii, deſcribe the arcs V v and R r; draw the right line v B; and from the interſecting point r draw r E parallel to v H; then will B E be the radius of curvature at the point B: for, C T $= \frac{yz}{b}$, that is, by ſubſtituting $\frac{ay}{b}$ for z, C T $= \frac{ay^2}{b^2}$; and by 8 and 4 E. 6. T C : C B :: C B : C H, that is, $\frac{ay^2}{b^2} : y :: y : \frac{b^2}{a} =$ C H; therefore T H $=$ B R $=$ B $r = \frac{ay^2}{b^2} + \frac{b^2}{a}$, and B V $=$ B $v = \frac{ay^2}{b^2} + \frac{2b^2}{a}$; and by 47 E. 1. H B $= \overline{BC^2 + CH^2}|^{\frac{1}{2}} = \overline{y^2 + \frac{b^4}{a^2}}|^{\frac{1}{2}} = \frac{\overline{a^2y^2 + b^4}|^{\frac{1}{2}}}{a}$: again, by 4 E. 6. B v : B H :: B r : B E, that is, $\frac{ay^2}{b^2} + \frac{2b^2}{a} : \frac{\overline{a^2y^2+b^4}|^{\frac{1}{2}}}{a} :: \frac{ay^2}{b^2} + \frac{b^2}{a} : \frac{\overline{a^2y^2+b^4}|^{\frac{1}{2}}}{a} \times \frac{a^2y^2+b^4}{a^2y^2+2b^4} = \frac{\overline{a^2y^2+b^4}|^{\frac{3}{2}}}{a^3y^2+2ab^4} =$ B E.

3. To find an equation that ſhall expreſs the nature of the evolute of a given involute curve.

Let B E be the radius of evolution or curvature at any point B in the involute curve A B, *fig.* 9. whoſe abſciſs is A C $= x$, and ordinate C B $= y$. Parallel to H A draw E N; produce B C to L; and equal and parallel to C L, draw D N from the vertex of the evolute D E; then will the triangles B H C and B E L be ſimilar: and therefore, by 4 E. 6. B H : H C :: B E : E L, that is, $\frac{\ddot{y}}{\dot{x}} \times \overline{\dot{x}^2 + \dot{y}^2}|^{\frac{1}{2}} : \frac{y\dot{y}}{\dot{x}} :: \frac{\overline{\dot{x}^2+\dot{y}^2}|^{\frac{3}{2}}}{\dot{x}\ddot{y}} : \dot{y} \times \frac{\dot{x}^2+\dot{y}^2}{\dot{x}\ddot{y}} =$ E L; and H C : C B :: E L : L B, that is, $\frac{y\dot{y}}{\dot{x}} : y :: \dot{y} \times \frac{\dot{x}^2+\dot{y}^2}{\dot{x}\ddot{y}} : \frac{\dot{x}^2+\dot{y}^2}{\ddot{y}} =$ L B. Now, theſe are general expreſſions for E L and L B, when $\dot{x}$ is conſidered as invariable, and the fluxion of $\dot{y}$ as negative. Hence, therefore,

If $\dot{x} = 1$, and the fluxion of $\dot{y}$ be negative, the general expreſſion for B L will be $= \frac{1+\dot{y}^2}{\ddot{y}}$, and this multiplied by $\dot{y}$ is $\dot{y} \times \frac{1+\dot{y}^2}{\ddot{y}} =$ the general expreſſion for L E. Now, by help of the equation of the given involute curve, exterminate $\dot{y}$, $\dot{y}^2$, and $\ddot{y}$, out of theſe expreſſions, and find the vertical diſtance A D. Then, if we put the abſciſs of the evolute D N $= u$, and its ordinate N E $= v$; by help of theſe two equations, $u =$ B L $-$ B C, and $v =$ A C $-$ A D $+$ L E, we may get the nature of the evolute curve D E required.

Note.—If the given involute be convex towards its axis, and x and y increaſe together, or the fluxions of x and $\dot{y}$ be both affirmative, then the general expreſſions for B L and L E will be $\frac{1+\dot{y}^2}{-\ddot{y}}$; and $\dot{y} \times \frac{1+\dot{y}^2}{-\ddot{y}}$ reſpectively; wherein the negative ſign ſhews, that the points L and E muſt be taken on the concave ſide of the involute curve, that is, on the other ſide of it with regard to x and y.

E. gr. To find the nature of the curve A E P (*fig.* 10.) by whoſe evolution the cycloid A B D is deſcribed.

Put A C $= x$, C B $= y$, arc F G $= z$, and O D or O F $= a$; then by Ex. 2. art. 1. above, $\dot{y} = \frac{\overline{2ay - y^2}|^{\frac{1}{2}}}{y}$ $\dot{y}^2 = \frac{2ay - y^2}{y^2}$, and $\ddot{y} = \frac{a}{y^2}$; wherefore, B L =

1 +

$$\frac{\dot x^2 + \dot y^2}{\dot y} = \frac{\overline{1 + \frac{2ay - y^2}{y^2}} \times \dot y^2}{a} = 2y,$$ and L E $= \dot y \times$ B L $= \frac{\overline{2ay - y^2}|^{\frac{1}{2}}}{y} \times 2y = 2 . \overline{2ay - y^2}|^{\frac{1}{2}}$. Hence, if we put the abſciſs A N $= u$, and ordinate N E $= v$, we have u (= B L − C B =) $2y - y = y$, and $v =$ (A C + L E =) $x + 2 . \overline{2ay - y^2}|^{\frac{1}{2}}$ that is, (becauſe $x = z - \overline{2ay - y^2}|^{\frac{1}{2}}$) $v = z + \overline{2ay - y^2}|^{\frac{1}{2}}$, or, (writing u for y its equal,) $v = z + \overline{2au - u^2}|^{\frac{1}{2}}$. Wherefore, the evolute curve A E P is a cycloid, and equal to the given cycloid A B D; for, let A S = S V = a, then (A N being = F I,) A T = F G = z, and N T $= \overline{2au - u^2}|^{\frac{1}{2}}$ = I G; and therefore, A T + T N $= z + \overline{2au - u^2}|^{\frac{1}{2}}$, that is, A T + T N = N E, which is the property of the cycloid; therefore, the evolute A E P is a cycloid; and becauſe A V = F D, therefore the cycloids A E P and A B D are equal. See Cycloid.

The evolute of a ſpiral, or indeed of any other curve, may be deſcribed by finding the radii of curvature at ſeveral points in the involute; for then we ſhall have as many points in the evolute, through which if a curve line be drawn, it will be the evolute ſought.

Wolf. Elem. Math. tom. i. p. 524, ſeq. or the Infinim. Petites of M. le Marquis de l'Hopital. Simpſon's Fluxions, vol. i. p. 71, &c. And Rowe's Fluxions, edit. 3. 1767, chap. vi. and vii. p. 103—132.

Since the radius of an evolute is either equal to an arc of an evolute, or exceeds it by ſome given quantity, all the arcs of evolutes may be rectified geometrically, whoſe radii may be exhibited by geometrical conſtructions; whence we ſee why an arc of a cycloid is double its chord; the radius of the evolute being double the ſame, and the evolute of a cycloid being itſelf a cycloid, equal and ſimilar to the involute.

M. Varignon has applied the doctrine of the radius of the evolute to that of central forces; ſo that having the radius of the evolute of any curve, one may find the value of the central force of a body; which, moving in that curve, is found in the ſame point where that radius terminates; or reciprocally, having the central force given, the radius of evolute may be determined. Hiſt. de l'Acad. Roy. des Sciences, an. 1706.

The variation of curvature of the line deſcribed by the evolution of a curve, is meaſured by the ratio of the radius of curvature of the evolute, to the radius of curvature of the line deſcribed by the evolution. See Maclaurin's Flux. art. 402. prop. 36.

Evolute, *imperfect.* M. Reaumur has given a new kind of evolute, under this denomination. Hitherto the mathematicians had only conſidered the perpendiculars let fall on the points of the convex ſide of the curve; if other lines not perpendicular were drawn upon the ſame points, provided they were all drawn under the ſame angle, the effect would be the ſame; that is, the oblique lines would all interſect within the curve; and by their interſections, form the infinitely ſmall ſide of a new curve, whereof they would be ſo many tangents.

This curve would be a ſort of evolute, and would have its radii; but an imperfect evolute, ſince the radii are not perpendicular to the firſt curve. Hiſt. de l'Acad. &c. an. 1709.

EVOLUTION, in *Geometry*, the unfolding or opening of a curve, and making it deſcribe an evolvent.

The word *evolutio* is formed of the prepoſition *e, out*, and *volvo, I roll*, or *wind*; q. d. an *unwinding*, or *unrolling.*

The equable evolution of the periphery of a circle, or other curve, is ſuch a gradual approach of the circumference to rectitude, as that its parts do all concur, and equally evolve, or unbend; ſo that the ſame line becomes ſucceſſively a leſs arc of a reciprocally greater circle, till at laſt they change into a ſtraight line. In the Philoſophical Tranſactions, N° 260, a new quadratrix to the circle is found by this means, being the curve deſcribed by the equable evolution of its periphery.

Evolution, in *Algebra*, is alſo uſed for the extraction of roots out of powers. In which ſenſe it ſtands oppoſed to involution. See Extraction *of roots.*

Evolution, as relating to *Military* operations, muſt be underſtood to be founded on the principles of Tactics (which ſee), and be conſidered indiſpenſably neceſſary to the ſafety, the progreſs, and the ſucceſs of all bodies of men, whether large or ſmall. The term is generally uſed as ſynonymous with manœuvre, but in ſtrictneſs they are by no means to be ſo accounted; for an evolution rather relates to an open, candid, and undiſguiſed movement, made either for a change of poſition, or for the general purpoſes of attack and defence; while a manœuvre applies abſtractedly to deceptious movements, to feints, and to that kind of trick which gives riſe to the ſaying ſo common among us, "I have out-manœuvred him." Thus the French, from whom we have directly borrowed the term, ſay, "un ruſé manœuvre," *i. e.* a cunning fellow; and among them a ſkilful ſeaman is deſignated "un manœuvrier."

In every ſervice, both in the military and naval departments, certain regulations exiſt which direct, that all candidates for promotion ſhould be acquainted, not ſimply with the ſeveral motions of the firelock, and the ordinary duties of individuals, but with a variety of movements to be made by entire battalions, or armies, and by either ſingle ſhips, ſquadrons, diviſions, or fleets reſpectively. It being our intention to amplify under the head of Tactics, *military* and *naval*, we ſhall in this place confine ourſelves to thoſe evolutions which, forming a part of the Britiſh diſcipline, ought to be thoroughly underſtood by every perſon whoſe purſuits tend towards the goal of martial celebrity; and ſhould be thoroughly underſtood by every officer, of whatever rank.

The following nineteen changes will be ſufficient for the purpoſe, under the remark, that we pre-ſuppoſe a battalion to be arranged at cloſe order, and all in readineſs for performing the required evolutions.

Evolution 1.

On a rear diviſion.	Form cloſe column of companies behind grenadiers. Form cloſe column of two companies. Face and march to the right. Deploy on the rear diviſion.	*Explanation.*—The column marches *quick*, 20 or 30 paces to the right, and, without halting, begins to deploy into line on the rear diviſion. The commanding officer of the battalion gives the word, for each diviſion to halt, front.

Evolution 2.

On a front diviſion.	Form cloſe column of companies in front of the left. Form cloſe column of two companies. Face and march to the left. Deploy on the front diviſion.	The column marches *quick*, 30 or 40 paces to the left, and, without halting, begins to deploy on the front diviſion. The commanding officer of the battalion gives the word for each diviſion to halt, front.

Evolution 3.

On a central diviſion.	Form cloſe column of companies on a central company, either flank in front, and facing to the rear. Countermarch of each diviſion in cloſe column. Deploy on any central named company.	The cloſe column is formed facing to the rear. It then countermarches each diviſion, ſo as to return to the proper front. In the central deployment by companies, the company officers give the words reſpectively to halt, front.

Evolution 4.

Change of poſition in open column.	Wheel back into open column of companies, the right in front. March forward 30 or 40 paces. Enter an oblique line (the three or four leading companies), by wheeling ſucceſſively to the left, a half-wheel. Halt. The rear companies file into column. Wheel up into line.	The battalion, thus, at an intermediate point, enters an alignment, on which it is to form.

Evolution 5.

Wing thrown back.	The left company is wheeled back till parallel with the original poſition. The reſt of the companies wheel into echellon. March to the rear. Form on the left company.	The whole companies wheel back at the ſame time; the left company twice the number of paces that the others do. Should it be neceſſary for the ſubſequent movements, the line may retire 50 or 60 paces, and then front.

Evolution 6.

Countermarch, and change of poſition.	Wheel back into open column, the right in front. Countermarch companies by files. March in column 30 or 40 paces. Head diviſion halts cloſe to the head of column. Form ſquare, and prepare for firing. Re-form in cloſe column. Open out to open column from the rear, and halt. Change head of column, by the countermarch of companies, from the rear to the front. Column moves on and halts. Wheel up into line.	After the countermarch by files, the column ſtands with its left in front. The column cloſes in quick time. The ſquare is formed, and cloſe column re-formed. The column opens out in quick time from its rear diviſion, and halts. The countermarch by companies, from the rear to the front, is in ordinary time. When the line is formed, it is then conſiderably to the reviewing general's right, and with its rear to him.

Evolution 7.

Countermarch by files on the centre of the battalion.	This brings back the battalion to its original front.

Evolution 8.

March in open column.	Form open column behind the left company, which is put in march when the third company has taken its place in column. The right ſub-diviſions double. The column halts, and pivots are corrected. Wheel up into line.	The companies that are filing incline towards the head of the column; ſucceſſively front at their wheeling diſtances, aſcertained as uſual by their ſerjeants; take up the ordinary ſtep, and follow in open column. When the column is marching ſteadily, the whole ſub-diviſions double at once, at one command, and again move up at another.

Evolution 9.

Echellon change of poſition.	Wheel back into open column, the left in front. The third company is wheeled back, the 8th of a circle, and each of the others 3-16ths of the circle. Form line on the third company by the echellon-march.	The line is thus formed oblique, from open column, on a central company, by the echellon-march.

Evolution 10.

Change of poſition.	The left company is wheeled up the 8th of a circle, and each of the others 1-16th. Form line by the echellon-march.	The line thus changes poſition to the front, on the left company, by the echellon-march.

Evolution 11.

Change of poſition.	The battalion faces to the right. March in file 50 or 60 paces. Halts. Wheels up into line, except the light company, which files quickly to the right, and forms behind the colours.	The column of companies is formed by the rear men of each moving up quickly to the left of their leaders, and of each other: the officers move to pivot flanks, and pivots are inſtantly corrected. The column halts when the colours are oppoſite to the general.

Evolution 12.

Retreat in line.	The battalion retires (50 paces). Halts; fronts. Fire twice by companies from centre to flanks. Retire by alternate companies in two lines (250 paces, each retreat about 50 paces.) Form line. Retire in line (50 paces). Halt; front.	The light company, being previouſly ſubdivided and prepared, acts in the retreat by alternate companies, filling up, or at leaſt occupying the intervals in the firſt line, and retiring with it to the ſecond, in which it continues to ſet in like manner, and thus alternately. When the line halts, and fronts, it reſumes its place on the left.

Evolution 13.

March to flank in echellon.	Companies make a half wheel to the right. March in echellon, (250 paces.) Wheel back on the march into parallel line. Forward (100 paces.) Halt. Fire thrice by companies, from flanks to centre.	At the word "wheel back into line," the pivot flanks mark time, and the divisions wheel back in ordinary time. At the proper inſtant, when the battalion is formed, the commander gives the word "Forward," for the whole to advance by the colours, and to correct any irregularity there may be in the battalion.

[Hitherto the battalion may have been *two* deep, but if its companies can muſter ten files each, the corps may now be formed *three* deep.]

Evolution 14.

Movements in the ſquare.	Form ſquare. March the ſquare by the left. Angle of the front face (50 paces.) Halt; form ſquare. March ſquare by the left face. Halt; form ſquare. March ſquare by the rear face. Halt; form ſquare. Fire in ſquare by companies. Form the line.	The ſquare is formed by the echellon march of companies. After the march by the left face, the ſquare is formed when oppoſite the general. The line is formed by the echellon wheel-up, and march of companies. When the order is given to form line, the light company marches quickly, and places itſelf two deep, and in two diviſions, ten or twelve paces behind the two centre companies.

Evolution 15.

Retiring, and filing to the rear.	Retire in line (100 paces.) File by companies from the proper right. Halt in open column, the right in front. Wheel up into line.	When the line has paſſed the light company twenty paces, that company extends to cover the centre of the battalion, and follows at 50 or 60 paces diſtance; and when the column halts to form, the light company paſſes quickly through and beyond it. The companies file quickly to the rear. The battalion forms line at the extremity of its ground; the light company 30 paces in its rear.

Evolution 16.

Filing, advancing, and charging to the front.	Advance in line (50 paces.) File from the right of companies to the front (50 paces.) Halt in open column, the left in front. Wheel up into line. Advance in line (50 paces.) Advance by alternate half battalions, and fire four times.	Before the line advances, the light company quickly forms, extended 30 paces before the centre, and preſerves that diſtance in advancing. When the column halts to form, the light company paſſes quickly to the rear, and aſſembles half of it behind each flank, then moves relatively with the flank-companies, till after the charge of bayonets. The alternate half-battalions fire, the two firſt ranks ſtanding.

Evolution 17.

Charge and purſuit.	Form line. Advance (50 paces.) Fire volley. Advance (50 paces.) Fire volley. Charge bayonets (50 paces.) Halt. Load.	After the volley, bayonets are ported; the battalion advances firm by the centre at the quick ſtep, and at the word "Halt," the front rank comes down to the charging poſition. The word "Prime and Load" is then given, and the light company, iſſuing from behind the flanks, purſue, return, and aſſemble, and join on the left of the battalion.

Evolution 18.

Retiring in line.	Retire in line (100 paces.) Retire by alternate half battalions. Fire four times. Retire in line (100 paces, or more.) Halt. Front.	The whole battalion being aſſembled, the alternate half-battalions fire, the two front ranks ſtanding.

Evolution 19.

Advance in line and ſalute.	Advance in line (100 paces.) Halt. Fire two vollies. Port arms at the laſt one, and half cock. Open ranks. Advance within 50 paces of reviewing general. Halt. General ſalute.	In the vollies the front rank kneels. The muſic may occaſionally play, and the drums roll, as the line advances. The muſic will play while advancing at open ranks.

We have ſelected this portion of the diſcipline ordered for the Britiſh army, becauſe it comprizes ſufficient changes to give our readers a correct idea of what are termed *evolutions*. Theſe are ſo contrived as to be performed on a very moderate extent of ground; each evolution ſerving to correct any obliquity, or lateral change of poſition, and confining the regiment within certain limits.

It may be proper to remark, that though the foregoing relate in this inſtance to a ſingle regiment under review, the whole of the charges may be conſidered as repreſenting thoſe made by a large army; the ſeveral companies being the repreſentatives of regiments, or of larger bodies. See BATTALION.

Fa. Hoſte, a Jeſuit, in 1697, printed a Treatiſe on Naval Evolutions, in folio. By naval evolutions he means the motions made by a fleet, ſquadron, or naval armament, in order to put themſelves in a proper diſpoſition for attacking the enemy, or defending themſelves with the moſt advantage. See TACTICS.

EVOLVULUS, in *Botany*, from *evolvo, to roll out or unfold*, in oppoſition to *Convolvulus*, with which the preſent genus agrees in habit, except in not having a convoluted ſtem. Linn. Gen. 152. Schreb. 204. Willd. Sp. Pl. v. 1. 1516. Juſſ. 134. Claſs and order, *Pentandria Tetragynia*. Nat. Ord. *Campanaceæ*, Linn. *Convolvuli*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, of five lanceolate, acute, permanent ſegments. *Cor.* of one petal, regular, wheel-ſhaped, plaited, ſlightly five-cleft. *Stam.* Filaments five, capillary, ſpreading, almoſt as long as the corolla; anthers rather oblong. *Piſt.* Germen ſuperior, nearly globular; ſtyles four, capillary, ſpreading, the length of the ſtamens; ſtigmas ſimple. *Peric.* Capſule nearly globular, of four cells and four valves. *Seeds* ſolitary, roundiſh, angular on the inner ſide.

Eſſ. Ch. Calyx of five leaves. Corolla five-cleft, wheel-ſhaped. Capſule ſuperior, of four cells. Seeds ſolitary.

Willdenow has ſeven ſpecies, five of which were known to Linnæus. Among the latter is *E. linifolius*, Linn. Sp. Pl. 392. (Convolvulus linifolius; Am. Acad. v. 4. 306. Syſt. Nat. ed. 10. v. 2. 923. Brown. Jam. t. 10. f. 2.) whence he informs us he derived the above generic character, having the plant alive under his own inſpection. It is a ſmall inconſpicuous annual, with ſlender, ſtraight, ſpreading ſtems; narrow, lanceolate, hairy leaves; and little, blue, axillary flowers; native of low ground in Jamaica.

The other ſpecies have rounder leaves, but otherwiſe agree very much with the above. They grow in the Eaſt or Weſt Indies, and are annuals of humble growth, and no conſpicuous attractions, being inferior in beauty to the meaneſt ſpecies of *Convolvulus*.

E. *tridendatus*, Linn. Sp. Pl. 392, is now returned to *Convolvulus*, ſee that genus, ſp. 19.

EUONYMUS, ευωνυμον of Theophraſtus, ſo called by antiphraſis, from ευωνυμος, *having a good name*, becauſe the plant was *infamous* for its ſtrong fœtid ſmell, and its poiſonous quality to cattle. Spindle-tree. Linn. Gen. 107. Schreb. 148. Willd. Sp. Pl. v. 1. 1130. Juſſ. 377. Gærtn. t. 113. Claſs and order, *Pentandria Monogynia.* Nat. Ord. *Dumoſæ*, Linn. *Rhamni*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, flat, in four or five deep, equal, roundiſh, concave ſegments. *Cor.* Petals four or five, ovate-oblong, flat, ſpreading, longer than the calyx. *Stam.* Filaments four or five, awl-ſhaped, erect, ſhorter than the petals, inſerted, alternately with them, into a glandular receptacle; anthers two-lobed. *Piſt.* Germen ſuperior, pointed; ſtyle ſhort, ſimple; ſtigma obtuſe. *Peric. Capſule* ſucculent, coloured, depreſſed, with four or five angles, and as many cells and valves. *Seeds* ſolitary, ovate, each wrapped up in a pulpy arillus.

Eſſ. Ch. Calyx flat. Petals five. Capſule ſuperior, five-ſided, coloured, of five cells and five valves. Seeds in a pulpy covering.

A genus of extra-tropical ſhrubs, the produce of Europe, North America and Japan. Willdenow has ſeven ſpecies. They are deſtitute of hairineſs, and have oppoſite branches and leaves; the latter ſimple, deciduous, more or leſs elliptical, entire or toothed, with ſcarcely any ſtipulas. Flowers of a dull or greeniſh hue, in axillary forked panicles, not ornamental. Fruit much more conſpicuous and often very beautiful, on account of the pink, waxy hue of the capſule, varying occaſionally to white, and orange coverings of the ſeeds.

E. Tobira. Thunb. Jap. 99. (Tobira; Kæmpf. Am. Exot. 796, cum ic.), a native of Japan, has terminal flowers, and in many other reſpects ſeems not perfectly to accord with this genus.

E. europæus. Sm. Fl. Brit. 262. Engl. Bot. t. 362; and *E. verrucoſus*, Jacq. Auſtr. t. 49; alſo *E. latifolius*, Jacq. Auſtr. t. 289; are good examples of it. Linnæus confounded them together as varieties, but Scopoli, and afterwards Jacquin, have well diſtinguiſhed them. The laſt ſpecies in particular is very remarkable for its warty branches, ſlender habit, reddiſh flowers, and ſmall pale capſules, out of which the black ſeeds, partially clothed with their ſcarlet arillus, hang by ſlender threads. The wood of all of them is tough, and uſed for ſkewers and ſpindles. It ſhould be cut in the ſummer. The fruit ſerves in many places to decorate churches and ruſtic kitchens at Chriſtmas-time. It is reported to be dangerouſly emetic and purgative.

Euonymus, in *Gardening*, comprehends plants of the hardy flowering ſhrubby kind, of which the ſpecies cultivated are, the common ſpindle-tree (*E. europæus*); the warted ſpindle-tree (*E. verrucoſus*); the purple-flowered ſpindle-tree (*E. atropurpureus*); the ever-green ſpindle-tree (*E. americanus*); and the broad-leaved ſpindle-tree (*E. latifolius.*)

The evergreen ſort of ſpindle tree has a variety with variegated leaves.

Method of Culture.—All the four more common ſorts may be propagated either by ſeeds, layers, or cuttings of the young ſhoots; but the evergreen kind requires a different method.

In the firſt mode, the ſeeds ſhould be ſown in the clumps or borders in the early autumn, covering them well in. In the following autumn the plants ſhould be removed, and ſet out in nurſery rows, being kept well cleared from weeds during the ſummer. After two or three years growth in this ſituation, they will be fit to plant out for good, in proper ſituations.

With reſpect to the young ſhoots, they may be laid down in the autumn, a ſlit being made at the joint placed the deepeſt in the ground. In the following autumn they will be well rooted, and may be taken off and planted out in the manner of the ſeedling plants.

The cuttings ſhould be made eight or ten inches in length, and planted in a ſhady border in the autumn. When they have ſtruck full root, they ſhould be carefully removed, and managed as thoſe raiſed from the ſeed.

But the two laſt methods, and thoſe of budding and grafting, are the only ones by which the green variety can be continued with certainty and ſucceſs.

With regard to the laſt ſpecies, it is beſt increaſed by laying down the young branches after being tongued in the autumn, managing them afterwards in the ſame manner as the others.

Theſe plants are ſufficiently hardy to bear the open air, when planted in warm ſheltered ſituations.

They are all very ornamental plants; the four common ſorts producing a fine effect by their berry-like ſeeds, and the laſt ſort but one by its evergreen leaves; the chief objection to the former kinds being their great aptitude to have their leaves compleatly eaten up by the caterpillars ſoon after they are fully expanded.

EVORA, or Elvora, anciently *Ebora*, in *Geography*, an ancient, walled and fortified, large but not populous, city of Portugal, the capital of the province of Alentejo, and an archbiſhop's ſee, ſituated on a gentle eminence in a fruitful plain, ſurrounded by hills, near the centre of the province; 65 miles E. Liſbon. The ſtreets are narrow, crooked, and full of angles. It has no trade or manufactures; but contains five pariſh churches, twenty-three religious houſes, and about twelve thouſand inhabitants. The cathedral and other buildings are high and in the Gothic ſtyle. This city is ſaid to have been founded by the Phœnicians, and walled round by Sertorius, who ſupplied the town with water by means of a beautiful aqueduct, (ſince entirely rebuilt by John III.,) and who, after having reſided there for a conſiderable time, was buried, as tradition reports, in this place. Julius Cæſar conſtituted it a municipium, and named it Liberalitas Julia. It was taken by the Moors in the year 715, and retaken by the Chriſtians under Giraldo, whoſe heroic conduct is celebrated by Camoens in his Luſiad, in 1166, and then reduced under the dominion of Alphonſo Henriques. In 1540 it was erected into an archiepiſcopal ſee by pope Paul III.; and the firſt prelate founded an univerſity, now fallen into decay. In this city are the remains of a temple of Diana, 7 pillars of which are ſtanding, of the Corinthian order, connected by a plaſter-wall. This edifice, at firſt a pagan place of worſhip, was converted into a Mooriſh moſque, and is now the butchers ſhambles. There are many other Roman veſtiges, inſcriptions, &c. particularly in the great ſquare, which indicate the antiquity of this place. Its fortifications are 12 baſtions, and two demi-baſtions, and a caſtle in ruins. On the north ſide of Evora the hills riſe, being round the town adorned with gardens, and on their ſummits with evergreen oaks. The road from hence to Montemor o novo, which lies at the diſtance of five leagues, paſſes over granite hills, partly covered with corn fields, and partly with fine woody or evergreen oaks and paſtures. N. lat. 38° 30′. W. long. 7° 42′.

EVORAMONTE, a town of Portugal, in the province of Alentejo, ſeated on a rock, and containing about 800 inhabitants; 15 miles N.E. of Evora. N. lat. 38° 42′. W. long. 7° 31′.

EVORIA, a town of European Turkey in Livadia; 24 miles N. of Lepanto.

EUOSMA, in *Botany*, from ευοσμος, *ſweet-ſmelling*, becauſe the flowers have the ſcent of hawthorn-bloſſoms. Jackſon in Andr. Repoſ. t. 520. Claſs and Order, *Pentandria Monogynia*. Nat. Ord. *Rotaceæ*, Linn. *Gentianæ*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, in five deep, obovate, concave, equal, permanent ſegments. *Cor.* of one petal, bell-ſhaped; tube dilated, as long as the calyx, pervious; limb in five broad, ſhort, obtuſe, ſpreading lobes. *Stam.* Filaments five, awl-ſhaped, ſhorter than the tube, inſerted into its lower part, alternate with the lobes of the limb; anthers incumbent, roundiſh, compreſſed. *Piſt.* Germen ſuperior, oval, two lobed; ſtyle very ſhort and thick; ſtigma capitate, four-lobed, on a level with the anthers. *Peric.* Capſule ovate, pointed, with a longitudinal furrow on each ſide, ſwelling irregularly from the projection of the ſeeds, of two valves, whoſe inflexed edges divide it into two cells; receptacles one in each cell, linear, triangular, parallel to the valves and cloſe to the partitions. *Seeds* five or ſix in each cell, in two rows, oval, flattened on the inner ſide, all over rough with minute tubercles.

Eſſ. Ch. Calyx deeply five-cleft. Corolla bell-ſhaped, with a five-cleft border. Stigma four-lobed. Capſule ſuperior, with two furrows and two cells, burſting at the top. *Seeds* ſeveral, oval, rough, affixed to a triangular receptacle.

1. *E. albiflora.* Andr. Repoſ. t. 520. Native of New South Wales, in the country near Port Jackſon, from whence ſpecimens and ſeeds were long ago ſent by Dr. White. It is ſaid to bear our winters in the open ground, flowering in April. *Stem* ſhrubby, with numerous, oppoſite, ſlender, ſquare, leafy, ſlightly downy branches. *Leaves* oppoſite, on ſhort ſtalks, lanceolate, acute, entire, ſmooth; ſhining and deep green above; paler, opaque, and ſomewhat glaucous beneath. *Stipulas* ſmall, briſtle-ſhaped, in pairs at the baſe of each footſtalk, ſomewhat hairy. *Flowers* in denſe, axillary, bracteated panicles, much ſhorter than the leaves; ſnow-white, ſmall, but copious, and very fragrant. *Capſules* about a quarter of an inch long, obtuſe, rugged, tipped with the ſhort permanent ſtyle.

The characters above given will, we believe, diſtinguiſh this genus from *Exacum*, to which it is moſt allied of any in the ſame natural order. See Exacum.

EVOVÆ, a barbarous word, ſays Rouſſeau, formed of the ſix vowels, which begin the ſyllables of the words *ſeculorum amen*, and which is only uſed in canto fermo. It is from the letters of this word that the tone is found in the pſalms and antiphonaria of the Roman catholic church, and the notes by which the verſes of the pſalms and canticles muſt be terminated.

The evovæ always begins by the dominant of the mode and ends upon the final.

EVOUTS, in *Geography*, a ſmall iſland in the Southern Pacific ocean; 15 miles S. from Terra del Fuego. S. lat. 55° 33′. W. long. 67° 36′.

EUPAREA, in *Botany*, ευπαρεια, *having beautiful cheeks*, in alluſion probably to the ſcarlet colour of the flowers, ſaid to reſemble *Anagallis arvenſis*. Gærtn. v. 1. 230. t. 50. Schreb. 156. Willd. Sp. Pl. v. 1. 1183. Mart. Mill. Dict. v. 2. Claſs and order, *Pentandria Monogynia*. Nat. Ord. *Lyſimachiæ*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, of five lanceolate, acute leaves. *Cor.* Petals from five to twelve, lanceolate, ſpreading, longer than the calyx. *Stam.* Filaments five; anthers. *Piſt.* Germen roundiſh, ſuperior; ſtyle briſtle-ſhaped, long; ſtigma ſimple. *Peric.* Berry dry, globoſe, crowned with the permanent ſtyle, of one cell. *Seeds* numerous, roundiſh, ſmall, affixed to a globoſe, fungous, central receptacle.

Eſſ. Ch. Calyx of five leaves. Petals from five to twelve. Berry ſuperior, dry, of one cell, with many ſeeds. Receptacle globoſe.

E. *amœna* is the only known ſpecies, gathered in New Holland by ſir Joſeph Banks and Dr. Solander. Gærtner deſcribes it as a procumbent plant, reſembling *Lyſimachia nummularia*, but about one-fourth its ſize. Flowers of the colour of the Scarlet Pimpernel. He adds that "the ſeed-veſſel, which-ever way preſſed, would not open by regular valves, ſo that it is very nearly allied to *Trientalis*." Indeed his figures betray the very cloſe affinity, even the identity of theſe two genera, except that one is deſcribed as polypetalous, the other monopetalous, and that the ſtamens of *Euparea* are not ſaid to equal the petals in number, when the latter are more than five.

EUPATORIA, formerly Koslof, or *Goſleve*, in *Geography*, a town and diſtrict of Ruſſia, in the province of Taurida or Crim Tartary, near the Black ſea. N. lat. 45° 40′. E. long. 33° 14′.

Eupatoria, or *Pompeiopolis*, in *Ancient Geography*, *Akmeſchid*, a town in the N.W. part of the Tauris Cherſoneſus.

Eupatoria, *Amid*, a town of the kingdom of Pontus, ſituated in the gulf of Amiſa, and contiguous to a town of the ſame name. Mithridates Eupator is ſaid to have built it, and to have given it his name.

EUPATORIUM, in *Botany*, ευπατωριον of Dioſcorides, from Mithridates, ſurnamed Eupator, who is reported to have brought this plant into uſe as a counter-poiſon. Linn. Gen. 413. Schreb. 546. Willd. Sp. Pl. v. 3. 1748. Sm. Fl. Brit. 859. Mart. Mill. Dict. v. 2. Juſſ. 178. Gærtn. t. 166. Claſs and order, *Syngeneſia Polygamia-æqualis*. Nat. Ord. *Compoſitæ diſcoideæ*, Linn. *Corymbiferæ*, Juſſ.

Gen. Ch. *Common Calyx* oblong, imbricated; ſcales linear-lanceolate, erect, unequal, unarmed. *Cor.* compound, uniform, diſcoid; florets all uniform, perfect, fertile, monopetalous, funnel-ſhaped, with a regular, five cleft, ſpreading border. *Stam.* Filaments five, capillary, very ſhort; anthers united into a cylindrical tube. *Piſt.* Germen minute; ſtyle thread-ſhaped, very long, cloven down as far as the top of the anthers, ſtraight; ſtigmas ſlender, bluntiſh, ſtraight. *Peric.* none, except the permanent calyx. *Seeds* ſolitary, oblong, angular; down long, rough, or feathery. *Recept.* naked.

Eſſ. Ch. Receptacle naked. Down rough or feathery. Calyx imbricated, oblong. Style prominent, cloven half way down, divaricated.

A large genus, chiefly, though not entirely, American. The *roots* are perennial. *Stem* ſometimes ſhrubby. *Leaves* oppoſite, moſtly ſimple, and ſtrongly ſerrated. *Flowers* corymboſe, terminal, numerous, white, blueiſh, or reddiſh. Whole plant, roughiſh, bitter, or aromatic. Willdenow has 71 ſpecies.

E. *cannabinum*, Engl. Bot. t. 428, ſingular for having fingered leaves, which indeed are ſometimes found undivided, is the only Britiſh ſpecies. It grows in watery places about the banks of rivers, or in mountainous boggy thickets, where it with us ſupplies the place of the Swiſs *Cacalia alpina*, which its pink flowers ſomewhat reſemble.

Several of the American ſpecies are eſteemed in that country, on account of their aromatic and tonic qualities, and known by the name of Fever root, or Fever weed. Among theſe, we believe, are E. *ſeſſilifolium*, *perfoliatum*, and *aromaticum*, but we want further information on this ſubject.

E. *Aya-pana*, Venten. Jard. de la Malmaiſon, t. 3, a native of the banks of the river of the Amazons, is ſaid to be "an excellent ſudorific and alexipharmic;" partaking therefore, no doubt, of the virtues of the above-mentioned ſpecies. Its *leaves* are lanceolate, nearly entire, and not accurately oppoſite. The *flowers* are purpliſh.

E. *zeylanicum*, Linn. Sp. Pl. 1172, has decidedly alternate leaves, ſo as to have raiſed a doubt in the mind of Linnæus whether it could belong to this genus; yet its fructification ſeems altogether like the generality of the ſpecies.

EUPEGIUM, in *Ancient Geography*, a town of Greece, in the Peloponneſus.

EUPEN, or Oepen, in *Geography*, a town of France, in the department of the Ourthe, and chief place of a canton in the diſtrict of Malmedy; 4 miles E.N.E. of Limburg. The place contains 6,749, and the canton 12,616 inhabitants, on a territorial extent of 102½ kiliometres and ſeven communes. Here is a conſiderable manufacture of cloth.

EUPETALOS, in *Natural Hiſtory*, the name of a gem deſcribed by the ancients as famous for its variety of colours. Pliny, lib. xxxii. cap. 10. tells us, that it ſhewed at once blue, fire-colour, red-lead colour, and yellow. It ſeems to have been the opal, and that Pliny's deſcription of it in this place was taken from ſome author he did not perfectly underſtand, as is the caſe in many of his accounts from the Greeks.

EUPHASEE, in *Geography*, the ancient name of Hiwaſſee river in Teneſſee, N. America; alſo the name of an Indian town on its S.W. bank, 28 miles from its mouth. See Hiwassee.

EUPHEMISMUS, Ευφημισμος, of ευ, *well*, and φημι, *I ſpeak*, in *Rhetoric*, a figure which expreſſes things in themſelves diſagreeable and ſhocking, by terms implying the contrary quality; that is, the Pontus, or Black ſea, having the epithet of αξενος, (i. e. *inhoſpitable*) given it on account of the ſavage cruelty of thoſe who inhabited the neighbouring countries; this name, by euphemiſm, was changed into that of Euxinus. Thus Ovid. Triſt. lib. iii. eleg. 13.

> "Dum me terrarum pars pene noviſſima Ponti
> Euxinus falſo nomine dictus habet."

In which ſenſe it only makes a ſpecies of irony. But every euphemiſm is not irony; for we ſometimes uſe improper and ſoft terms in the ſame ſenſe with the proper and harſh. See Voſſ. Rhet. lib. iv. cap. 186, ſeq.

EUPHEMIUS, in *Biography*, ſucceeded to the high dignity of patriarch of Conſtantinople in the year 490. He was zealouſly attached to the doctrines of the Catholic church, of which he gave proof by ſtriking out from the liſts of perſons in communion with the church, the name of Peter Mongus, patriarch of Alexandria, becauſe that prelate had pronounced an anathema againſt the council of Chalcedon. This circumſtance produced a violent ſchiſm between the two patriarchs, who convened their reſpective ſynods, in which they mutually procured excommunications of each other to be iſſued. In the year 491, on the death of Zeno, when Anaſtaſius was taking meaſures to ſecure the imperial throne, Euphemius warmly oppoſed him, on account of his known Arian principles, and when he found his oppoſition fruitleſs, he refuſed to crown the new emperor till he had delivered to him a written confeſſion of orthodox faith, and engaged under his hand, and by the ſanctity of an oath, to maintain the principles of the Catholic doctrine, as eſtabliſhed by the council of Chalcedon. In the year 493, Theodoric, having become maſter of Italy, ſent ambaſſadors to Anaſtaſius to treat for peace, to which Euphemius was thought to be the chief obſtacle. In a ſhort time afterwards Anaſtaſius having confidentially informed the patriarch of his deſire to terminate in an honourable manner the war in which he was engaged with the Iſaurians, Euphemius betrayed his ſecret to the patrician John, the father-in-law of Athenodorus, one of the chiefs of the Iſaurians. The emperor was made acquainted with the patriarch's conduct, and laid the caſe before an aſſembly of biſhops, who were convened at Conſtantinople in the year 495, and by his influence with them, obtained a decree that Euphemius ſhould be depoſed, and cut off from the communion of the church. He afterwards obtained a ſentence of baniſhment againſt Euphemius, who died at Ancyra in the year 515. Moreri.

EUPHON, in *Acouſtics*, a muſical inſtrument lately contrived by Dr. Chladni of Wittemberg, who, in conſequence of a variety of experiments on the longitudinal vibrations of elaſtic bodies, conſtructed this inſtrument, ſo called from its pleaſant ſound, which conſiſts of glaſs tubes diſpoſed in a proper frame, and expreſſing their ſounds by being rubbed longitudinally. The euphon has ſome reſemblance to a ſmall writing deſk. When opened, the glaſs tubes, of the thickneſs of the barrel of a quill, and about 16 inches long, are ſeen in an horizontal poſition. They are wetted with water by a ſponge, and ſtroked with the wet fingers in the direction of their length, ſo that the increaſe of the tone depends merely on the ſtronger or weaker preſſure, and the ſlower or quicker movement of the fingers. The number of tubes is 42. In the back part there is a perpendicular ſounding-board divided in the middle, through which the tubes paſs. From this conſtruction it appears, that the euphon ſhould not be conſidered as an altered or improved harmonica, (See Armonica), but as a totally new and different inſtrument. In regard to ſweetneſs of ſound, it approaches very near to the harmonica; but it poſſeſſes ſeveral advantages, peculiar to itſelf. It is ſimpler, with regard both to its conſtruction and the movement neceſſary for producing the ſound, as neither tuning nor ſtamping is required, but merely the movement of the finger. It produces its ſound more ſpeedily; ſo that as ſoon as it is touched you may have the tone as full as the inſtrument is capable of rendering it; whereas in the harmonica, the tones, particularly the lower ones, muſt be made to increaſe gradually.

It has alſo greater diſtinctneſs in quick paſſages, becauſe the tones do not reſound ſo long as in the harmonica, where the ſound of one low tone is often heard when you wiſh only to hear the following tone. The uniſon is purer than is generally the caſe in the harmonica, where it is difficult to have perfect glaſſes, which in every part give like tones with mathematical exactneſs. It is however as difficult to be tuned as the harmonica. It does not affect the nerves of the performer; for a perſon ſcarcely feels a weak agitation in the fingers; whereas in the harmonica, particularly in concords of the lower notes, the agitation extends to the arms and even through the whole body of the performer. This inſtrument is leſs expenſive than the harmonica; when one of the tubes breaks, or any other part is deranged, it can ſoon be repaired, and at very little expence: whereas, when one of the glaſſes of the harmonica breaks, it requires much time and is very difficult to procure another capable of giving the ſame tone as the former, and which will correſpond ſufficiently with the ſeries of the reſt. For an account of the experiments that led the author to the conſtruction of this inſtrument, and of the various ſtages of his progreſs in the improvement of it, we refer to the Philoſophical Magazine, vol. ii. p. 391, &c.

EUPHONIC Accent. See Accent.

EUPHONY, in *Elocution* and *Compoſition*, that ſweet or pleaſing quality in the ſucceſſive ſounds of language, which reſults from happy combinations of the enunciative elements, ſuch eſpecially as, though eſſentially different in their characteriſtic powers, melt eaſily into each other ſo as to preſerve an uninterrupted flow of utterance through the reſpective members of a ſentence, without labour to the ſpeaker, or offence to the hearer. The word is formed of ευ, *bene, well*, and φωνη, *vox, voice*. Quintilian calls *euphonia, vocalitas*; Scaliger, *facilis pronunciatio*. The moſt obvious rule with reſpect to euphonic compoſition is that a due mixture ſhould be made of conſonants and vowels; and the principle of this rule may be at once explained and illuſtrated by the following parody on a famous but ſophiſtical couplet in Pope's Eſſay on Criticiſm,

"Your conſonants with vowels well combine,
And twelve ſmall words may flow in one ſmooth line."

But this is not all that is requiſite for perfect euphony: every vowel does not blend with equal grace and facility with every conſonant; nor is every ſucceſſion of mere vowels, or every ſucceſſion of conſonants, equally offenſive or cacophonous. Words or ſyllables, for example, terminating with thin vowels, may be followed by other words or ſyllables, commencing with broad or open vowels, or the reverſe, with very happy effect; and ſome conſonants may be brought together, in immediate ſucceſſion, even as terminative and initial elements of following ſyllables or words, in ſuch way as rather (while they increaſe the ſonorous energy of ſuch compoſition,) to diverſify the time and expreſſion, than to diſturb the euphony of the ſentence. All the liquids eſpecially (thoſe that properly ought to be, as well as thoſe that commonly are ſo called) combine with almoſt equal facility with other liquids, and with vowels or with the conſonants, whether ſemi-liquids, ſibilants, or mutes. (See Liquid, Mute, &c.) Which of theſe, and under what circumſtances, may be thus brought together, with the happieſt effect of euphony and expreſſion, it would require a much longer diſcuſſion than we have ſpace for, to aſcertain; and, after all, much muſt be left to the taſte, the ear, and the experimental diſcrimination of the writer. But it is not upon the writer alone, that the effect of euphony depends. The reader or reciter muſt alſo do his part, for though it is very poſſible ſo to write, that no organs, and no management of thoſe organs, can elicit in the delivery, any thing but the diſſonance of cacophony; there are ſome pedants who contrive to render even the ſmootheſt compoſitions harſh and cacophonous, and then aſcribe to their native language, (of the very elements and genius of whoſe oral compoſition they are utterly ignorant,) the diſguſting diſſonance which does, in reality, belong to their own jargonized utterance. Euphony in the reader or ſpeaker depends principally upon his ſkill and management in the articulation and implication of the ſucceſſive elements, ſyllables, and words as explained under the term Enunciation; and upon his giving full tune, and ſufficient quantity to the liquids and liquifiable conſonants. Cacophony (the antagoniſt of Euphony) on the contrary, reſults in the reader, from the laboured ſeparation of terminatives and initials, that might eaſily have been implicated; from giving unneceſſary impulſe and force to the mutes, from hurrying over the liquids, and partially tuneable elements, as if they were mere mutes, and from perpetual unneceſſary interruptions in the ſtream of enunciative delivery.

EUPHORBIA, in *Botany*, ευφορβιον of Dioſcorides, ſo named after Euphorbus, phyſician to Juba king of Lybia. Spurge. Linn. Gen. 243. Schreb. 326. Willd. Sp. Pl. v. 2. 881. Sm. Fl. Brit. 513. Mart. Mill. Dict. v. 2. Juſſ. 385. Claſs and order, *Dodecandria Trigynia*. Nat. Ord. *Tricoccæ*, Linn. *Euphorbiæ*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, inflated, ſomewhat coloured, with four, in ſome few inſtances five, marginal teeth, permanent. *Cor.* Petals, or Nectaries, four, ſometimes five, turbinate, gibbous, thick, abrupt, unequal in ſituation, alternate with the teeth of the calyx, inſerted into its margin by their claws, permanent, bearing plenty of honey. *Stam.* Filaments numerous, 12 or more, threadſhaped, jointed, longer than the corolla, inſerted into the receptacle, coming to maturity at different periods, ſeparated by briſtly ſcales; anthers roundiſh, of two diſtinct lobes. *Piſt.* Germen ſuperior, roundiſh, three-ſided, elevated on a ſtalk above the margin of the calyx; ſtyles three, cloven; ſtigmas obtuſe. *Peric.* Capſule ſtalked, roundiſh, three-lobed, of three cells, and three valves which ſeparate elaſtically. *Seeds* ſolitary, roundiſh.

Obſ. The petals or nectaries are for the moſt part four, in ſome flowers five, which often happens on the ſame plant, ſuch flowers being furniſhed with ſtamens only, without a piſtil, and coming forth earlier than the reſt. In many the petals are glandular, in others creſcent-ſhaped, or toothed; in ſome few thin and membranous; they are commonly ſituated as it were on the outſide of the calyx. The capſule is either ſmooth, or hairy, or warty.

Eſſ. Ch. Calyx of one leaf, inflated, inferior. Nectaries four or five, inſerted into the calyx. Capſule ſtalked, three-lobed.

A vaſt, but very natural, genus, whoſe ſpecies amount in Willdenow's work to 124. They are divided into ſeveral ſections. All abound with an acrid milk.

Thoſe of the firſt ſection have a very peculiar thick, ſhrubby, fleſhy, angular ſtem, armed with ſpines, and bearing few or no leaves. To this belongs *E. officinarum*, probably the original ſpecies. See its figure in Commelin's Hort. Amſt. v. 1. t. 11. Alſo *E. antiquorum*, ib. t. 12, an Eaſt Indian plant, which ſeems very improperly named, as neither agreeing with the deſcriptions of the ancients, nor growing in the country whence they procured their ευφορβιον.

The ſecond ſection has ſhrubby ſtems without thorns, neither forked nor umbelliferous. As *E. Caput Meduſæ*, Comm. Hort. t. 17, common in Green-houſes; and *E. petiolaris*, Curt. Mag. t. 883.

The third has forked ſtems, not umbelliferous, and the plants are moſtly herbaceous and annual, as *E. picta*, Jacq. Ic. Rar. t. 477, and *pilulifera*, t. 478; alſo *E. Peplis*, Engl. Bot. t. 2002, common on the ſea ſhores of the ſouth of Europe.

The fourth has the flowers in an umbel, three-branched in the firſt inſtance, and the branches ſubſequently forked repeatedly, each ſubdiviſion of the infloreſcence accompanied by a pair of heart-ſhaped, unequal ſided, ſomewhat coloured bracteas, as our common weed *E. Peplus*, Curt. Lond. faſc. 1. t. 35. Engl. Bot. t. 959.

The fifth has a four-branched umbel, as the great *E. Lathyris* of the gardens, commonly called the Caper tree, remarkable for its long, dark, four-rowed leaves. There are but few ſpecies in this ſection.

The ſixth, a numerous ſection, has a five-branched umbel, like the common *E. helioſcopia*, Curt. Lond. faſc. 1. t. 36. Engl. Bot. t. 883; and the rare and ſplendid *E. punicea*, Sm. Ic. Pict. t. 3, a ſhrubby Jamaica plant, of which a moſt miſerable ſpecimen is drawn in Jacq. Ic. Rar. t. 484.

The ſeventh and laſt ſection conſiſts of ſuch ſpecies as have numerous rays to the common umbel, like *E. Cypariſſias*, Engl. Bot. t. 840, frequent in gardens, and *amygdaloides*, t. 256, very common in woods.

Euphorbia, in *Gardening*, comprehends plants of the herbaceous, ſhrubby, ſucculent kinds, the principal cultivated ſpecies of which are; the triangular ſpurge (E. antiquorum); the Canary ſpurge (E. canarienſis); the officinal ſpurge (E. officinarum); the Meduſa's head ſpurge (E. caput Meduſæ); the myrtle-leaved ſpurge (E. tithymaloides); the ſeven-angled ſpurge (E. heptagona); the warty-angled ſpurge (E. mammilaris); and the Cape ſpurge (E. lathyris): the firſt ſpecies is a large plant, of which there is a variety with a naked three-cornered compreſſed ſtalk, ſending out a great number of erect branches, which are likewiſe generally three-cornered, but ſometimes four-cornered; armed with ſhort crooked ſpines, having no leaves. The plants have not, we believe, yet produced flowers in this climate. This variety, like the ſpecies from which it is produced, is a native of the Eaſt Indies.

The fourth ſpecies has alſo a variety frequently denominated the "Little Meduſa's head," which has a thick ſhort ſtalk, ſeldom more than eight or ten inches in height, from which come out a great number of ſlender trailing branches, about a foot in length, intermixing, and having the ſame appearance with the other, but ſmaller and much ſhorter; the ends are beſet with narrow leaves, between which the white flowers come out and appear. Its native ſituation is the ſame as that of the ſpecies from which it is derived. According to ſome there are likewiſe a double branching, a dwarf trailing, and other varieties.

The fifth ſort has alſo laurel leaved and variegated leaved varieties.

Method of Culture.—Theſe different ſorts of plants may be raiſed by planting cuttings, which have been made at a joint, five or ſix inches in length, after having been rolled in ſand, and laid upon a ſhelf for ſome days to have the wounds healed over, in the ſummer ſeaſon about the middle, chooſing ſmall pots for the purpoſe filled with light, dry, ſandy mould, with ſome rubbiſh at the bottoms, ſuch as that formed of one fourth part of lime-rubbiſh which has been well ſcreened, the ſame quantity of ſea ſand, and one half of the whole of light freſh vegetable earth, which ſhould be very well mixed and incorporated together, by being often turned over; then plunging the pots in the bark hot bed, giving due ſhade when the weather is hot and ſunny, with a little water occaſionally once or twice a week. As ſoon as the plants have ſtricken root, air ſhould be admitted to them pretty freely in the ſituation in which they may be; or they may, in order to be hardened, be removed into the ſtove.

In the after management they ſhould be allowed larger pots annually as they advance in growth, and be often refreſhed with water during the ſummer months, but very ſparingly in the winter ſeaſon.

It may be remarked that moſt of theſe ſorts of plants are capable of being kept in the hot-houſe, on the ſhelves, and ſome of them, as the fifth, ſixth, and ſeventh ſorts, in a dry airy green-houſe, or glaſs caſe, during the winter months, great care being taken to protect them well from the froſts; being ſet out in the ſummer in the open air: but the fourth ſpecies requires ſome ſort of ſupport in order to prevent the branches, by their weight, forcing it upon the pots; as by this ſort of treatment the plants will riſe to the height of four or five feet, throwing out a great number of ſide branches. The eighth kind, however, requires little or no particular care after it has been once introduced, except merely that of keeping the young plants clean, as it will be continued by its ſcattering the ſeeds.

All theſe plants, with the exception of the laſt, afford great variety in collections of the hot and green-houſe kinds; and that alſo in the clumps and borders of the pleaſure grounds, among others of the leſs hardy ſorts.

EUPHORBIÆ, in *Botany*, the 96th natural order in Juſſieu's ſyſtem, or the 1ſt of his 15th claſs. The definition of this claſs is,—Cotyledons two. Petals none. Stamens in a ſeparate flower from the piſtils. Its characters are thus more fully explained. Flowers either monoecious, that is, males and females together on the ſame plant, or dioecious, on ſeparate ones; very rarely hermaphrodite. Calyx in all of one leaf, or a ſcale ſupplying its place. Corolla none, except occaſionally ſome ſcales, or internal diviſions of the calyx, reſembling petals. In the male flowers the ſtamens are inſerted either into the upper or lower part of the calyx, or ſcale which ſupplies its place, definite, or rarely indefinite, in number; their filaments diſtinct, or rarely united into a central ſtalk, originating from the middle of the calyx. Germen in the females ſimple, or ſometimes more than one, ſuperior, or rarely inferior; ſtyle one, or ſeveral, rarely wanting; ſtigma either ſolitary or more than one. Fruit either ſuperior or inferior, various in the ſtructure and number of its cells.

The learned author, by his ſubſequent remarks and explanations, is evidently aware of the difficulties attending this claſs, which indeed is in no ſenſe really a natural one, its orders having little or no affinity to each other, except the two laſt *Amentaceæ* and *Coniferæ*.

The characters of the order of *Euphorbiæ* are, *Flowers* monoecious or dioecious, or rarely hermaphrodite. *Calyx* of each tubular, or deeply divided, ſimple or double, the internal ſegments occaſionally reſembling petals. *Petals* none, except the ſegments juſt mentioned. *Stamens*, in the male flowers, definite or indefinite in number, their filaments inſerted either into the receptacle, or the centre of the calyx, diſtinct or united, ſometimes branched, ſometimes jointed. In ſome there are chaffy ſcales between the filaments. *Germen*, in the female flowers, ſolitary, ſuperior, ſeſſile or ſtalked; ſtyles in ſome caſes ſeveral, often three, with an equal number of cells to the capſule, each containing one or two ſeeds; in others the ſtyle is ſimple, with three or more ſtigmas, the fruit of ſeveral

veral cells, equalling the ſtigmas in number, with one or two ſeeds in each. In all the cells are furniſhed with two internally elaſtic valves; the ſeeds have a partial covering, and are attached at the upper part to the permanent central axis of the fruit. Corculum flat, enveloped in a fleſhy albumen. The plants are either herbaceous, or ſhrubby, or arboreſcent; ſome of them milky. Leaves alternate or oppoſite, (in ſome few inſtances wanting,) either with or without ſtipulas. The firſt ſection conſiſts of ſuch genera as have ſeveral ſtyles, moſtly three. Theſe are *Mercurialis*, *Euphorbia*, *Argythamnia* of Browne's Jam. 338. Sw. Prod. 39, *Cicca*, *Phyllanthus*, *Xylophylla*, *Kirganelia*, *Kiggellaria*, *Clutia*, *Andrachne*, *Agyneia*, *Buxus*, *Securinega* of Commerſon, *Adelia*, *Mabea*, Schreb. 641, *Ricinus*, *Jatropha*, *Dryandra*, *Aleurites*, *Croton*, *Acalypha*, *Caturus* and *Excæcaria*. The ſecond ſection, with a ſolitary ſtyle, contains *Tragia*, *Stillingia*, *Sapium of* Browne, *Hippomane*, *Ægopricon*, *Sechium* of Browne, *Hura*, *Omphalea*, *Plukenetia* and *Dalechampia*.

The ſeeds of theſe plants are mild and eatable in many inſtances, if freed from their integuments and corculum, the latter being very dangerouſly purgative, as in *Euphorbia* and even *Ricinus*, proving mild in the latter only from the copious oil of the cotyledons. *Euphorbia*, which gives its name to this natural order, can only by a very bold analogy, or rather hypotheſis, be ſaid to have no corolla, and is very imperfectly polygamous, not monoecious; indeed Juſſieu allows it to be hermaphrodite. See EUPHORBIA.

EUPHORBIUM, is a moſt acrid gum reſin, which exudes from the *Euphorbia officinarum* and other ſhrubs of the ſame genus, and was formerly uſed in pharmacy, but is now nearly, if not, entirely rejected.

This gum is brought from Barbary and other parts of the Mediterranean in tears or drops of an irregular form, generally entangling much impurity; of a pale yellow colour without, and white within. Euphorbium has no ſmell: when taken into the mouth it gives at firſt no taſte, but after a little time a moſt acrid biting ſenſation is felt, which increaſes to an intolerable degree, and if not immediately rejected it proceeds to corrode the ſkin of the tongue and fauces. The ſame acrimony is ſhewn when applied to the body in any other manner. In reducing it to powder the duſt that flies off will excite the moſt violent ſneezing, and often bleeding from the noſtrils and throat, ſo that particular precautions muſt be taken. When laid for ſome time on the ſkin it bliſters.

The ſpirituous tincture of euphorbium is ſtill more acrid.

This gum reſin, on account of its extreme acrimony, can hardly be uſed with ſafety as an internal medicine, as it is liable to produce violent diarrhœa and bloody ſtools, and much inflammation. The only purpoſe for which it has been employed in the later diſpenſatories has been in mixture with cantharides to increaſe the veſicating and irritating property, but euphorbium is now altogether diſuſed.

EUPHORIA, in *Botany*, ſo named by Commerſon from ευφορος, *fertile*, a genus comprehending the two Chineſe fruits Lit-chi and Longàn, to which Juſſieu ſuſpects Forſter's *Pometia* may alſo belong. See SCYTALIA.

EUPHORY, ſignifies the ſame as *Eucracy*.

EUPHRASIA, in *Botany*, from ευφραινω, *to exhilarate*, or *delight*, alluding to the brightneſs or gaiety of the bloſſoms. Eye-bright. Linn. Gen. 304. Schreb. 401. Willd. Sp. Pl. v. 3. 192. Tournef. t. 78. Sm. Fl. Brit. 650. Mart. Mill. Dict. v. 2. Juſſ. 100. Gærtn. t. 54. Claſs and order, *Didynamia Angioſpermia*. Nat. Ord. *Perſonatæ*, Linn. *Pediculares*, Juſſ.

Gen. Ch. *Cal.* perianth of one leaf, inferior, cylindrical, four-cleft, equal, permanent. *Cor.* of one petal, ringent; tube as long as the calyx; upper lip concave, notched; lower ſpreading, deeply three-lobed, its lobes equal, obtuſe, notched. *Stam.* Filaments four, thread-ſhaped, ſituated cloſe under the upper lip; anthers of two lobes, the lobes unequally ſpinous at their lower extremities. *Piſt.* Germen ſuperior, ovate; ſtyle thread-ſhaped, agreeing in form and ſituation with the ſtamens; ſtigma obtuſe, undivided. *Peric.* Capſule ovate-oblong, compreſſed, of two cells and two valves; the partition contrary to the valves. *Seeds* numerous, minute, roundiſh, longitudinally ſtriated.

Eſſ. Ch. Calyx cylindrical, four-toothed, equal. Upper lip of the corolla cloven; lower three-lobed, the lobes cloven. Anthers bearded with unequal ſpines. Capſule ovate-oblong. Seeds ſtriated.

Botaniſts are not perfectly agreed about the limits of this genus, and its near allies *Bartſia* and *Rhinanthus*. The firſt of Willdenow's twelve ſpecies, E. *latifolia*, Linn Sp. Pl. 841, is *Bartſia latifolia*, Sm. Prod. Fl. Græc. Sib. 428, a beautiful native of the ſouth of Europe. His ſixth, E. *odontites*, is *Bartſia odontites* of Hudſ. Fl. Angl. 268, and Sm. Fl. Brit. 648. Engl. Bot. t. 1415.

E. *officinalis*, Linn. Sp. Pl. 841. Engl. Bot. t. 1416. Curt. Lond. faſc. 5. t. 42. common in heathy and mountainous paſtures, which its gay bloſſoms greatly enliven in autumn, is a genuine and original example of the genus. This is a ſmall, upright, annual plant, with ovate ſharply ſerrated *leaves*. The *flowers* are white, ſtrongly ſtreaked with purple, having a yellow ſpot on the lip. On the Alps they are often larger, light purple, and ſtill more beautiful.

The dazzling brilliancy of theſe little bloſſoms ſeems to have given riſe to the vulgar opinion, that the plant was good for the eyes; whence its Engliſh name Eye-bright.

EUPHRATENSIA, in *Ancient Geography*. See COMMAGENE.

EUPHRATES of Alexandria, in *Biography*, a Stoic philoſopher, who flouriſhed in the ſecond century, was a friend of Dio and of Apollonius Tyanæus, who introduced him to Veſpaſian. Although a violent quarrel aroſe between the latter philoſopher and Euphrates, in conſequence of which Philoſtratus, the panegyriſt of the former, inveighs with great ſeverity againſt the latter, it appears from the teſtimony of Epictetus, Pliny the younger, and Euſebius, that Euphrates was univerſally eſteemed for his talents and virtues, and that the cenſures of Philoſtratus deſerve only contempt. Pliny's character of him is highly intereſting. "If ever," ſays he (Ep. l. i. ep. 10.), "polite learning flouriſhed at Rome, it certainly does at preſent. Of this I could give you many inſtances; but I will content myſelf with naming only Euphrates the philoſopher. When, in my youth, I ſerved in the army in Syria, I had an opportunity of converſing familiarly with this excellent man, and took ſome pains to gain his affection, though that indeed was not difficult; for he is exceedingly open to acceſs, and full of that gentleneſs of manner which he teaches. Euphrates is poſſeſſed of ſhining talents, which cannot fail to intereſt even the unlearned. He diſcourſes with great accuracy, dignity, and elegance; and frequently riſes into the ſublimity and luxuriance of Plato himſelf. His ſtyle is copious and diverſified, and ſo wonderfully ſweet, as to captivate even the moſt reluctant auditor. Add to all this, his graceful form, comely aſpect, long hair, and large white beard; circumſtances which, though they may probably be thought trifling and accidental, contribute, however, to procure him much reverence. There is no diſguſting negligence in his dreſs; his countenance is grave, but not auſtere; his approach commands reſpect, without exciting awe.

With the ſtricteſt ſanctity, he unites the moſt perfect politeneſs of manner. He inveighs againſt vice, not againſt men; and, without chaſtiſing, reclaims the offender. You liſten with fixed attention to his exhortations, and even when convinced, ſtill hang with eagerneſs upon his lips."

In conformity to the principles of the Stoic philoſophy, Euphrates, when he found his ſtrength worn out by diſeaſe and old age, voluntarily put a period to his life by drinking hemlock, having firſt, for ſome unknown reaſon, obtained permiſſion from the emperor Adrian. Brucker's Hiſt. Phil. by Enfield, vol. ii.

EUPHRATES, the reputed founder of a religious ſect in the ſecond century, ſometimes called "Ophians," or "Ophites," and ſometimes "Serpentinians," names derived from the peculiar tenet which he held, that the ſerpent, by which our firſt parent was deceived, was either Chriſt himſelf, or "Wiſdom" concealed under the form of that animal, and that he was the occaſion of all the knowledge which men had received. Hence he is ſaid to have inculcated a particular veneration for the ſerpent, preſerving a living one, offering to it a ſubordinate kind of divine honour, and bringing it out to partake of or to conſecrate the euchariſt. Origen and others contend that the followers of Euphrates were not Chriſtians, but calumniators of Jeſus Chriſt, and oppoſers of his doctrine: but Dr. Lardner, who has taken ſome pains in inveſtigating the ſubject, conſiders them as believers in Chriſtianity, and maintaining that Jeſus, who was born of a virgin, was a moſt excellent man, and that, having by his miracles and inſtructions manifeſted himſelf to be the true Meſſiah, was crucified, and afterwards raiſed from the dead, received into heaven, where he ſits on the right hand of God. He conceives that what ſome have ſaid of them, reſpecting the ſerpent being Chriſt, muſt be a miſtake, founded on an opinion that the brazen ſerpent in the wilderneſs was a type or figure of Chriſt. The other accounts of worſhipping the ſerpent, &c. this judicious and learned writer rejects without heſitation. Moreri. Lardner.

EUPHRATES, in *Ancient Geography*, one of the moſt conſiderable and beſt known rivers of Aſia, the ſource of which was in the mountains of Armenia north of Abus, which after receiving ſeveral ſtreams in this part of Armenia, at the towns of Elegia, Gymnias, and Brapus, purſued its courſe towards the ſouth-weſt, ſeparating Armenia Major, on the eaſt, from Armenia Minor on the weſt. It then proceeded ſouth-eaſtward, waſhing the ſkirts of Syria, and dividing Arabia from Meſopotamia; and afterwards directing its courſe towards the north-eaſt, it ſeparated Chaldæa and Babylonia from Meſopotamia, till at length mixing its waters with thoſe of the Tigris, with which it previouſly communicated by ſeveral canals, it emptied itſelf into the Perſian gulf. The Euphrates, according to Ptolemy, above Babylon, near a town in Meſopotamia, called Sipphara, divided itſelf into two branches, one running to Babylon, and the other to Seleucia, where it fell into the Tigris. Pliny ſays the latter was partly artificial; for he places Seleucia at the confluence of the Tigris and Euphrates, adding that the Euphrates was conveyed to it by a canal. Prideaux, on the authority of Pliny, ranks this artificial branch among the ſtupendous works of Nebuchadnezzar. Between theſe two branches a canal was cut from the Euphrates, above Babylon, to the Tigris at Apamea, 60 miles below Seleucia. This canal was denominated *Naarmalcha*, and was dug by Nebuchadnezzar, as Abydenus informs us, to convey the waters of the Euphrates, when it overflowed, into the Tigris, before they reached Babylon. At the diſtance of 800 furlongs from Babylon to the ſouth was another canal, called by Arrian Pallacopes, and by Appian Pallacotta, derived from the branch of the Euphrates that paſſed through Babylon, and continued to certain lakes or marſhes in Chaldæa. On this canal, or river, as Arrian calls it, Alexander ſailed from the Euphrates to the above-mentioned lakes. But it is impoſſible, at this diſtance of time, and after the changes that have occurred, to trace out the numerous branches and canals which watered the ancient country of Babylon. This great river moved ſlowly through a great part of its courſe, and was ill adapted for navigation, as ſome parts of it were ſhoal and others rocky. Thevenot, however, is of opinion, that the Euphrates might, with little trouble, be made navigable, even by great barks, quite to the Tigris, only by clearing the channel of the ſtones with which it is choked in ſome places. The ancient mode of navigating this river was very extraordinary. The veſſels were round, without diſtinction of head or ſtern, and no better than great wicker baſkets, covered over with hides, guided by two oars or paddles. They were capable of carrying a very conſiderable weight; and when they had unloaded their cargo at Babylon, they were ſold, but the hides were kept: and loading their aſſes with them, the navigators returned home by land, the rapidity of the ſtream not allowing them to return by water.

EUPHRATES, in *Modern Geography*, a river of Aſiatic Turkey, which riſes from the mountains of Armenia, as ſome have ſaid, in two ſtreams, a few miles to the N.E. of Erzeron, the ſtreams uniting to the S.W. near that city; and chiefly purſuing a S.W. direction to Semiſat, where it would fall into the Mediterranean, if not prevented by a high range of mountains. In this part of its courſe the Euphrates is joined by the Morad, a ſtream almoſt doubling in length that of Euphrates, ſo that the latter river might more juſtly be ſaid to ſpring from mount Ararat, about 160 Britiſh miles to the eaſt of the imputed ſource. At Semiſat, the ancient Samoſata, this noble river aſſumes a ſoutherly direction; then runs an extenſive courſe to the S.E., and after receiving the Tigris, falls by two or three mouths into the gulf of Perſia, about 50 miles S.E. of Baſſora. N. lat. 29° 50'. E. long. 66° 55'. The comparative courſe of the Euphrates may be eſtimated at about 1400 Britiſh miles. This river is navigable for a conſiderable diſtance from the ſea. This river in its courſe ſeparates Aladulia from Armenia, Syria from Diarbekir, and Diarbekir from Arabia, and paſſing through the Arabian Irak, there joins the Tigris.

EUPHRATES, a river of Africa, in the country of Whidah, on the Slave coaſt.

EUPHROSYNE, in *Mythology*, one of the three Graces. See GRACES.

EUPHROSYNUM, in *Botany*, a name uſed by Pliny and ſome others for the common borrage. See BORRAGE.

EUPILIS, in *Ancient Geography*, *Puſſiano*, a lake of Italy, in Gallia Ciſalpina, whence, according to Pliny, iſſued the river Lambrus.

EUPNŒA, of ευ, *well*, and πνεω, *I breathe*, in *Medicine*, is a right and natural reſpiration.

EUPOLIS, in *Biography*, an Athenian who flouriſhed B.C. 440, was known as a comic writer, and one of that claſs who marked out by name the objects of their ſatire, which rendered him extremely popular with the many, as he was dreaded by the great. He is mentioned by Horace and Quintilian, who put him in the ſame claſs with Cratinus and Ariſtophanes. His comedies were of a political caſt, in one of which Alcibiades was ſo ſeverely attacked, that he is ſaid to have hired aſſaſſins to throw him into the ſea. The plot did not ſucceed, for Eupolis wrote ſeveral comedies after the period aſſigned to this fact, and Ælian relates that he died at Ægina. Fragments of his works have come down to us, and titles of twenty of his plays. Gen. Biog.

EUPORIA, in *Ancient Geography*, a town of Macedonia, placed by Ptolemy in Biſaltia.

Euporia, of ευ and πορος, *paſſage*, in *Medicine*, is an eaſy preparation of medicines, or the eaſineſs of their operation.

EUPSYCHIANS. See Eunomioeupsychians.

EURA, in *Geography*, a town of Sweden, in the government of Abo; 17 miles N.E. of Abo.

EVRA, a town of Abyſſinia; 12 miles S.E. of Siré.

EVRACMINNA, a town of Sweden, in the government of Abo; 17 miles S. of Biorneborg.

EVRAN, a town of France, in the department of the North Coaſts, and chief place of a canton in the diſtrict of Dinan, four miles S. of it. The place contains 3573, and the canton 9175 inhabitants, on a territorial extent of 117½ kiliometres and ſeven communes.

EURAN Islands, a cluſter of ſmall iſlands, on the eaſt ſide of the gulf of Bothnia. N. lat. 63° 54′. E. long. 22° 39′.

EURANIUM, in *Ancient Geography*, a town of Aſia Minor, in Caria.

EURE, in *Geography*, a river of France, which has its ſource in the foreſt of Logny, and terminates in the Seine, above Pont de l'Arche. Its courſe is northward, and extends 36 leagues.

Eure, formerly *Ouche*, a department of the ſecond or northern region of France, in 49° N. latitude, bounded on the north by the department of the Lower Seine, on the eaſt by that of the Oiſe, on the ſouth by the departments of the Eure and Loire and the Orne, and on the weſt by the department of the Calvados. It takes its name from the river Eure, which traverſes it; and its capital is Evreux. It contains 307 ſquare leagues, and 415,574 inhabitants in five diſtricts, *viz.* Fontaudemer, Louviers, Les Andelys, Evreux, and Bernay, 35 cantons, and 843 communes. Its fertile ſoil yields grain, hemp, flax, and paſtures; and it has conſiderable foreſts.

Eure *and Loire*, a department of the ſecond or northern region of France, in 48° 15′ N. lat. compoſed of a part of *Beauce* and of *Perche*, bounded on the N.W. by the department of the Eure, on the eaſt by the departments of the Seine and Oiſe and the Loiret, on the ſouth by the departments of the Cher and Loiret, and on the weſt by the departments of the Orne and Sarte. It takes its name from the rivers Loire and Eure, which water it; and its capital is Chartres. It contains 300 ſquare leagues, and 259,967 inhabitants. It is divided into four diſtricts, *viz.* Nogent-le-Rotrou, Chartres, Chateaudun, and Dreux; 23 cantons, and 460 communes. This department, on account of its great fertility, is called the granary of Paris, and it abounds in fruits and rich paſtures

EVRE, or Yevre, a river of France, which diſcharges itſelf into the Cher by two ſtreams, one near Vierſon, the other at Bourges.

EVRECY, a town of France, in the department of the Calvados, and chief place of a canton in the diſtrict of Caen; ſeven miles S.W. of Caen. The place contains 850, and the canton 13,110 inhabitants, on a territorial extent of 145 kiliometres, and 29 communes.

EVREGNIES, a town of France, in the department of Jemmappe; nine miles N.N.W. of Tourney.

EUREOS, in *Natural Hiſtory*, the name of a ſtone, deſcribed by Pliny, and ſeeming plainly to be the ſame with the tecolithus, which he mentions in another place, and to be the ſtone now called *lapis Judaicus*, and known at this time to be the petrified ſpine of a ſort of echinus marinus, or ſea urchin.

EVREUX, Mediolanum, *Eborice*, or *Civitas Evevigorum*, in *Geography*, a town of France, in the department of the Eure, of which it is the capital, and chief place of a diſtrict. Its north diviſion contains 4200, and the canton 10,458 inhabitants, and the ſouth diviſion 4226, and its canton 10,853 inhabitants; the territorial extent comprehends 345 kiliometres, and each diviſion includes 30 communes. Before the revolution this was the ſee of a biſhop, ſuffragan of Rouen; containing nine pariſh churches, two abbies, and ten convents. This is an ancient and conſiderable town, with large ſuburbs, ſituated in a deep and fruitful vale on the river Eton, 23 miles N.W. from Paris. Its cathedral is a fine Gothic ſtructure. The manufactures of Evreux conſiſt of woollen and linen cloth, and its trade of rice, grain, wine, and cyder; but they are not conſiderable. N. lat. 49° 2′. E. long. 1° 15′.

EURIA, in *Ancient Geography*, a town of Greece, in Epirus.

EURIPIDES, in *Biography*, the contemporary and rival of Sophocles, and one of the moſt ancient Greek tragedians, was born in the iſle of Salamis, in the firſt year of the 75th olympiad, B C. 480, according to many writers, though the Arundelian marble places his birth five years earlier. His father's name was Mneſarchus, an Athenian, and that of his mother was Clito, a ſeller of herbs, according to the report of Ariſtophanes, the avowed enemy of Euripides; but by the teſtimony of later grammarians, founded on the authority of Philochorus, an ancient writer, ſhe was of noble deſcent. Before the birth of his ſon, Mneſarchus is ſaid to have conſulted the oracle of Apollo concerning his future deſtiny, and to have received for anſwer, "that the child who ſhould be born to him would reach the ſummit of glory, and gain the honour of the ſacred garland," which was underſtood to ſignify the crown of victory at the olympic games. When Greece was invaded by Xerxes, Mneſarchus and his wife retired for ſafety, among other Athenians, to the iſland of Salamis. In the autumn of the year 480 B.C. when this invaſion took place, the fate of Greece was in a great meaſure decided by the naval victory of Salamis over the Perſians; and on the ſame day, it is ſaid, Euripides was born, who in memory of this battle, fought in the narrow channel, or *Euripus*, which divides Salamis from the continent, received his name. Euripides, at ſubſequent periods of his life, was accuſtomed to frequent the iſland of his nativity, where was ſhewn a cave, in which ſome of his tragedies are ſaid to have been compoſed. Euripides, in conformity to the ſuggeſtion of the oracle, and alſo to the cuſtom of the country, qualified himſelf for honourable and ſucceſsful conteſt at the public games, by an early initiation in the uſual gymnaſtic exerciſes; but his views were directed to nobler purſuits. Accordingly, whilſt he paid ſome attention to the art of painting, he ſtudied rhetoric under Prodicus, celebrated for the allegory of the choice of Hercules, preſerved by Xenophon, and received inſtructions in phyſics from Anaxagoras, and in morals from Socrates. In his 18th year he firſt applied himſelf to the compoſition of tragedies, the number of which, during the courſe of his life, amounted, as ſome ſay, to 75, but according to others, to 92. He does not appear, however, to have been very ſucceſsful in his exhibitions on the theatre, for no more than five of his performances gained the prize at the olympic games: but they were privately read with avidity and highly applauded by his countrymen. To this purpoſe we may mention the following fact. After the unfortunate expedition of the Athenians againſt Syracuſe, ſeveral captives were kindly treated by the Sicilians, and obtained relief from indigence and wretchedneſs, by going about from place to place, reciting and ſinging the verſes of Euripides. Upon their return to their own country, the poet received their perſonal acknowledgments. Socrates was the friend of Euripides, and is ſaid to have given him advice and aſſiſtance in the compoſition of ſome of his dramas; and he occaſionally attended the public exhibition of them. In the character of Palamedes the poet was ſuppoſed to have delineated that of Socrates; and ſome verſes are quoted addreſſing the Greeks as having ſlain the beſt and wiſeſt of their nation, which the audience applied to the fate of this philoſopher, burſting into tears at the recollection of their crime. As Socrates had become an object of public perſecution and calumny before the repreſentation of the Palamedes, ſome application of the character to his circumſtances might probably have been intended by the poet. But his death could only be alluded to by way of probable anticipation, as he ſurvived Euripides ſome years. The remarkable effect aſcribed to the paſſage of the Palamedes juſt mentioned might poſſibly have taken place at ſome repreſentation of that play ſubſequent to the death of Socrates. Euripides was the conſtant rival of Sophocles, and their mutual jealouſy ſeems to have degenerated into declared enmity. Our poet was frequently the object of raillery to Ariſtophanes. Euripides was twice married; but as he was diſappointed in his expectation of domeſtic happineſs, he is ſaid to have indulged a kind of antipathy to women, for which this circumſtance has been pleaded as an apology. Hence he obtained the name of Μισογυνης, *woman-hater*, though his editor, Barnes, ſtrenuouſly defends him from the charge implied in this appellation, obſerving, that if he has deſcribed ſome females with all the vices incident to human nature, yet he has delineated many others with all the virtues that can adorn their ſex; and Sophocles is ſaid to have obſerved, that the hatred which he expreſſed againſt women was confined to the ſtage. In advanced life he enjoyed ſo little felicity at Athens, that he accepted an invitation to the court of Archelaus, king of Macedonia, where he was honourably treated, though he did not altogether eſcape the effects of malicious jealouſy. To the conſequence of a quarrel from this cauſe ſome have aſcribed his tragical death; for as he was walking in a wood, the king's hounds were let looſe upon him, and tore him in pieces. Others ſay that his death was owing to natural decay. He died at the age of about 75 years. The Athenians ſent embaſſadors to Macedonia, to requeſt the removal of his body to his native country; but Archelaus refuſing to comply with their requeſt, cauſed him to be interred with great magnificence, and erected in honour of him a noble monument in the vicinity of Pella, his chief city. The Athenians appointed a public mourning on occaſion of his death, and erected in memory of him a cenotaph on the road leading from the city to the Piræus. The following epitaph is aſcribed to Thucydides, the hiſtorian.

> "Μνημα μεν Ελλας απασ᾽ Ευριπιδου· οστεα δ᾽ισχει
> Γη Μακεδων, ἡ γαρ δεξατο τερμα βιου.
> Πατρις δ᾽Ελλαδος Ελλας Αθηναι· πλειστα δε Μουσαις
> Τερψας, εκ πολλων και τον επαινον εχει."

"All Greece is the monument of Euripides; the Macedonian land poſſeſſes his bones, for there he reached the boundary of his life. His country is Athens, the Greece of Greece; having afforded general delight by his muſe, he enjoys the recompence of general praiſe."

It has been recorded to the reproach of Euripides, that many of the maxims which he attributes to his dramatic characters are favourable to vice; and though he cannot be wholly exculpated from this charge, he abounds with moral maxims, expreſſed in noble and elegant language, which deeply impreſs the mind of the reader. He has been alſo charged with moroſeneſs of temper; but however this be, he introduces numerous paſſages of tender and delicate pathos. As a tragedian, when compared with Sophocles, it ſeems to be the general opinion, that with leſs pomp of diction, leſs force and elevation of character, and leſs knowledge of dramatic effect than his rival, he more excels in tenderneſs, ſuavity, and moral ſentiment. Ariſtotle calls him the "moſt tragical" of all the poets, meaning either that he was the moſt ſkilful in the drama, or the moſt pathetic. Euripides, it ſhould be recollected, was the favourite poet of Milton. Poſſeſſing a high notion of the preceptive office of the theatre, he was once deſired by the auditors to retrench a paſſage in one of his plays, but he ſtepped forward and ſaid, "I do not write in order to learn from you, but to teach you." Of his works nineteen compleat plays, and the commencement of a twentieth, are ſtill remaining. Of theſe, both ſingly and collectively, there are ſeveral editions. The beſt of the whole works are thoſe of Baſil, 1551, of Plantin, 1571, of Commelin, 1597, of Paul Stephens, 1604, 1611, of Barnes, *Camb.* 1694, and of Muſgrave, Oxf. 1778. Bayle. Moreri. Barnes. Gen. Biog.

EURIPUS, Ευριπος, in *Hydrography*, properly ſignifies a certain ſtrait of the ſea which divides Eubœa from Attica, Bœotia, and Locris, where the currents are ſo ſtrong that the ſea is ſaid to ebb and flow ſeven times a day; in which place, as the ſtory commonly goes, Ariſtotle drowned himſelf out of chagrin, for not being able to account for ſo unuſual a motion. This ſtrait was ſo narrow overagainſt Chalcis as ſcarcely to admit a galley. It is now called the gulf of Negropont.

Euripus has ſince become a general name for all ſtraits, where the water is in great motion and agitation.

The ancient circuſes had their Euripi, which were no other than pits or ditches, on each ſide of the courſe, into which it was very dangerous falling with their horſes and chariots as they ran races. The term Euripus was more particularly applied by the Romans to three canals or ditches which encompaſſed the circus on three ſides, and which were filled occaſionally, to repreſent naumachiæ or ſea-battles.

The ſame people called their ſmaller fountains or canals in their gardens Euripuſes; and their largeſt, as caſcades, &c. *Niles.*

EUROCLYDON, of Ευρος, *eaſt-wind*, and κλυδων, *wave*, is a ſpecies of wind, of which we have an account only in Acts, xvii. 14. and concerning the nature of which critics have been much divided. Bochart, Grotius, Bentley, and others, ſubſtitute another reading, ſupported by the Alexandrian MS. and the Vulgate, *viz.* Ευρακυλων, or *Euroaquilo*; but Mr. Bryant defends the common reading, and conſiders the Euroclydon, *i. e.* Ευρος κλυζων, as an eaſt-wind that cauſes a deep ſea or vaſt inundation. He maintains, in oppoſition to Dr. Bentley's reaſoning, who ſuppoſes that the mariners in the ſhip, the voyage of which is recited in this paſſage, were Romans, that they were Greeks of Alexandria, and that the ſhip was an Alexandrine ſhip, employed in the traffic of carrying corn to Italy; and therefore, that the mariners had a name in their own language for the particular typhonic or ſtormy wind here mentioned. He alſo ſhews from the paſſage itſelf, that the tempeſtuous wind called Euroclydon, beat (κατ᾽ αυτης) upon the iſland of Crete; and therefore, as this is a relative expreſſion, referring to the ſituation of the perſon who ſpeaks of it, who was at that time to the windward, or ſouth of it, the wind blew upon ſhore, and muſt have come from the ſouth or ſouth-eaſt; which, he adds, is fully warranted from the point where the ſhip was, and the direction it ran in afterwards, which was towards the north and north-weſt. Bryant's Obſervations, &c. 1767, p. 1. &c.

EURO-AUSTER. }
EURO-*Notus.* } See WINDS.

EUROMA, in *Ancient Geography*, a town of Aſia, in Phœnicia.

EUROMUS, a town of Aſia, in Caria; ſituated E. of mount Grius, N. of mount Latmus, and N.W. of the town of Mylaſa. It had a theatre and a magnificent temple.

EVRON, in *Geography*, a town of France, in the department of the Mayenne, and chief-place of a canton, in the diſtrict of Laval; 15 miles E.N.E. of Laval. This place contains 4044 and the canton 13,213 inhabitants, on a territorial extent of 205 kiliometres and 11 communes. The fairs of this town are frequented.

EUROPA, in *Mythology*, daughter of Agenor, king of Phœnicia, by his wife Telaphaſſa, who was ſo beautiful, that, according to the fable, Jupiter is ſaid to have fallen in love with her, and to have ordered Mercury to convey her to the ſea-ſhore, where that god, having transformed himſelf into a bull, took her upon his back, and tranſported her into Crete. Some have explained this fable by alleging that a captain of Candia, named Taurus, carried off that princeſs, after he had taken the city of Tyre from Agenor; but others, with greater probability, aſſert, that ſome merchants of Crete, having arrived upon the coaſts of Phœnicia, and ſeen the young Europa, were ſo much ſtruck with her beauty, that they carried her off for their king Aſterius; and as their ſhip bore upon the fore-caſtle a white bull, and that king of Crete had aſſumed the name of Jupiter, it was hence fabled that the god had transformed himſelf into a bull, in order to carry off the princeſs. Aſterius is ſaid to have married her, and to have had by her three ſons; after which ſhe is reported to have engaged the attachment and eſteem of the Cretans to ſuch a degree, that they worſhipped her after her death as a divinity. They even inſtituted a feaſt in honour of her, which was called Hellotia. They afterwards gave her the ſurname of Minerva, and celebrated to her honour that feſtival which was conſecrated to that goddeſs among the Cretans. Several authors have been of opinion that Europe took its name from this princeſs: but the learned Bochart believes that this part of the world was ſo denominated from the whiteneſs of its inhabitants. M. Gebelin, however, deduces the name of Europa from *Wrab*, ſignifying Occidental, and expreſſing its ſituation with regard to Aſia.

EUROPA *rocks*, in *Geography*, rocks in the ſtrait of Mozambique. S. lat. 21° 30′. E. long. 40° 16′.

EUROPE, one of the four grand diviſions, or quarters, as they have been ſomewhat improperly called, of the terraqueous globe. Although Europe be leſs conſiderable in extent than Aſia, or America, or even Africa, it claims on a variety of accounts our more particular attention. In modern times it has been the ſeat of literature and ſcience; in this part of the globe every kind of cultivation and improvement has made the moſt rapid progreſs, and it has been diſtinguiſhed, not only by the general temperature of its climate, the fertility of its ſoil, and the abundance of its productions for the ſupply of neceſſity and the gratification of luxury, but more eſpecially for the wiſdom, ſtrength, and courage of its inhabitants, and for the excellence of its government, laws, and religion. The boundaries of Europe were very inaccurately aſcertained by the ancient geographers, and the name itſelf ſeems to have originated in a ſmall diſtrict near the Helleſpont. More than a third part of Europe, towards the north and eaſt, has only been known with preciſion in modern times. It lies chiefly in the temperate zone, north of Africa, and north-weſt of Aſia, between 35° 25′ and 71° 23′ N. lat. and between 9° 40′ W. and 61° 5′ E. longitude. From the Portugueſe cape, denominated by our mariners the rock of Liſbon, in the weſt, to the Uralian mountains in the eaſt, the length may be about 3,300 Britiſh miles; and the breadth from Cape Nord in Daniſh Lapland to Cape Matapan, the ſouthern extremity of Greece, may be about 2,350. The contents in ſquare miles have been variouſly eſtimated, but at a medium may be ſtated at about 2½ millions. On the ſouth, Europe is bounded by the Mediterranean ſea, on the weſt by the Atlantic, which contains the moſt remote European iſlands, the Azores and Iceland, Greenland being regarded as a part of North America. On the north the boundary is the Arctic ocean, comprehending the remote iſles of Spitzbergen, and Novaya Zemlia, or the New Land. "Toward the eaſt the limits, (ſays Mr. Pinkerton,) admit of ſome diſcuſſion: the Uralian mountains, a grand natural limit, not extending to the Arctic ocean, the river Cara, which flows into the ſea of Karſhoye, is admitted as a boundary. The Uralian limit extends to about 56′ of N. latitude; to the ſouth of which the grand confines of Europe and Aſia have been ſought in the petty diſtinctions of Ruſſian governments. More natural limits might be obtained by tracing the river Ouſa from its ſource, to its junction with the Belaia. Thence along the Kama to the Volga, which would conſtitute a ſtriking natural diviſion, to the town of Sarepta; whence a ſhort ideal line, the only one admitted in this delineation, will lead due weſt to the river Don, which would complete the unaſcertained boundary; that on the north and weſt of the Euxine being clear and preciſe."

The ancient inhabitants of Europe conſiſted of Celts in the weſt and ſouth; Fins in the north-eaſt; and Laps or Laplanders, reſembling the Samoieds of Aſia in the fartheſt north, who enriched their rude language by adopting that of the more civilized Fins. The ancient inhabitants, who ſeem to have been thinly ſcattered, were driven towards the weſt and north by the Scythians or Goths from Aſia, whoſe deſcendants occupy the greater part of Europe; by the Sarmatians or Slavonic tribes, alſo from Aſia, the anceſtors of the Ruſſians, Poles, &c. and who were accompanied by the Heruli, uſing what is now called the Lettic ſpeech, to be found in Pruſſia, Lithuania, Samogitia, Courland, and Livonia, ſomewhat akin to the Slavonic language, with various ſhades of diſtinction. The colony of Iberi, northern Mauretani, paſſed into Spain at a very early period; and the later acceſſion of Hungarians and Turks from Aſia may likewiſe be commemmorated. The preſent population of Europe is commonly eſtimated at 150,000,000; and though ſome writers have aſſerted that this quarter of the globe was anciently more populous than it is now, the opinion does not ſeem to be well founded. It will not readily be adopted by thoſe who duly conſider the number and magnitude of modern cities, towns, and villages; the abolition of feudal wars; the adoption of a mode of combat leſs deſtructive than that which formerly prevailed; the gradual extirpation of ſuperſtition, fanaticiſm, barbarity, and ſlavery; and the many extenſive improvements made in agriculture, by eradicating foreſts, draining marſhes, cultivating waſtes, and opening canals of communication in the interior countries. It is generally allowed, that, notwithſtanding the ravages of war, and emigrations to foreign parts, the population of moſt European ſtates has been, for ſome time paſt, increaſing. The prevalence of the Chriſtian religion throughout Europe, except in ſome parts of Turkey, has been favourable to knowledge, induſtry, and civilization; and it has contributed to conſtitute the whole of Europe, as it were, into one republic, ſo that any uſeful diſcovery made in one ſtate paſſes rapidly to the reſt. The mutual intercourſe between the different ſtates of Europe is very much facilitated by its inland ſeas, as well as navigable rivers and canals. Of the inland ſeas the principal are the Mediterranean, the Baltic, and the White ſea, which ſee reſpectively. Its other ſeas are the German, often ſtyled the North ſea, the Iriſh ſea, and various parts of the Atlantic. The gulfs and bays of Europe are very numerous, among which we may reckon the following, *viz.* the Bothnian and Finland gulfs; the Murray frith, and Frith of Forth, on the eaſt coaſt of Scotland; the bay of Biſcay, a large inlet of the Atlantic, on the eaſt bounded by France, and on the ſouth by Spain; the gulfs of the Mediterranean, *viz.* that of Lyons, S. of France; that of Genoa, between Corſica and the Genoeſe republic; the gulf of Venice, between Italy and Greece; the gulf of Lepanto, N. of Morea; the Archipelago between Greece and Aſia Minor; the ſea of Marmara between Europe and Aſia; and the ſea of Azoph on the north coaſt of the Euxine. The moſt conſiderable ſtraits are that of Waygatz at the N. E. extremity of Europe; the ſound of Elſinore between the iſland of Zealand and Sweden; the Little Belt between Funen and Jutland; the Categat, or entrance into the Baltic; the ſtrait of Dover, or Engliſh channel, between England and France; the Briſtol channel, between England and Wales; St. George's channel, between Great Britain and Ireland; Pentland frith, between Scotland and the Orkney Iſles; the ſtrait of Gibraltar, between Spain and Africa; the ſtrait of Meſſina, between Italy and Sicily; the Dardanelles ſtrait, or ſouth entrance into the ſea of Marmara; the ſtrait of Conſtantinople, that forms a communication between the ſea of Marmara and the Euxine; and the ſtrait of Caffa, between the Euxine and the ſea of Azoph. The moſt remarkable capes are North Cape, the extreme point of Lapland; Cape Finiſterre, on the N. W. coaſt of Spain; Cape St. Vincent, the S. W. extremity of Portugal; and Cape Matapan, the S. point of the Morea. Its principal lakes are thoſe of Onega, Ladoga, and Peipus, in Ruſſia; thoſe of Geneva and Conſtance, S. W. and N. of Switzerland; Lago Maggiore, and others, in the northern parts of Italy. The largeſt rivers are the Volga, Don, and Dwina, in Ruſſia; the Dnieper on the eaſt border of Poland; the Danube, between Hungary and European Turkey; the Rhine and Elbe in Germany; the Rhone in France; the Po and Tyber in Italy; the Tago in Spain; the Scheldt and Meuſe in the Netherlands; the Thames and Severn in England; the Tay in Scotland, the Shannon in Ireland, &c. &c. The principal chains of mountains are the Carpathian or Krapach mountains, between Poland and Hungary; the Alps, between France, Switzerland, and Italy; the Apennines, in Italy; the Pyrenées between France and Spain; and the extenſive ridge that ſeparates Norway from Sweden. The moſt diſtinguiſhed iſlands are Great Britain and Ireland, the Orkney Iſles, the Hebrides, Zealand, and Funen, in the Baltic; Iceland, in the North ſea; and in the Mediterranean, Ivica, Majorca, Minorca, Sardinia, Corſica, Sicily, Malta, Candia, and the iſlands of the Archipelago.

The principal European ſtates are the Britiſh empire, including England, Scotland, and Ireland; the ſtates of Denmark, comprehending Denmark with the adjacent iſlands, Norway and Iceland; Sweden; Ruſſia, formerly called Muſcovy; Holland; France, including the Netherlands, Italian ſtates, and other late acquiſitions; Switzerland; Germany and Auſtria; Pruſſia; Bohemia and Hungary; Poland, now diſmembered; Spain; Portugal; Sicily; Malta; and Turkey in Europe. See each under its appropriate title.

EUROPEAN Hours. See Hour.

European *Ocean.* See Ocean.

EUROPUS, in *Ancient Geography*, a town of Aſia, in Parthia, founded, as Strabo ſays, by Nicator, and called by the Parthians *Arſacia.*—Alſo, a town of Aſia, in Syria, ſituated on the banks of the Euphrates, E. of Hieropolis, and S. of Zeugma.—Alſo, a town of Aſia, in Caria.—Alſo, a town of Macedonia.—Alſo, a river of Greece, in Theſſaly, which roſe in mount Citarius, and flowed into the Peneus.

EUROTAS, a river of Laconia, which commenced on the frontiers of Arcadia, watered Sparta, and proceeding ſouthward, diſcharged itſelf into the Laconic gulf.—Alſo, a river of Greece, in Theſſaly, near mount Olympus.—Alſo, a river of Italy, near Tarentum, the ſame with the river Galeſus, according to Polybius.

EURUS, in *Mythology*, the genius of the ſouth-eaſt wind, according to the Grecian diviſion of the compaſs into eight points; but according to the Roman diviſion into four, Eurus was the intelligence that preſided over the whole eaſtern quarter of the heavens. (See Wind.) "Eurus," ſays Spence, "according to the Roman poets, ſeems to have his character compoſed from the Apeliotes and Eurus of the Greeks: by one deſcription of him he ſhould have a look that ſeems delighted, and in another he is ſpoken of as playful and wanton. He is ſometimes deſcribed as impetuous, and ſometimes as diſordered with the ſtorm he has been driving along the ſea. Horace gives us a picture of the former, and Valerius Flaccus of the latter. I ſhould be apt to imagine, from ſome expreſſions in the poets, that he was ſometimes repreſented on horſeback, or perhaps in a chariot, whirling through the air; but there are ſo few remains of the ancient artiſts relating to theſe airy beings, that we have nothing from them to confirm any ſuch conjecture."

EURYA, in *Botany*, ſuppoſed to be from ευρυς, *broad* or *ample*, the application of which to this plant we do not, from any part of the deſcription or figure, perceive. Thunb. Jap. 11. Schreb. 321. Willd. Sp. Pl. v. 2. 856. Mart. Mill. Dict. v. 2. Juſſ. 432. Claſs and order, *Dodecandria Monogynia.* Nat. Ord. uncertain, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, of five ovate, concave, obtuſe, ſmall leaves, with two leſſer ones at its baſe. *Cor.* Petals five, roundiſh-ovate, concave, the ſize of the calyx. Nectary a glandular ring round the baſe of the germen. *Stam.* Filaments thirteen, extremely ſhort; anthers erect, ſquare, almoſt as long as the corolla. *Piſt.* Germen ſuperior, roundiſh, ſmooth; ſtyle awl-ſhaped, ſhorter than the ſtamens; ſtigmas three, reflexed. *Peric.* Capſule globoſe, tipped with the permanent ſtyle, ſmooth, of five valves and five cells, ſcarcely ſo big as a pepper-corn. *Seeds* ſeveral, obſcurely triangular, dotted, brown, deſtitute of pubeſcence.

Obſ. Thunberg obſerved the flowers to be moſt frequently dioecious.

Eſſ. Ch. Calyx double; the inner of five equal leaves; the outer of two ſmaller ones. Petals five. Capſule ſuperior, of five cells and five valves. Seeds numerous.

E. *japonica.* Thunb. Jap. 191. t. 25. (Fiſakaki; Kæmpf. Amœn. Exot. 778.) A Japaneſe ſhrub, common on the hills about Nagaſaki, flowering in September and October, and cultivated in gardens for the ſake of its elegance. It is ſmooth in every part. *Branches* ſlender, alternate, leafy. *Leaves* alternate, ſtalked, elliptic-lanceolate with a blunt point, ſerrated, compared by Kæmpfer to thoſe of tea, evergreen, yellowiſh beneath, an inch or two long. *Flowers* axillary, in pairs, ſtalked, ſmall, white or reddiſh. Thunberg deſcribes the fruit as above; but Kæmpfer ſays "the *berries* reſemble thoſe of juniper, and are juicy, giving a ſtain like ultramarine, and containing from ten to twenty hardiſh brown ſeeds, crackling under the teeth." If Thunberg adverted to this deſcription, he might perhaps deduce the generic name, though incorrectly, from ευ, *well*, and ρυαξ, *a flowing of juice*, or *a falling of berries.*

EURYALE, in *Mythology*, one of the Gorgons, daughter of Phorcys, and ſiſter of Meduſa: ſhe was ſubject neither to old age nor death.

EURYAMPUS, in *Ancient Geography*, a town of Macedonia, in Magneſia.

EURYANDRA, in *Botany*, from ευρυς, *broad*, and ανηρ, *a male*, becauſe the male organs, or ſtamens, are dilated at the ſummit. Forſt. Gen. t. 41. Schreb. 367. Juſſ. 280. See Tetracera; to which genus Schreber, in his emendanda, 833, and Willdenow, Sp. Pl. v. 2. 1242, have at the recommendation of Solander referred it.

EURYDICE, in *Mythology*, the wife of Orpheus, who, flying from Ariſtæus that endeavoured to raviſh her, was ſlain by a ſerpent. Her huſband went down to the ſhades, and by the force of his muſic perſuaded Pluto and Proſerpine to give him leave to carry back his wife; which they granted, provided he did not look on her till he came to the light; but he, breaking the condition, was forced to leave her behind him.

EURYMEDON, in *Ancient Geography*, *Zacuth*, a river of Aſia, in ancient Pamphylia, which had its ſource in mount Taurus, paſſed the town of Aſpenus, and diſcharged itſelf into the ſea of Pamphylia.

EURYMENÆ, a town of Greece, in Theſſaly.

EURYNOME, in *Mythology*, the mother of the three Graces.

EURYNOMIA, Ευρυνομεια, in *Antiquity*, an anniverſary ſolemnity in honour of Eurynome, by ſome thought to be the ſame with Diana, by others one of Oceanus's daughters.

EURYPHON, the Cnidian phyſician, in *Biography*, was a contemporary of Hippocrates, but probably older in years, ſince he is deemed the author of the Cnidian aphoriſms, which are quoted by Hippocrates. Theſe two phyſicians are ſaid by Soranus to have met in conſultation in the preſence of king Perdiccas. Euryphon is mentioned by Plato the comedian, as having produced many ſcars on the ſkin of Cineſias, the ſon of Evagoras, by the employment of actual cauteries for the cure of empyema, or pulmonary conſumption; a practice which Hippocrates purſued. See Le Clerc Hiſt. de la Med.

EURYTHMIA, from ευ and ρυθμος, *order*, an old term in *Surgery*, ſignifying adroitneſs in handling inſtruments.

EURYTHMY, Ευρυθμια, in *Architecture*, *Painting*, and *Sculpture*, a certain majeſty, elegance, and eaſineſs, appearing in the compoſition of divers members or parts of a body, building, or painting, and reſulting from the fine proportions thereof.

The word is Greek, and ſignifies literally a *conſonance* or *fine agreement*, or, as we call it, a *harmony of all the parts*, being compounded of ευ, *well*, and ρυθμος, *rythmus*, *cadence*, or *agreement of numbers*, *ſounds*, or the like things.

Vitruvius ranks eurythmia among the eſſential parts of architecture; he deſcribes it as conſiſting in the beauty of the conſtruction or aſſemblage of the ſeveral parts of the work, which renders its aſpect or whole appearance graceful; *e. gr.* when the height correſponds to the breadth, and the breadth to the length, &c.

"From theſe three ideas or deſigns, *viz.* orthography, ſcenography, and profile, it is that eurythmy, *majeſtica*, and *venuſta ſpecies edificii*, do reſult, which creates that agreeable harmony between the ſeveral dimenſions, ſo as nothing ſeems diſproportionate, too long for this, or too broad for that, but correſponds in a juſt and regular ſymmetry, and conſent of all the parts with the whole." Evelyn's Account of Archit. &c.

EUSCOM, in *Geography*, a river of Canada, which runs into lake St. Clair. N. lat. 42° 45′. W. long. 82° 25′.

EUSDALE, or Eysdale, a ſmall iſland on the W. coaſt of Scotland, noted for its quarries of ſlate. N. lat. 56° 13′. W. long. 5° 48′.

EUSEBES, the name of a ſpecies of marble mentioned by Pliny: he has given us no deſcription of it, but only tells us, that there was a ſeat made of it in the temple of Hercules at Tyre, from which the prieſts pretended that the gods uſed to ariſe.

EUSEBIANS, a denomination given to the ſect of Arians, on account of the favour and countenance which Euſebius, biſhop of Cæſarea, ſhewed and procured for them at their firſt riſe; or rather from the protection afforded to Arius, and the adoption of his opinions by Euſebius biſhop of Nicomedia. See Arians.

EUSEBIUS, pope, in *Biography*, a native of Greece, ſon of a phyſician, perhaps he himſelf at one period was a phyſician, ſucceeded Marcellus in the ſee of Rome. It is believed that he filled the pontificate but a very few months. He was a violent opponent to the re-admiſſion of lapſed Chriſtians to communion, and his conduct on this head created great diſſenſions at Rome, to put an end to which the emperor Maxentius baniſhed him to Sicily. Moreri. Bower.

Eusebius, ſurnamed *Pamphilus*, was born at Cæſarea in Paleſtine, of which he was afterwards biſhop, about the year 270. Of his parents, and his inſtructors in early life, we have no account; nor is any thing recorded concerning his family. His talents and learning may, however, be juſtly appreciated by his numerous and valuable works. Having been ordained preſbyter, probably, by Agapius, biſhop of Cæſarea, he ſet up a ſchool in that city, which produced many learned men, and whilſt he was in this ſituation he formed an intimate acquaintance and friendſhip with Pamphilus, a learned preſbyter of the ſame church, who is ſuppoſed to have afforded him much aſſiſtance in his ſtudies. When Pamphilus was impriſoned in the year 307, Euſebius attended him to animate his fortitude and comfort him in his diſtreſs: and after the martyrdom of his friend in 309, he removed to Tyre, where he witneſſed the firmneſs and patience with which many Chriſtians endured the ſeverity of perſecution. From thence he went to Egypt, where the ſame ſcene was exhibited, and where he himſelf was impriſoned. As he did not ſuffer in common with others, ſome perſons have inſinuated, that he procured his liberty by ſacrificing, or by ſome other mean compliance, unbecoming his Chriſtian principles and profeſſion. But Dr. Lardner has alleged ſeveral circumſtances which evince this accuſation to be altogether unfounded. At the cloſe of the Diocleſian perſecution, Euſebius returned to Paleſtine, and ſucceeded Agapius, according to the more general opinion, as biſhop of Cæſarea in the year 315. It is certain, however, that he was biſhop of Cæſarea in the year 320 at the lateſt. After this period he was preſent at moſt of the ſynods held in that part of the world; and on all occaſions diſtinguiſhed himſelf by recommending peace and mutual forbearance. At the famous council of Nice in 325, he was placed by command of Conſtantine on the right hand of the throne, and opened the meeting by a panegyrical addreſs. At this council he ſeems to have been deſirous of compromiſing the diſpute between Arius, to whoſe ſentiments he probably inclined, and the orthodox party; and with this view propoſed a creed, which all the fathers allowed to be unexceptionable. Some of the moſt zealous partizans, however, ſuggeſted the propriety of introducing the word ὁμοούσιος, or *conſubſtantial*, as applicable to the Son; and the motion for this purpoſe was carried by a majority. Euſebius for ſome time demurred, alleging that the expreſſion was unſcriptural; but at length, being allowed to ſubſcribe to the term in his own ſenſe of it, he ſubmitted; and the word became afterwards the teſt of orthodox belief, but very ineffectual for allaying the diſſenſions of the Chriſtian church. In the year 330 Euſebius concurred with the council at Antioch in depoſing Euſtathius the biſhop; but though the biſhops and people concurred in electing him for this ſee, which was more honourable and profitable than that of Cæſarea, he peremptorily refuſed the acceptance of it. Although they applied to Conſtantine for the interpoſition of his authority, Euſebius wrote to the emperor, and obtained his permiſſion to decline it, accompanied with encomiums on his moderation and diſintereſtedneſs, which he juſtly merited. At the council of Tyre in 335 he joined thoſe biſhops who condemned the proceedings of Athanaſius, biſhop of Alexandria; and he was deputed to attend the emperor, in order to juſtify the meaſures that had been adopted againſt that prelate. On occaſion of this viſit to Conſtantinople, he pronounced his panegyric on the emperor, and obtained ſingular marks of Conſtantine's condeſcenſion and favour. After his return to Cæſarea, the emperor kept up an epiſtolary correſpondence with him, ſpecimens of which are preſerved in Euſebius's life of that prince. This work was written ſoon after the death of the emperor; nor did the biſhop long ſurvive, for he died in the year 339 or 340. Of the learning and application of Euſebius, his works afford ample evidence. "From his works it appears," ſays Tillemont, "that he had read all ſorts of Greek authors, whether philoſophers, hiſtorians, or divines, of Egypt, Phœnicia, Aſia, Europe, and Africa." Euſebius had opportunities for converſing with the moſt learned men of his time, and he had acceſs to the beſt libraries: ſo that from theſe different reſources he was able to compile works of various kinds, in which he exerciſed a laudable caution with reſpect to his authorities and facts, and in which he alſo manifeſts a conſiderable degree of candour and impartiality. His works, however, as compoſitions, claim no very high commendation, as they are deſtitute of elegance and perſpicuity. Upon the whole we may obſerve, that he was a good man as well as a learned ſcholar; zealouſly attached to religion, without bigotry; an enemy to eccleſiaſtical tyranny and diſcord, and always deſirous of accommodating differences, and reconciling contending parties. Nevertheleſs Dr. Lardner mentions with diſapprobation his concurrence with the Arian party in the harſh treatment given to Euſtathius, biſhop of Antioch, Athanaſius of Alexandria, and Marcellus of Ancyra. As to his ſentiments with regard to the doctrine, warmly controverted in his time, Dr. Jortin inclines to think, that he was neither an Arian nor an Athanaſian, but that he endeavoured to ſteer a middle courſe, and yet inclining more to the Arians than to the Athanaſians. Dr. Lardner, with his uſual caution, obſerves, that this is a queſtion which cannot be eaſily decided.

Of the works of Euſebius we can here enumerate only the principal, referring for an account of the reſt to the writers cited at the cloſe of this article. The firſt that deſerves mention is the "Eccleſiaſtical Hiſtory," in ten books, publiſhed in 326, and containing the hiſtory of the Chriſtian church from the birth of Chriſt to his own times. The beſt edition is that of Valeſius, publiſhed at Cambridge by Reading in three volumes folio. This contains Euſebius's "Life of Conſtantine," in four books, written in 337 or 338, and other eccleſiaſtical hiſtorians, Socrates, Theodoret, &c. In this hiſtory we have ſeveral paſſages concerning the canon of ſcripture; in which the author treats of the order of the goſpels; of the ſcriptures univerſally acknowledged, and of thoſe that are not ſuch; of the epiſtles, &c. (See Canon.) Euſebius's "Chronicle" was a work of prodigious labour and learning, and is preſerved only in a Latin verſion of Jerome. The "Evangelical Preparation," in 15 books, and ten books of the "Evangelical Demonſtration," which originally comprehended 20 books, are ſtill extant; and contain the moſt learned defence of Chriſtianity againſt both Jews and Pagans, tranſmitted to us from antiquity. A beautiful edition of theſe valuable works was publiſhed in Greek, by Robert Stephens, in 1544 and 1545, in 2 vols. fol., and reprinted at Paris, in 1628, in 2 vols. fol., with a Latin verſion of the former, and various readings from different MSS. and notes by Francis Vigerius, and Donatus's Latin verſion of the latter. Euſebius was alſo the author of a "Commentary upon the 150 Pſalms," publiſhed by Montfaucon in 1705, as far as the 119th pſalm: "A Commentary upon the Prophecies of Iſaiah," publiſhed likewiſe by Montfaucon: "An Expoſition of the Song of Songs," publiſhed by Meurſius in 1627; "A Treatiſe againſt Hierocles" who had made a compariſon of Apollonius Tyanæus with Jeſus Chriſt, ſtill extant in the original Greek; "Two books againſt Marcellus," who revived the hereſy of Sabellius, and "Three books of Eccleſiaſtical Theology," written in 336; "An Apology for Origen," in 6 books, the joint work of Euſebius and Pamphilus, now exiſting in a Latin verſion; "Ten Evangelical Canons," or rules for harmonizing the goſpels; the "Topics," in two books, being a kind of dictionary of places mentioned in the Scriptures; "A deſcription of the Church of the Sepulchre at Jeruſalem, &c." compoſed in 335; "An Oration in praiſe of Conſtantine," which is as much an argument for the truth of the Chriſtian religion, as a panegyric upon the emperor, and much commended by Du Pin and Lardner; the "Life of Conſtantine," in 4 books, already mentioned: "Fourteen ſmall pieces in Latin," publiſhed by James Sirmond in 1643, 8vo. and many other treatiſes, that are no longer extant. Fabr. Bibl. Græc. v. vi. Cave's H. L. vol. i. Lardner's Works, vol. iv. Jortin's Rem. on E. H. vol. ii.

Eusebius, firſt of all biſhop of Berytus in Phœnicia, and afterwards of Nicomedia, in Bithynia, was advanced to the ſee of Conſtantinople in 338 or 339. He was a relation of the emperor Julian, who was educated by him, and probably alſo of Conſtantine: and as he was a man not only diſtinguiſhed by his abilities and learning, but favoured with free acceſs to the court, his influence on behalf of the Arian party, to which he was attached, was always of great importance to their cauſe. From the protection afforded to Arius and his followers by Euſebius they were frequently denominated "Euſebians." Although he remonſtrated againſt the proceedings of the court of Nice in 325, at which he was preſent, he ſubſcribed the creed, probably with the ſame explanation which was given by the biſhop of Cæſarea of the ſame name. That this was the caſe we may infer from the patronage which he afforded to the Arians, and which cauſed Conſtantine to depoſe him from his ſee and to ſend him into exile. He was afterwards, *viz.* in 328 or 329, recalled, and reſtored to his ſee, as well as to the favour of the emperor. Afterwards, when the Arian party became triumphant at the court of Conſtantinople, he encouraged the perſecution of thoſe who had been the perſecutors of Arius. Having maintained his credit and influence with Conſtantine till his death, he gained in an equal, if not greater, degree, the confidence of his ſon Conſtantius; who promoted him, in 338, to the ſee of Conſtantinople. In this high ſtation he was active in promoting the Arian intereſts, and in perſecuting the Catholics. Soon after the council of Antioch, held in 341, probably in the ſame or the ſucceeding year, he terminated his career. Euſebius was eminent for his abilities and learning; and his friends have extolled his piety and virtue: but no ſufficient apology can be offered for his intolerance. His writings were numerous, but none of them remain, except a "Letter concerning Arius and his Opinions," preſerved by Theodoret. Fabr. Bibl. Græc. vol. vi. Cave's H. L. vol. i. Lardner's Works, vol. iv.

Euſebius, biſhop of Emeſa, who flouriſhed about the year 340, was deſcended of a very honourable family, and born at Edeſſa in Meſopotamia, at which place he enjoyed the benefit of a learned education, and of early inſtruction in the ſacred ſcriptures. He afterwards removed to Paleſtine, where he ſtudied under Patrophilus of Scythopolis, and Euſebius of Cæſarea. He likewiſe went to Antioch, and from thence to Alexandria, in which city he ſtudied philoſophy, and then returned to Antioch. Some time after that, having refuſed the offer of the ſee of Alexandria, from which Athanaſius was depoſed in 341, he was appointed biſhop of Emeſa; where his diſtinguiſhed proficiency in literature and the ſciences led the ignorant populace to charge him with the practice of magical arts. Under this accuſation, he was obliged to retire to Laodicea, and to ſeek the protection of George, biſhop of that city, who was afterwards his biographer. When the prejudices of the miſguided people at Emeſa ſubſided, he returned thither, and here he ſpent the greater part of the remainder of his life, which terminated at Antioch about the year 360. He is generally thought to have embraced the Arian tenets: though Cave thinks that he ſhould be ranked among the Semi-Arians. However this be, his character was held in high eſtimation for virtue and piety, as well as for learning and eloquence. Although he was great and good, as Sozomen ſays, he experienced the envy of thoſe who are offended at other men's virtues. The emperor Conſtantius, however, was much pleaſed with him, and his attendance was always required by that prince in his expeditions againſt the Perſians. He wrote a great number of books, which were chiefly treatiſes againſt the Jews, againſt the Novatians, and againſt the Manichæans; 10 books upon the epiſtle to the Galatians; and many ſhort homilies upon the goſpels. His works are in general loſt. His treatiſe againſt the Jews is ſaid to be ſtill extant in a Greek MS. in the library at Vienna. The homilies, that have been publiſhed under his name at Paris in 1575, and at Antwerp in 1602, 8vo. are now allowed to be the productions of other writers. Socr. Hiſt. Eccl. l. iii. Cave's H. L. vol. i. Lardner's Works, vol. iv.

Euſebius, biſhop of Verceil, or Vercelli, in Italy, was born in Sardinia; and flouriſhed about the year 354. In this year he was deputed by pope Liberius to plead the cauſe of Athanaſius, after his expulſion from Alexandria, before the emperor Conſtantius; and in the council at Milan he was a zealous advocate for the depoſed biſhop, and for the Nicene creed. The Arian party, however, prevailed, and a decree was paſſed for condemning the conduct of Athanaſius. Euſebius reſiſted, and for his unyielding ſteadineſs he was baniſhed to Scythopolis in Syria, afterwards to Cappadocia, and laſt of all into the Upper Thebais. The cauſe of orthodoxy, nothwithſtanding all his ſufferings, found him an undaunted and perſevering advocate. Upon the acceſſion of Julian to the empire, he and other friends were allowed to return home; and during the remainder of his life he maintained his invincible attachment to the Catholic doctrine, and his zeal in promoting it. He died about the year 370, or ſoon after. Moſt of his works have been loſt: but it is ſaid that in the cathedral church at Verceil there is a MS., containing a Latin verſion of the four Goſpels, which is inſerted in the "Evangeliarium Quadruplex Latinæ Verſionis Antiquæ, ſeu veteris Italicæ," publiſhed by Joſeph Bianchini, at Rome, in 1749. Cave's H. L. vol. i. Lardner's Works, vol. iv. chap. 90.

Euſebius, biſhop of Dorylæum in Phrygia in the fifth century, was at firſt an eminent advocate at Conſtantinople, but embracing the eccleſiaſtical life, he obtained the above-mentioned ſee, and diſtinguiſhed himſelf by his oppoſition to the Eutychians. Some few of his works remain, which are of a polemical nature, and not worth mentioning. Cave's Hiſt. Lit. vol. i.

EUSENE, in *Ancient Geography*, a town of Aſia, in Paphlagonia. Ptolemy.

EUSHAR, in *Geography*, a town of Aſiatic Turkey, in Natolia; 24 miles E. of Iſbarteh.

EUSHEIM, a town of Germany, in the principality of Wurzburg; 3 miles N.W. of Volckach.

EUSIMARA, in *Ancient Geography*, a town of Aſia, in Melitené, a country of Cappadocia, ſeated on the bank of the Euphrates. Ptolemy.

EUSKIRCHEN, in *Geography*, a town of France, in the department of the Roer; 20 miles S.E. of Juliers.

EUSTACE, or Eustatia, an inconſiderable American iſland, about 20 miles in circuit, forming with a long point of land the entrance to the harbour of St. Auguſtine, in Eaſt Florida. It was alſo called Metanzas, or Slaughter, from a butchery made upon it by the Spaniards.

EUSTACHE, David, in *Biography*, a French proteſtant miniſter, at Montpellier, aſſiſted at the national ſynod held at London in 1659, as deputy of the province of Lower Languedoc, and was nominated by the aſſembly to preſent to the king the letter which they had addreſſed to him. He performed the taſk much to the ſatisfaction of thoſe who had appointed him to the office. He was author of many theological pieces and ſermons; the titles of ſome of the former are "Salutary Remedies againſt a Departure from God;" "The Triumph of Faith;" "An Anſwer to the Queſtion aſked of the Proteſtants, where was your Church before Luther;" "The Orator Tertullus convicted;" which was a reply to the harangue ſuppoſed to be made by the wiſe men of the pretended reformed religion to the queen Maria Thereſa, upon her entrance into the kingdom, in which they declared that being informed ſhe had expreſſed great concern that part of the king her huſband's ſubjects were heretics, they came to leſſen that concern by embracing her majeſty's religion, and that this they did after having been ſatisfied, by the teſtimony of their moſt famous authors, that one may be ſaved in the Romiſh religion. Moreri. Bayle.

EUSTACHIAN Tube, in *Anatomy*, is the paſſage by which air is conveyed from the fauces to the tympanum of the ear, ſo called from an Italian anatomiſt. See Ear.

Eustachian *valve*, is a part formed in the right auricle of the heart. See Heart.

EUSTACHIUS, Bartholomew, in *Biography*, one of the moſt celebrated anatomiſts of the ſixteenth century, was a native of a little village in Italy, called San Severino. He purſued his ſtudies at Rome, where he firſt conceived a bias in favour of medicine, and eſpecially of anatomy, which he cultivated with ſuch ſucceſs, that he was appointed to the profeſſor's chair in that college. This is nearly the ſum of our knowledge reſpecting the life of this celebrated man: he died at Rome in 1574. Euſtachius was the author of ſeveral works, the greater part of which is loſt. His treatiſe "De Controverſiis Anatomicorum," which was one of the moſt conſiderable of his productions, is much regretted. Thoſe of his writings, which remain, conſiſt of his Opuſcula, which appeared under the following titles, "Opuſcula Anatomica, nempe de Renum ſtructura, officio, et adminiſtratione: de auditûs organo: oſſium examen: de motu capitis: de vena quæ azygos dicitur, et de alia, quæ in flexu brachii communem profundam producit: de dentibus." Venet. 1563, and again in 1674, with the notes of Pinus. An edition was alſo publiſhed at Leyden, 1707, under the ſuperintendance of Boerhaave.

Euſtachius was the author of ſeveral diſcoveries in anatomy; he was the firſt who deſcribed the renal capſules, and the thoracic duct; and his name, ſtill attached to the paſſage leading from the throat to the internal ear, (the Euſtachian tube,) announces the origin of our knowledge on that ſubject. A ſeries of figures engraved on copper were mentioned in his Opuſcula as nearly finiſhed; but they were loſt for more than 150 years, and were diſcovered, and publiſhed at Rome in 1714, by Lanciſi, phyſician to pope Clement XI. in one volume folio. Theſe plates were again publiſhed, but not well printed, at Geneva in 1717. The edition of Rome in 1728 is excellent; but the one publiſhed at the ſame city, 1740, by Petrioli, is leſs valuable. The ſame work was twice publiſhed at Leyden, under the direction of Albinus, *viz.* in 1744 and 1762.

Euſtachius edited the lexicon of Erotian at Venice in 1666, under the title of "Erotiani, Græci ſcriptoris vetuſtiſſimi, vocum, quæ apud Hippocratem ſunt, collectio, cum annotationibus Euſtachii," in 4to. Eloy. Dict. Hiſt.

EUSTATHIANS, in *Eccleſiaſtical Hiſtory*, a name given to the Catholics of Antioch in the fourth century, on occaſion of their refuſal to acknowledge any other biſhop beſide St. Euſtathius, biſhop of Sebaſté in Armenia, depoſed by the Arians.

The denomination was given them during the epiſcopate of Paulinus, whom the Arians ſubſtituted for St. Euſtathius, about the year 330, when they began to hold their aſſemblies apart. About the year 350, Leontius of Phrygia, called the Eunuch, who was an Arian, and was put in the ſee of Antioch, deſired the Euſtathians to perform their ſervice in his church; which they accepted; and the church of Antioch ſerved indifferently thus both for the Arians and Catholics.

This, we are told, gave occaſion to two inſtitutions, which have ſubſiſted in the church ever ſince; the firſt was pſalmody in two choirs; though Mr. Baillet thinks, that if they inſtituted an alternate pſalmody between two choirs, it was between two Catholic choirs, and not by way of reſponſe to an Arian choir. The ſecond was the doxology, *Glory be to the Father, and the Son, and the Holy Ghoſt.*

This conduct, which ſeemed to imply a kind of communion with the Arians, gave great offence to abundance of Catholics, who began to hold ſeparate meetings, and thus formed the ſchiſm of Antioch. Upon this the reſt, who continued to meet in the church, ceaſed to be called Euſtathians; and that appellation became reſtrained to the diſſenting party.

St. Flavianus, biſhop of Antioch, in 381, and one of his ſucceſſors Alexander, in 482, brought to paſs a coalition or re-union between the Euſtathians and the body of the church of Antioch, deſcribed with much ſolemnity by Theodoret, Eccl. lib. iii. cap. 2.

Eustathians were alſo a ſect of heretics in the fourth century, denominated from their founder Euſtathius, a monk ſo fooliſhly fond of his own profeſſion, that he condemned all other conditions of life. Whether this Euſtathius was the ſame with the biſhop of Sebaſté and chief of the Semiarians, it is not eaſy to determine.

He excluded married people from ſalvation; prohibited his followers from praying in their houſes, and obliged them to quit all they had as incompatible with the hopes of heaven.

He drew them out of the other aſſemblies of Chriſtians to hold ſecret ones with him, and made them wear a particular habit; he appointed them to faſt on Sundays; and taught them that the ordinary faſts of the church were needleſs, after they had attained to a certain degree of purity which he pretended to. He ſhewed great horror for chapels built in honour of martyrs, and the aſſemblies held therein.

Several women, ſeduced by his reaſons, forſook their huſbands, and abundance of ſlaves deſerted their maſters' houſes.

He was condemned at the council of Gangra, in Paphlagonia, held between the years 326 and 341. Socr. lib. ii. cap. 43 and Sozom. lib. iv. cap. 24. Hard. Concil. Coll. tom. i. p. 530.

EUSTATHIUS, in *Biography*, a ſaint in the Greek and Roman churches, and biſhop of Antioch, was tranſlated to that ſee from the biſhopric of Beræa, in Syria, about the year 323. He was a ſtrenuous opponent of the Arian doctrine, and is ſaid to have been the firſt eccleſiaſtic of conſequence who wrote againſt it. He was diſtinguiſhed by his zeal at the council of Nice in 325, and by his exertions in carrying the deciſions of that council into effect. This conduct ſo much exaſperated the Arian biſhops, that they got him accuſed of adhering to the doctrine of Sabellius, rather than to that of the council of Nice. His enemies alſo ſuborned an infamous woman to appear before the ſynod of the Eaſtern biſhops, to charge Euſtathius with being father of a child which ſhe held in her arms: other charges, equally diſreputable, were made againſt him: of theſe he was declared guilty, and depoſed from his paſtoral office. He was afterwards baniſhed to Trajanopolis in Thrace, where he died. Of his numerous writings we have few remains, excepting the fragments collected by Fabricius. Jerome thought highly of his talents; Sozomen commends him for his piety and eloquence, and ſays that his works were in high eſtimation in his time. By Theodoret he is called the great Euſtathius: but Socrates and others ſpeak very ſlightingly of his talents, and Socrates ſays he is one of thoſe obſcure perſons who had endeavoured to raiſe his own reputation by oppoſing Origen. He is generally admitted to have been the author of "A Diſſertation concerning the Ventriloquiſt or Pythoneſs," mentioned in Samuel, firſt book, chap. xxvii. written againſt Origen on that ſubject. This was publiſhed by Alladius in Greek, with a Latin verſion, in 1629, and may be found in the 29th volume of the "Bibliotheca Patrum," and in the eighth volume of the "Critici Sacri." Fabr. Bib. Græc. vol. viii. Cave's H. L. vol. i. Lardner's Works, vol. iv.

EUSTATIA, or Eustatius, *St.*, in *Geography*, one of the leeward Caribbee iſlands; which is a huge pyramidal rock riſing out of the ſea, about 29 miles in compaſs; but for its ſize the Dutch, by their induſtry, rendered it one of the moſt valuable of the Caribbees. The ſides of the mountains are laid out in pretty ſettlements; but they have neither ſprings nor rivers. Sugar and tobacco have been the chief produce of this iſland, which the Dutch have cultivated even to the top of the pyramid, which terminates in a plain ſurrounded with woods, having a hollow in the middle that ſerves as a den for wild beaſts. This iſland has afforded ſubſiſtence for five thouſand white people, and fifteen thouſand negroes, who rear hogs, kids, rabbits, and all kinds of poultry in ſuch abundance, that they have been able to ſupply even their neighbours. It has but one landing place, which the original occupiers, finding difficult of acceſs, fortified, ſo as to render it almoſt impregnable. Such for many years was the policy of the Dutch in the government of this iſland, that they have been jealous of admitting any ſtrangers into their harbour, and kept them ignorant of its internal riches, whilſt it has ſerved as a ſtorehouſe for all European commodities. The property of it was firſt granted by the States-General to certain merchants of Fluſhing. It was firſt ſettled about the year 1600; but in the wars between the Engliſh and Dutch in 1665, the latter were diſpoſſeſſed of it by an armament from Jamaica. The Engliſh were afterwards diſpoſſeſſed by the combined forces of the Dutch and French; and the latter kept poſſeſſion of it till it was reſtored to the Dutch by the treaty of Breda. Soon after the revolution, the French ejected the Dutch from this iſland, whence they were again driven by the Engliſh under ſir Timothy Thornhill, who, with a view to the protection of the Dutch, left a ſmall Engliſh garriſon in the fort. The peace of Ryſwick reſtored the Dutch to the entire poſſeſſion of the iſland. In the year 1781 this iſland was obliged to ſurrender to the Engliſh under admiral Rodney, who confiſcated the private property of the inhabitants under a plea that they had aſſiſted France and the United States with naval and other ſtores. Before the cloſe of the year it was retaken by the French under the command of the marquis de Bouille; but reſtored to the Dutch at the peace in 1783. It is diſtant 9 miles N. W. from St. Chriſtopher's. N. lat. 17° 30′. W. long. 63° 8′.

Eustatia, is alſo the name of a town in the fore-mentioned iſland.

EUSTATIUS, in *Biography*, archbiſhop of Theſſalonica, flouriſhed in the 12th century, under the emperors Manuel, Alexius, and Andronicus Comnenus. He is celebrated for his great learning as a grammarian and critic, and is eſpecially known as a commentator on Homer and Dionyſius the geographer. His annotations on the former are copious, and abound in hiſtorical and philological deſcriptions: they were publiſhed at Rome in four volumes folio, between the years 1542 and 1550, and have been re-printed, particularly at Florence in 1730, with the notes and tranſlations of Politi and Salvini. The commentaries on Dionyſius were firſt printed in the Greek, by Robert Stephens in 1547, and have been ſeveral times re-printed. A Latin verſion of them was given by Politi in 1742, at Geneva, in two volumes octavo. Moreri.

EUSTEPHIA, in *Botany*, ευϛεφιος, *wearing a beautiful crown*, alluding to the coronet formed in the mouth of the flower, by the tranſverſe ſegments of the ſtamens. Cavan. Ic. v. 3. 20. Willd. Sp. Pl. v. 2. 48. Vent. Regn. Veg. v. 2. 282. Claſs and order, *Hexandria Monogynia*. Nat. Ord. *Spathaceæ*, Linn. *Narciſſi*, Juſſ.

Gen. Ch. *Cal.* Sheath oblong, divided to the baſe into four acute ſegments, withering. *Cor.* ſuperior, of one petal, tubular, regular, in ſix deep, linear, obtuſe, nearly equal ſegments, three of which are internal; without any appendage at the mouth. Nectary ſix little cavities in the baſe or tube of the corolla. *Stam.* Filaments ſix, inſerted into the bottom of the corolla, juſt above each nectariferous pore, linear, flat, ſomewhat longer than the corolla, and three-cleft juſt where they emerge from it, the middle ſegment longeſt, erect, ſlender, bearing the anther, the lateral ones ſhort, and horizontally divaricated, forming a crown in the mouth of the corolla; anthers incumbent, ovate. *Piſt.* Germen inferior, turbinate, triangular; ſtyle thread-ſhaped, the length of the ſtamens; ſtigma ſwelling, undivided. *Peric.* as far as can be judged from the germen, a capſule of three cells. *Seeds* . . . .

Eſſ. Ch. Calyx a divided ſheath. Corolla ſuperior, regular, tubular, cylindrical, in ſix deep ſegments. Nectary ſix pores in the baſe of the corolla. Filaments with two lateral points.

1. E. *coccinea*, Cavan. Ic. t. 238. Flowered in the royal garden at Madrid in May 1794, but its native country is unknown. *Root* perennial, bulbous. *Leaves* radical, ſeveral, linear, obtuſe, ſomewhat falcated. *Stalk* ſolitary, above a foot high, ſtout, ſmooth, ſlightly compreſſed. *Flowers* four in a terminal umbel, drooping, ſcarlet, reſembling thoſe of *Cyrtanthus anguſtifolius*, but very diſtinct in their ſtructure. *Sheath* nearly as long as the partial flower-ſtalks and flowers together.

EUSTOCHIUM, or Eustochia, in *Biography*, a Roman lady in the 4th century, who is highly ſpoken of by St. Jerome, was a deſcendant from the families of the Scipios and Paulus Æmilius, and rendered herſelf celebrated for the proficiency which ſhe had made in literature. She was well acquainted with the Hebrew and Greek, as well as the Latin tongues, and converſant with the moſt important theological ſubjects. In the Catholic world her memory is cheriſhed on account of her early devotedneſs to a religious courſe. She profeſſed herſelf a diſciple of St. Jerome, whom ſhe followed from Rome to Cyprus, and thence to Antioch, Egypt, and numerous other places, and at length fixed her reſidence in a monaſtery at Bethlehem. Her mother Paula deſerted a young family to accompany her in theſe excurſions. Moreri.

EUSTRATIUS, a preſbyter of the church of Conſtantinople, flouriſhed about the year 578, and was author of "A Treatiſe concerning the Souls of the Dead," intended to prove that the ſouls of all men are active after their ſeparation from the body, and that they act differently according to the difference of their merits. He was author alſo of "The Life of the Patriarch Eutychius," which appears to have been a funeral oration pronounced by Euſtratius in the great church at Conſtantinople, a ſhort time after the death of the ſubject of it.

Eustratius, archbiſhop of Nice in the twelfth century, is mentioned by Anna Comnena, and other Latin writers, as a perſon of profound learning and ſkill, as well in civil as eccleſiaſtical affairs. He was author of "A Treatiſe againſt Chryſolanus concerning the proceſſion of the

Holy Spirit," and of other unpubliſhed treatiſes. The only works of his which have been committed to the preſs are "Commentaries on the latter Analyſis of Ariſtotle," publiſhed in Greek at Venice, in 1534: and "Commentaries on the Ethics of Ariſtotle," publiſhed likewiſe in Greek at the ſame place, 1536, and at Paris in Latin, 1543. Moreri.

EUSTYLE, formed of ευ, *bene*, *well*, and ϛυλος, *column*, in *Architecture*, a kind of edifice, where the columns are placed at a moſt convenient diſtance one from another, the intercolumniations being all juſt two diameters and a quarter of the column, except thoſe in the middle of the fronts, before and behind, which are three diameters diſtant.

The euſtyle is a medium between the pycnoſtyle, and areoſtyle.

Vitruvius, lib. iii. cap. 2 obſerves, that the euſtyle is the moſt approved of all the manners of intercolumniation, and that it ſurpaſſes all the reſt in conveniency, beauty, and ſtrength.

EUTACA, in *Geography*, a mountain of Egypt, near the Red ſea; 12 miles S. of Suez.

EUTAM, a ſmall iſland of the Weſt Indies, near the eaſt coaſt of Porto-Rico. N. lat. 18° 18'. W. long. 64° 41'.

EUTERPE, in *Botany*, ευτερπης, *pleaſing or agreeable.* Gærtn. v. 1. 24. t. 9. Juſſ. 453. Suppoſed by Juſſieu to be the ſame with his *Corypha Sabal*, ſee our CORYPHA, ſp. 3, which Adanſon likewiſe made a diſtinct genus. If it be ſo, Gærtner's claſſical appellation may well take place of the barbarous Sabal.

EUTERPE, of ευ, *well*, and τερπω, *I delight*, in *Mythology*, one of the nine Muſes, which preſided over wind-inſtruments: ſhe is repreſented with a crown of flowers, playing on a double flute, with Cupid at her knees. Sometimes ſhe has a maſk in her left hand, and a club in her right. To her the invention of tragedy is aſcribed.

EUTHIA, a term in the *Ancient Muſic*, which implies a ſucceſſion of notes proceeding from grave to acute. Euthia was one of the parts of the ancient Melopœia.

EUTHYMIA, Ευθυμια, among the Greeks, ſignified ſuch a diſpoſition or ſtate of the mind, as could not be ruffled either by good or bad fortune, by ſickneſs or health, good or evil. Mem. Acad. Inſcript. vol. xiv. p. 131.

EUTHYMIUS, in *Biography*, flouriſhed in the tenth century, firſt as a monk, and afterwards, by his talents and virtues, he ſo far recommended himſelf to notice, that he obtained the appointment of "Syncelle," an office of high rank under the patriarch, and he was alſo choſen confeſſor by the emperor Leo VI. In 906 the patriarch Nicholas was depoſed by the emperor, and Euthymius was elevated to it in his ſtead. Upon the death of Leo, his ſucceſſor Alexander II. re-eſtabliſhed Nicholas in the patriarchal chair, and ſentenced Euthymius to baniſhment, a puniſhment which he bore with fortitude and patience till his death, in or about the year 920. Another patriarch of Conſtantinople, of the name of Euthymius, obtained that dignity in the year 1410, and enjoyed it till his death in 1416. Moreri.

EUTHYMIUS ZIGABENUS, was a monk of the order of St. Baſil, who flouriſhed at Conſtantinople about the beginning of the twelfth century. By his ſuperior talents he acquired the patronage and eſteem of the emperor Alexius Comnenus, at whoſe command he drew up his Panoplia, or defence of the orthodox faith againſt all hereſies. It conſiſts chiefly of paſſages ſelected from the writings of the ancient Greek fathers on different points, in which heretics have departed from the Catholic doctrine. Euthymius was alſo the author of "A Commentary upon the Pſalms and Canticles," of which a Latin verſion was publiſhed by Saulius in 1530, and ſince that time more than once reprinted: "A Commentary on the four Evangeliſts," ſelected from the ancient fathers; "Commentaries on the Epiſtles of St. Paul;" "A Treatiſe againſt the Hereſies of the Maſſalians, &c." Moreri.

EUTHYPOROS, from ευθυς, *ſtraight*, and ποριζω, *to paſs into*, among the old terms of *Surgery*, meant extenſion, made in a ſtraight line, in order to reduce fractures, and diſlocation.

EUTIN, in *Geography*, a town of Germany, in the biſhopric of Lubeck, ſituated by the ſide of a lake, the uſual reſidence of the prince biſhop, the biſhopric, like that of Oſnaburg, being ſecular; 20 miles N. of Lubeck. N. lat. 54° 10'. E. long. 10° 32'.

EUTOCIUS, in *Biography*, a conſiderable mathematician, who lived at the time of the decline of the ſciences in Greece, was a native of Aſcalon, in Paleſtine, and a diſciple of Iſidorus, one of the celebrated architects employed by the emperor Juſtinian. He probably flouriſhed about the commencement of the ſixth century, though we have no particulars reſpecting his life; but his works reflect much honour on his memory. He wrote elaborate and perſpicuous "Commentaries on the books of Archimedes concerning the Sphere and Cylinder;" and alſo on the firſt four books of the Conics of Apollonius Pergæus. Theſe commentaries have not only elucidated many difficult paſſages in thoſe profound writers, but have tended to throw light on the hiſtory of mathematics. There have been many editions of them, but the moſt magnificent was that in the edition of the works of Archimedes, printed at Oxford in folio, in the year 1792, which was prepared for the preſs by Torelli of Verona; and that in Dr. Halley's edition of the eight books of Apollonius, publiſhed at Oxford in 1710. Moreri. Montucla.

EUTROPIUS, a Latin hiſtorian of the fourth century, is ſuppoſed to have been a native of Acquitain. He bore arms under Julian, in his expedition againſt the Perſians, and is ſaid to have riſen to the ſenatorian rank. He wrote ſeveral works, of which the only one remaining is an abridgment of the Roman hiſtory, in ten books, from the foundation of the city to the reign of the emperor Valens. This is a neat compendium, and has long ſince been received as a ſchool-book. Moreri.

EUTROPIUS, the eunuch miniſter of the emperor Arcadius, who roſe by baſe and infamous practices from the vileſt condition to the higheſt pitch of opulence and power, was probably a native of Aſia. In the year 395 he was made great-chamberlain to Arcadius, emperor of the Eaſt. After the fall of Rufinus, he ſucceeded that miniſter in the confidence of his maſter, and roſe to unlimited authority. All perſons of whatever rank humbled themſelves before the favourite, who became the capricious diſpoſer of honours and emoluments of every kind, and in 399 he, an eunuch, even aſſumed the dignity of conſul, a diſgrace to Rome never before equalled. Honours, if ſuch they may be denominated, of every kind were accumulated upon him: the towns were filled with his ſtatues, and he was entitled the third founder of Conſtantinople. His predominant paſſion was the love of money, and of courſe the moſt ſhameful venality directed all appointments to the high offices of the ſtate. As a ſecurity to his perſon, a law of treaſon was paſſed, which extended the penalties of that crime to every attempt againſt the miniſters and ſervants, as well as againſt the perſon of the emperor. Such a ſhield was not ſufficient to defend him from the influence of court intrigue. An inſult

ſult which he offered to the empreſs cauſed her to implore the protection of her huſband, and at the ſame moment complaints were offered againſt him from other quarters, which induced the emperor to ſign his condemnation, and the fallen and juſtly execrated favourite was obliged to ſeek refuge in the ſanctuary of a church, from the pulpit of which Chryſoſtom pronounced an eloquent diſcourſe, pointing him out to the people as an example of the inſtability of human grandeur. He afterwards ſurrendered himſelf on promiſe that his life ſhould be ſpared, and was condemned to perpetual exile in Cyprus. Thither he was conveyed, but being haſtily brought back and tried on another charge, he was condemned and beheaded in the year 399. Gibbon.

EUTYCHIA, in *Ancient Geography*, an iſland of the Ægean ſea, before the Pagaſei gulf.

EUTYCHIANS, in *Eccleſiaſtical Hiſtory*, ancient heretics, who denied the duplicity of natures in Chriſt; thus denominated from Eutyches, the archimandrite, or abbot of a monaſtery at Conſtantinople, who began to propagate his opinion A. D. 448.

The averſion Eutyches bore to the hereſy of Neſtorius threw him into another extreme not leſs dangerous than that he ſo warmly oppoſed; though ſome paſſages in St. Cyril, which raiſed the unity of the perſon of Jeſus Chriſt very high, contributed likewiſe to his deluſion. At firſt he held that the *Logos*, *Word*, brought his body down with him from heaven; which was a near approach to the hereſy of Apollinarius; and, though he afterwards teſtified the contrary, in a ſynod at Conſtantinople, wherein he was condemned, yet he could not be brought to acknowledge that the body of Jeſus Chriſt was conſubſtantial with ours.

In effect, he did not ſeem quite ſteady and conſiſtent in his ſentiments; for he appeared to allow of two natures, even before the union; which was apparently a conſequence he drew from the principles of the Platonic philoſophy, which ſuppoſes a pre-exiſtence of ſouls; accordingly he believed that the ſoul of Jeſus Chriſt had been united to the divinity, before the incarnation; but then he allowed no diſtinction of natures in Jeſus Chriſt ſince his incarnation.

See the diſſertation of H. Hardouin, "De Sacramento Altaris;" wherein that Jeſuit endeavours to unfold all the ſentiments of the Eutychians.

This hereſy was firſt condemned in a ſynod held at Conſtantinople, by Flavian, in 448, approved by the council of Epheſus, called *Conventus latronum*, in 449, and re-examined and fulminated, in the general council of Chalcedon, in 451. The legates of pope Leo, who aſſiſted at it, maintained, that it was not enough to define, that there were two natures in Jeſus Chriſt, but inſiſted ſtrenuouſly, that, to remove all equivocations, they muſt add theſe terms, *without being changed, or confounded, or divided.*

The hereſy of the Eutychians, which made a very great progreſs throughout the Eaſt, at length became divided into ſeveral branches. Nicephorus makes mention of no fewer than twelve; ſome called *ſchematici*, or *apparentes*, as only attributing to Jeſus Chriſt, a phantom, or appearance of fleſh; and no real fleſh; others *Theodoſians*, from Theodoſius, biſhop of Alexandria; others *Jacobites*, from one James, *Jacobus*, of Syria; which branch eſtabliſhed itſelf principally in Armenia, where it ſtill ſubſiſts. Others were called *Acephali*, q. d. *without head;* and *Severians*, from a monk called Severus, who ſeized on the ſee of Antioch in 513.

Theſe laſt were ſubdivided into five factions, *viz. Agnoetæ*, who attributed ſome ignorance to Jeſus Chriſt; the followers of Paul; Μελαινοι, that is, the *black Angelites*, thus called from the place where they were aſſembled; laſtly, *Adrites*, and *Cononites.*

Eutychians was alſo the name of another ſect, half Arian, half Eunomian, which aroſe at Conſtantinople in the fourth century.

It being then a matter of mighty controverſy among the Eunomians at Conſtantinople, whether or no the Son of God knew the laſt day and hour of the world, particularly with regard to that paſſage in the Goſpel of St. Matthew, chap. xxiv. ver. 36. or, rather, that in St. Mark, xiii. 32. where it is expreſſed, that *the Son did not know it, but the Father only;* Eutychius made no ſcruple to maintain, even in writing, that the Son did not know it; which ſentiment diſpleaſing the leaders of the Eunomian party, he ſeparated from them, and made a journey to Eunomius, who was then in exile.

That heretic acquieſced fully in Eutychius's doctrine, and admitted him to his communion; Eunomius dying ſoon after, the chief of the Eunomians at Conſtantinople refuſed to admit Eutychius; who, upon this, formed a particular ſect of ſuch as adhered to him, called *Eutychians.*

This ſame Eutychius, and one Theophronius, as was ſaid in Sozomen's time, were the occaſions of all the changes made by the Eunomians in the adminiſtration of baptiſm; which conſiſted, according to Nicephorus, in only uſing one immerſion, and not doing it in the name of the Trinity, but in memory of the death of Jeſus Chriſt.

Nicephorus calls the chief of that ſect not Eutychius, but Eupſychius, and his followers Eunomioeupſychians.

EUTYCHIANUS, in *Biography*, biſhop of Rome, ſucceeded to that high office on the death of Felix, in the year 275, and preſided over the church about eight or nine years, when he died. Catholics have conſidered him as a martyr to the cauſe of truth; but hiſtorians, in general, infer, from the unmoleſted ſtate of Chriſtians, at that period, in Rome, that he died a natural death. There are two decretal epiſtles of this pope extant, relative to ſubjects of eccleſiaſtical diſcipline. Moreri. Bower.

EUTYCHIUS, patriarch of Conſtantinople, was born in the year 512. He was brought up to the eccleſiaſtical profeſſion, and obtained in early life the epiſcopal dignity in a town of Pontus, which he afterwards relinquiſhed, and entered into a monaſtery in the city of Amaſæa. In 552 he was deputed by the biſhop of that city to Conſtantinople, as his repreſentative, in the approaching general council that was to be held there. Before the meeting of the council, he obtained the favour of Juſtinian, who raiſed him to the patriarchate of Conſtantinople, which became vacant in the year 553, by the death of Mennas. Almoſt immediately after he had aſſumed the new character, he preſided at the council in which the opinions of Origen and his followers were condemned. Some years after, *viz.* in the year 564, Juſtinian endeavoured to obtain the patriarch's ſanction to a doctrine which he had adopted, *viz.* that the body of Jeſus Chriſt was rendered incorruptible before his reſurrection, by the union of the divine and human natures; but when Eutychius ſteadily refuſed to countenance the opinion, the emperor depoſed him from the patriarchate and ſent him into exile. In 578, he was reinſtated in the ſee of Conſtantinople, by the emperor Tiberius II. and he died in the year 585, at the age of 73. There is extant, in the fifth volume of the "Collectio Conciliorum," an epiſtle of his to pope Vigilius.

He was author of other pieces; of theſe a fragment of one only remains, "Concerning the Souls of the Dead." Moreri.

EUXINE Sea, called the *Black Sea*, as it is ſaid, either from its black rocks, or dangerous navigation, an inland ſea, ſituated partly in Europe, and partly in Aſia; bounded on the north by the government of Caucaſus and Ekatarinoſlaf, on the caſt by Mingrelia and Georgia, on the ſouth by Natolia, and on the weſt by European Turkey. This ſea is divided into the Euxine proper, the Pontus Euxinus, computed to be 1000 verſts in length, and 500 in breadth, and the ſea of Azof, (ſee Azof) the Palus Mæotides of the ancients, which, without including the bay of Tagauroh, is ſtated to be 200 verſts long, and 160 verſts broad. Both theſe are now entirely within the confines of the Ruſſian empire. The ſea of Azof, called palus, or a marſh, by the ancients, becauſe it was polluted by mud, is united to the Euxine by the ſtraits of Caſſa, or the ancient Cimmerian Boſphorus. The moſt important of the bays formed by theſe ſeas are the Liman, at the mouth of the Dnieper, the bay near Perekop, and that cloſe to Yenikalé. The moſt conſiderable iſland belonging to theſe ſeas in the vicinity of the Ruſſian coaſts, is Taman. The principal harbours are Caffa, now Theodoſia, Sebaſtopol, Koſlof, Balaklava, and ſome others. At the weſtern extremity of theſe ſeas, within the province of Taurida, is a very large pool, called Sivaſh, or the Putrid ſea, which is about 140 verſts long, and 54 broad. The chief rivers that fall into the Euxine, are the Kuban, or Hypanis of the ancients, the Don, or ancient Tanais, the Dnieper or Boryſthenes of ancient geographers, and the Bogur, which riſes in Poland, parting that kingdom, and a portion of European Turkey from Ruſſia, and at Otchakof, falls into the Euxine. The Euxine ſea was formerly denominated αξινος, or *inhoſpitable*, on account of the barbarity of the inhabitants of its coaſts; but when they became civilized by their commerce with the Greeks, the name was changed into ευξινος, i. e. *hoſpitable*, or favourable to ſtrangers.

EUZET, a town of France, in the department of the Gard; nine miles W. N. W. of Uzes.

EUZOIUS, in *Biography*, was in early life a deacon of the church of Alexandria, from which office he was expelled by Alexander, biſhop of that ſee, at the ſame time with Arius, on account of his eſpouſing the principles of that celebrated character. They were both involved in the like condemnation at the council of Nice. About the year 355, he preſented a confeſſion of faith to the emperor Conſtantine, which met with the approbation of that ſovereign, and which was the means of bringing him into conſequence at the imperial court, when the orthodox party were thrown in the back ground. He was appointed to the ſee of Antioch, and called upon to baptiſe the emperor Conſtantius. His influence was now very conſiderable, and to this the friends of Athanaſius attribute much of the perſecution by which that biſhop was harraſſed. Moreri.

Euzoius, biſhop of Cæſarea, was educated in that city at the ſame time with Gregory Nazianzen. On the death of Acacius he obtained the biſhopric of Cæſarea, after maintaining a violent conteſt with the different rival candidates. He was in principle an Arian, or nearly ſo, and on that account was depoſed from his ſee under the reign of the emperor Theodoſius, about the year 380. He was author of numerous treatiſes now loſt; poſſeſſed with much learning, and was very diligent in the diſcharge of his epiſcopal functions; but he is principally celebrated on account of his great exertions in promoting the intereſts of ſcience and literature. He manifeſted much zeal in the reſtoration and improvement of the library at Cæſarea, which had been originally collected by Origen and Pamphilus, and was at this period fallen into decay. To this object he devoted his time and labour, taking care that faithful tranſcripts ſhould be procured of ſuch books as were in a periſhing ſtate, and increaſing their numbers by new collections. Moreri.

EWAGE, *Ewagium*, in our *Old Writers*, the ſame with *aquage*, which is toll paid for water-paſſage. It is derived from the French *eau*, water.

EWALD, John, in *Biography*, a Daniſh poet, was born at Copenhagen in the year 1743. His father was a clergyman, and when he found his own end approaching he ſent his ſon for education to Sleſwick, and died in a few hours after. Licht, the perſon to whoſe care young Ewald was entruſted, treated him in every reſpect as his own ſon, and gave him free acceſs to his library. The books moſt agreeable to his taſte were romances, which he read with the greateſt avidity. The adventures of Tom Jones and Robinſon Cruſoe, particularly the latter, had made ſuch an impreſſion on his mind, and had excited his paſſions ſo ſtrongly, that he eloped from Sleſwick in his thirteenth year, in order to proceed to Holland, that he might undertake a voyage to Batavia, in the hope of being ſhipwrecked and thrown on ſome deſert iſland. Scarcely had he travelled four miles, before he was overtaken by his preceptor and friend, who carried him back by force. At another time having read and heard of many romantic tales reſpecting ſaints and martyrs, he was deſirous of becoming a martyr for the cauſe of Chriſtianity. At length he reſolved upon the profeſſion of a ſoldier, which being oppoſed by his friends, he left home, in company with his brother, and joined the Pruſſian ſervice, from this he deſerted to the Auſtrian army, in which he was firſt a drummer, and then a ſerjeant. A commiſſion was offered him, provided he would embrace the Catholic religion, which he abſolutely refuſed, and in a ſhort time deſerted again. On his return to Denmark he devoted himſelf to theology, and ſtudied with ſo much deligence as to be fit for examination in the courſe of a year. He had paid his addreſſes to a lady, who, ſuſpecting him not to be in earneſt, gave her hand to another: this ſo affected Ewald as to produce a complete change in his diſpoſition, and to give his ideas a melancholy caſt. He now abandoned himſelf to pleaſure, and injured his conſtitution. To give vent to the effuſions of his mind, he wrote a piece, called "The Temple of Good Fortune," which proved the ſource of all his future fame. It obtained the approbation of the ſociety of Belles-lettres; and procured him the friendſhip of M. Carſtens, a zealous votary of the muſes, which he enjoyed, without interruption, during the remainder of his life. On the death of Frederic V. in 1766, he compoſed an elegy, which was received with univerſal approbation, and Ewald, intoxicated with the praiſes beſtowed upon his work, began to conſider himſelf one of the greateſt poets that Denmark had ever produced. The ſociety of Belles-lettres propoſed as the ſubject of a prize the beſt ode on any of the attributes of the deity, and Ewald, determined to try his fortune, made choice of the divine goodneſs, and had already formed his plan, when he learned that Benzon, one of his moſt intimate friends, was employed on the ſame ſubject. Unwilling to enter the conteſt with a friend he abandoned his ſubject, and wrote his Adam and Eve, a ſort of half drama, in one act, which poſſeſſed much merit, but without order or any regard to the laws of compoſition. He hoped that this might obtain the prize, but was diſappointed, and began to ſtudy poetry, being now reſolved to read; and not to write any more for two years. The works of Corneille and Klopſtock fell into his hands, and gave his taſte a new direction. His next work was "Rolfe Krage," a tragedy in the ſtyle of Oſſian, and "The ſongs of Skalden," which he wrote under the eye of Klopſtock, who had a very great and ſincere affection for him. During the time he was employed on this piece, he was attacked by a diſeaſe, under which he languiſhed for ten years. It proceeded from the gout, and was often attended with excruciating pain, yet his ſpirits and cheerfulneſs rarely forſook him, and he wrote in the intervals of his eaſe ſome ſmall theatrical pieces, which in part related to preſent times and manners, and which abounded with humour and the keeneſt ſatire. Ewald had obtained from the king a penſion of a hundred dollars, but this being inſufficient for his maintenance, he was obliged, by writing temporary poems, to gain a part of his livelihood, till the profits ariſing from the repreſentation of his theatrical pieces, and from the ſale of his works, ſhould place him beyond the fear of want. He died at Copenhagen in March 1781, in the thirty-eighth year of his age. In ſtrength of imagination, ſpirit and originality, Ewald ſurpaſſes all the other Daniſh poets. His excellent qualities gained him the affection of thoſe who knew him. He never proſtituted his muſe to improper purpoſes, and never, ſays his biographer, did an immoral or pernicious line flow from his pen. A complete edition of his works was publiſhed at Copenhagen between the year 1781—1791. Gen. Biog.

EWANICZOW, in *Geography*, a town of Poland, in the palatinate of Kaminiec; 64 miles N.N.W. of Kaminiec.

EWANO, a town of Poland, in Galicia; 36 miles S.E. of Halicz.

EWE, a ſmall iſland on the W. coaſt of Scotland, at the entrance of Loch Ewe. N. lat. 57° 53′. W. long. 5° 37′.

Ewe, in *Rural Economy*, the female of the ſheep kind of animals. It is of very great importance in the forming of this ſort of ſtock to have good ewes. (See Sheep.) It is the practice in ſome of the more northern diſtricts to have recourſe to the milking of the ewes in order to make cheeſe from it. But it is ſaid to have been lately found ſo injurious to the animals, and to be attended with ſo little profit, that it is, at preſent, much on the decline.

Ewe-*Cheeſe*, is that ſort of cheeſe which is prepared from the milk of the ewe. It is a very ſtrong pungent kind of cheeſe, which is not well reliſhed by many. Some, however, conſider it as very rich and excellent, preferring it to the other ſorts of cheeſe. In ſome places theſe cheeſes are made of a conſiderable ſize, perhaps, nearly as large as thoſe of the Cheſhire dairies, one, two, or three hundred ewes being milked regularly for the purpoſe. See Cheese.

EWELL, in *Geography*, is a market town in the hundred of Copthorne, and county of Surry, ſituated at the foot of Banſtead downs, diſtant S.E. by E. of London 13 miles. The weekly market is held on Thurſdays, and it has two annual fairs, one the 12th of May, the other the 29th of October. The number of houſes, according to the returns in 1801, is 194, and of inhabitants 1112. Here is the head of an extraordinary ſpring, which forms a curious natural jet d'eau, breaking out in ſeveral places. After watering Epſom-court meadows it flows in a fine ſtream called the Malden, and falls into the river Thames at Kingſton.

Near this town ſtood the magnificent palace, from its grandeur and ſplendid decorations, denominated "None-Such," erected by king Henry the Eighth. Charles the Second having conferred it upon his favourite miſtreſs, the infamous ducheſs of Cleveland, ſhe cauſed it to be taken down, and ſold the materials.

EWENNY, a river which has its ſource in the mountains to the north of Peterſton ſuper montem, and paſſing by Coychurch and Ewenny priory, joins the river Ogmore near Merthyr Mawr, below which it falls into the Briſtol channel. A phenomenon on this ſtream has given riſe to a geological error, which has generally been credited without proper inveſtigation, that the river makes a "dip under a mountain, appearing again near Nevern bridge, after a ſubterraneous paſſage of two miles." "Mr. Lethieuller obſerves, "that between Merthyr Mawr, near which alſo were deep ſands, and New-inn bridge, the river Ogmore, or rather a branch of it, runs a quarter of a mile under the hill, paſſing alſo under ſeveral natural bridges; after which, iſſuing out with great violence, it joins the main ſtream. The maps again here miſtake in giving this river the name of Ogmore before its junction with the Ewenny, after which only it aſſumes that name, being called before the Bridgend river, as it comes from Bridgend, where it runs under ground a little to the north of that place, and appears again from under Ogmore hill." See Archæologia, vol. iv. p. 27. It occurs near the junction of the Ewenny with the river Ogmore. From the foot of a long ridge of down, where the hill makes a bold eſcarpement to the vale, iſſues a large body of water, exceeding the quantity previouſly flowing down the river, except after rains. In its paſſage from under the hill it is heard to boil and rage, and ruſhes out with foaming impetuoſity, as though it had met with violent interruption in its courſe; and forms two ſtreams, which immediately appear different in the velocity of their motions and quality of their contents; one being what is vulgarly called *hard*, and the other *ſoft* water. The ſtream to the ſouthward is ſought for culinary, and that to the northward for lavatory purpoſes. In trying it, Mr. Evans obſerves, "the water from the oppoſite ſides of the ſtream had a different effect upon the tongue and palate, and by a brief analyſis it was diſcovered, that the one contained a portion of calcareous matter in ſolution; and the other left but little reſidue, which was of an argillaceous nature." An attempt was then made to aſcertain whether the river might not enter ſome other part of the hill, and by a ſubterraneous paſſage here ſeek daylight again, as is reported of the Deveril in Wiltſhire, and the Mole in Surry. But after a fruitleſs ſearch the ſmalleſt veſtige of ſuch a ſubterraneous courſe could not be traced. The phenomenon therefore in queſtion appears to proceed from two powerful ſprings, riſing in the internal parts of the hill, the ſtreams of which having flowed ſeparately, here unite, but without intermingling their waters, till they join the Ewenny. Evans's Tour in South Wales.

Ewenny *Priory*, in *Antiquity*, was a monaſtery of the Benedictine order, founded by John Maurice de Lundres, Lord of Ogmore, A. D. 1140; and given as a cell to Glouceſter Abbey. Its revenues, as valued at the diſſolution, were 78*l.* 0*s.* 8*d.* It ſtands cloſe to the road leading from Newton to Pyle in Glamorganſhire, South Wales, in a marſhy plain, near the banks of the river Ewenny. It was ſurrounded by ſtrong embattled walls, having two gateways; and the one forming the principal entrance had two portculliſes: theſe, with parts of maſſive towers viſible among its ruins, indicate it was intended as a place of ſecurity, as well as religious retirement. The buildings appear to have been very extenſive, and ſome rooms, which formed the abbot's lodge yet remaining, are large and ſtately; particularly the great hall or refectory. But the abbey church, ſtill ſtanding, is a noble edifice, the ſimple and uniform architecture of which muſt be gratifying to every admirer of the arts. It is a maſſive building of a cruciform ſhape, conſiſting

ing of a nave, two tranſepts, and a choir; in which heavy circular arches reſt upon round bulky columns with ſimple capitals: the windows alſo and door-ways have all the circular arch, which have induced ſome to refer it to a Saxon period. The whole certainly denotes the earlieſt Norman ſtyle of architecture. The curious ſtone vaulted groined roof of the choir claims particular attention; and the neglected effigies of the founder, bearing this inſcription, "Ici giſt Morice de Lundres le fundur, Deu li rende ſun labur. Am." In the ſouth tranſept lies another rude ſtone figure of a knight in armour, which has generally been thought commemorative of Pain de Tuberville lord of Coity. But ſir Richard Hoare has ſhewn this ſtatement, which originated with Camden, to be erroneous. After having the tomb cleaned, he was enabled to read the inſcription thus,

> "Sire Roger de Remi giſt ici
> Deu de ſon alme eit merci am."

The perſon here named "De Remi," ſir Richard ſuppoſes to have been ſome friend, and follower of Morice de Lundres. The floor of the church has been paved with glazed porcelain tiles, ornamented with various devices, ſuch as are ſeen in other buildings of a ſimilar nature; but few now remain. The nave is at preſent uſed as the pariſh church for divine worſhip, and the choir has a cemetery for diſtinguiſhed families in the vicinity: monuments for whom, particularly that of Carne, adorn its walls. It muſt be matter of regret to thoſe intereſted in ancient buildings, to ſee the preſent dilapidated ſtate of this once noble ſtructure: in many places rooflefs, the windows unglazed, the roof of the choir cracked, the ſepulchral monuments broken, and thrown careleſsly about; and this noble ſanctuary, which has ſtood near ſeven hundred years, and exhibits the moſt perfect ſpecimen of early Norman architecture of any church in the kingdom, rapidly approaching to its diſſolution. Evans's Tour in South Wales, and the Tranſlation of Gyraldus's Itinerarium by ſir Richard Colt Hoare.

EWER, in *Rural Economy*, a term ſometimes provincially applied to the udder of the cow, or other animal. See Udder

EWES, or Eus, in *Geography*, a river of Scotland, which joins the Eſk at Langholm, in Dumfries-ſhire; and the valley through which it paſſes is called Ewesdale.

EWRY, an office in the king's houſhold, where they take care of the linen for the king's table; lay the cloth, and ſerve up water in ſilver ewers after dinner, whence the office takes its name.

EXACERBATION, in *Medicine*, ſignifies the increaſe or return of the ſymptoms in thoſe fevers of the remittent, intermittent, or even continued claſs, in which the febrile condition is renewed at regular periods, or becomes augmented. It is nearly ſynonymous with *Paroxyſm*; but is more particularly reſtricted to the periodical increaſe of the remittent, or continued fevers, in which there is no abſolute ceſſation of the febrile ſtate. The evening exacerbation of hectic fever is a familiar example. Dr. Cullen aſſerts his belief, that there are commonly two exacerbations and remiſſions both of hectic and of continued fever in the day; the one in the forenoon, the other in the evening: that of the morning, however, if it really occurs, is leſs diſtinct, and many practitioners have been unable to detect it. See Fever, and Hectic.

EXACHORD. See Hexachord.

EXACHORDE, *Fr.* Essacordo, *Ital.*, an inſtrument with ſix ſtrings, or a ſyſtem compoſed of ſix ſounds, ſuch as the hexachord of Guido, which ſee.

EXACTION, in *Law*, a wrong done by an officer, or one pretending to have authority: in taking a reward, or fee, for that in which the law allows not of any.

The difference between exaction and extortion, conſiſts in this; that extortion is, where the officer takes more than his due; and exaction, where he wreſts a fee, or reward, where none is due.

EXACTIS, in *Natural Hiſtory*, a name given by Linkius, and ſome other authors, to a ſpecies of ſtar-fiſh, of the more branched kind, whoſe rays are ſix in number, when they firſt part from the body, but very ſoon branch out into a great number more. See Star-*fiſh*.

EXACTOR Regis, in *Law*, the king's exactor, or collector. Sometimes it is taken for the ſheriff. But generally, "quicunque publicas pecunias, tributa, vectigalia & res fiſco debitas exigit, proprie nominatur exactor regis."

EXACUM, in *Botany*, a name which Pliny ſays has been given to the Leſſer Centaury, becauſe it carries off all bad medicines by ſtool, apparently from ἐξ, *out of*, and [illegible], *to drive*, or *force onward*. Linn. Gen. 57. Schreb. 77. Willd. Sp. Pl. v. 1. 634. Sm. Fl. Brit. 182. Mart. Mill. Dict. v. 2. Juſſ. 142 Gærtn. t. 114. Claſs and order, *Tetrandria Monogynia*. Nat. Ord. *Rotaceæ*, Linn. *Gentianæ*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, in four deep, ovate, ſlightly ſpreading, permanent ſegments. *Cor.* of one petal, permanent, ſalver-ſhaped; tube inflated, the length of the calyx; limb in four deep, roundiſh, ſpreading lobes. *Stam.* Filaments four, thread-ſhaped, inſerted into the tube, not ſo long as the limb; anthers roundiſh. *Piſt.* Germen ſuperior, oval, filling the tube; ſtyle thread-ſhaped, rather oblique, the length of the ſtamens; ſtigma capitate. *Peric.* Capſule elliptical, as long as the calyx, compreſſed, with a longitudinal furrow at each ſide, of two cells, burſting at the top. *Seeds* numerous, ſmall, roundiſh, affixed to a central receptacle which forms the partition of the capſule.

Eſſ. Ch. Calyx in four ſegments. Corolla ſalver-ſhaped, with an inflated tube. Capſule ſuperior, with two furrows, two cells, and many ſeeds, burſting at the top. Stigma capitate.

Obſ. The flowers in ſome ſpecies are five-cleft, with a correſpondent number of ſtamens.

Since this genus was founded by Linnæus on the examination of ſome dried Eaſt Indian ſpecimens of his *E. ſeſſile* and *pedunculatum*, Sp. Pl. 163, ſeveral ſpecies have been added to it by different botaniſts, either entire new diſcoveries, or ſeparated from the old genus of *Gentiana*. Vahl has alſo referred hither the *Coutoubea* of Aublet, Guian. t. 27, 28, with unqueſtionable propriety, though Juſſieu and Schreber have kept it ſeparate, the latter by the name of *Picrium*, alluding to its bitterneſs.

Our only Britiſh ſpecies is *E. filiforme*, Engl. Bot. t. 235, found in ſpongy or ſandy bogs, in Dorſetſhire, Devonſhire, and Cornwall, flowering in July. This is a ſmall, ſlender, inconſpicuous annual, with a branched *ſtem*; oppoſite, ſeſſile, lanceolate *leaves*; and ſmall, terminal, ſolitary, yellow *flowers*, expanded only while the ſun ſhines bright upon them. It was the *Gentiana filiformis* of Linnæus and all following authors, till referred to *Exacum* in Engl. Bot.

E. *viſcoſum*. Sm. Ic. Pict. t. 18. (Gentiana viſcoſa; Ait. Hort. Kew. v. 1. 321.) has pentandrous five-cleft flowers. This is a handſome green-houſe plant, brought from the Canary iſlands by Mr. Maſſon. The *ſtem* is ſhrubby, three feet high, with oblong ribbed *leaves*, and large terminal panicles of yellow *flowers*.

The annual ſpecies are ſcarcely to be cultivated, no ſucceſsful method of raiſing them from ſeed in a garden having yet been diſcovered.

EXÆRESIS, from εξ, *out of*, and αιρω, *to remove*, in *Surgery*, was divided by the ancients into ſix branches, namely, ſyntheſis, diæreſis, exæreſis, aphæreſis, proſtheſis, and diorthroſis. Exæreſis implied all ſuch methods and operations, as had for their object the removal of diſeaſed, redundant, or extraneous ſubſtances from the body.

EXAGGERATION, in *Rhetoric*, a figure whereby we enlarge or heighten things; making them appear more than they really are, whether as to goodneſs, badneſs, or other qualities.

The word is formed of the Latin *exaggero, I exaggerate;* which is a compound of *ex* and *agger, a mound*, or *elevation of earth*. See Hyperbole.

Exaggeration, in *Painting*, is a method of repreſenting things, wherein they are loaded too much, or marked too ſtrongly; whether in reſpect of the deſign, or the colouring, or the poſition of the object.

Exaggerating differs from caricaturing, in that the latter perverts, or gives a turn to the features, &c. of a face which they had not; whereas the former only improves, or heightens what they had.

The latter is a kind of burleſque on the object, and is generally meant to ridicule: the former is uſually an exalting or enlivening of the beauties of the object, beyond what nature allows. The painter is obliged to have recourſe to an exaggeration of colours, both on account of the ſurface of his ground, the diſtance of his work, and of time, and the air, which diminiſh and weaken the force of the colours; but this exaggeration muſt be conducted in ſuch a manner, as not to put the objects out of their natural characters. The term exaggeration is not now in uſe. See Style in *Painting*.

EXAGON. See Hexagon.

EXA'LMA, from εξαλλω, *to leap out*, in *Surgery*, a diſlocation of the vertebræ, according to Hippocrates.

EXALTACION, in *Geography*, a town of South America, in the government of Moyes; 50 miles S. of Trinidad.

Exaltation *of the Croſs*. See *Exaltation of the* Croſs.

EXALTATION, Elevation, is chiefly uſed in a figurative ſenſe, for the raiſing or advancing a perſon to ſome eccleſiaſtical dignity; and particularly to the papacy.

The term exaltation is, in ſome meaſure, appropriated to the pope; and expreſſes his inauguration, coronation, taking poſſeſſion, and the beginning of his pontificate.

We ſhall here add, that the croſs was delivered up by a treaty of peace made with Siroes, Choſroes' ſon. The inſtitution of this treaty is commonly ſaid to have been ſignalized by a miracle; in that Heraclius could not ſtir out of Jeruſalem with the croſs, while he had the imperial veſtments on, enriched with gold, and precious ſtones; but bore it with eaſe, in a common dreſs.

But, long before the empire of Heraclius, there had been a feaſt of the ſame denomination obſerved both in the Greek and Latin churches, on occaſion of what our Saviour ſaid in St. John, xii. 32. "And I, if I be exalted, or lifted up, will draw all men unto me." And again, in ch. viii. ver. 28. "When ye have exalted, or lifted up, the Son of man, then ſhall ye know that I am he." F. Du Soulier aſſures us, that M. Chaſtelain was of opinion, this feaſt had been inſtituted, at leaſt at Jeruſalem, two hundred and forty years before Heraclius.

The feaſt of the dedication of the temple built by Conſtantine, was held, ſays Nicephorus, on the fourteenth of September, the day on which the temple had been conſecrated, in the year 335; and this feaſt was alſo called the exaltation of the croſs, becauſe it was a ceremony therein, for the biſhop of Jeruſalem to aſcend a high place, built by Conſtantine for that purpoſe, in manner of a pulpit, called by the Greeks, the "ſacred myſteries of God," or, "the holineſs of God," and there hoiſt up the croſs, for all the people to ſee it.

Exaltation, in *Phyſics*, denotes the act, or operation, of elevating, purifying, ſubtilizing, or perfecting, any natural body, its principles and parts; alſo the quality, or diſpoſition, which bodies acquire by ſuch operation.

The term exaltation has been peculiarly affected by the ancient chemiſts and alchemiſts; who imagining it to have ſome extraordinary emphaſis, are employing it on every occaſion.

Exaltation, in *Aſtrology*, is a dignity which a planet acquires in certain ſigns, or parts of the zodiac; which dignity is ſuppoſed to give it an extraordinary virtue, efficacy, and influence. The oppoſite ſign, or part of the zodiac, is called the dejection of the planet.

Thus, the 15th degree of Cancer is the exaltation of Jupiter, according to Albumazar, becauſe it was the aſcendant of that planet at the time of the creation; that of the ſun is in the 19th degree of Aries; and its dejection in Libra; that of the moon is in Taurus, &c. Ptolemy gives the reaſon of this in his firſt book De Quadrup.

EXAMEN, or Examination, an exact and careful ſearch, or inquiry, in order to diſcover the truth or falſehood of a thing.

EXAMILION, &c. See Hexamilion, &c.

EXAMINATION, Self, is a point much inſiſted on by divines, and particularly the ancient fathers, by way of preparation to repentance. St. Ignatius reduces it to five points; *viz.* 1. A returning of thanks to God for his benefits. 2. A begging of grace and light, to know and diſtinguiſh our ſins. 3. A running over all our actions, occupations, thoughts, and words, in order to learn what has been offenſive to God. 4. A begging of pardon, and conceiving a ſincere ſorrow for having diſpleaſed him. And, 5. Making a firm reſolution not to offend him any more; and taking the neceſſary precautions to preſerve ourſelves from it.

Examination *of Bankrupt*, in *Law*. See Bankrupt.

Examination *of Priſoners*. See Commitment.

Examination, or Inspection, *Trial by*, is when, for the greater expedition of a cauſe, in ſome point or iſſue being either the principal queſtion, or ariſing collaterally out of it, but being evidently the object of ſenſe, the judges of the court, upon the teſtimony of their own ſenſes, ſhall decide the point in diſpute. Thus, in caſe of a ſuit to reverſe a fine for non-age of the cognizor, or to ſet aſide a ſtatute or recognizance entered into by an infant; in this, and in ſimilar caſes, a writ ſhall iſſue to the ſheriff (9 Rep. 31.), commanding him that he conſtrain the ſaid party to appear, that it may be aſcertained by the view of his body by the king's juſtices, whether he be of full age or not. If, however, the court, upon inſpection, has any doubt of the age of the party, it may proceed to take proofs of the fact; and, particularly, may examine the infant himſelf upon an oath of *voir dire, veritatem dicere*, that is, to make true anſwer to ſuch queſtions as the court ſhall demand of him; or the court may examine his mother, his godfather, or the like. (2 Roll. Abr. 573.) In like manner, if a defendant pleads in abatement of the ſuit that the plaintiff is *dead*, and one appears and calls himſelf the plaintiff, which the defendant denies; in this caſe the judges ſhall determine, by inſpection and examination, whether he be the plaintiff or not. (9 Rep. 30.) Alſo, if a man be found by a jury an idiot, *à nativitate*, he may come in perſon into the chancery before the chancellor, or be brought there by his friends, to be inſpected and examined, whether idiot or not; and if, upon ſuch view and inquiry, it appears he is not ſo, the verdict of the jury, and all the proceedings thereon, are utterly void and inſtantly of no effect. (Ibid. 31.) The trial by inſpection may be alſo uſed, upon an appeal of maihem, when the iſſue joined is whether it be maihem or no maihem, this ſhall be decided by the court upon inſpection, for which purpoſe they may call in the aſſiſtance of ſurgeons. (2 Roll. Abr. 578.) And by analogy to this, in an action of treſpaſs for maihem, the court (upon view of ſuch maihem as the plaintiff has laid in his declaration, or which is certified by the judges who tried the cauſe to be the ſame as was given in evidence to the jury) may increaſe the damages at their own diſcretion (1 Sid. 108.); as may alſo be the caſe upon view of an atrocious battery. (Hardr. 408.) But then the battery muſt likewiſe be alleged ſo certainly in the declaration, that it may appear to be the ſame with the battery inſpected. Alſo, to aſcertain any circumſtances relative to a particular day paſt, it hath been tried by an inſpection of the almanac by the court. Thus, upon a writ of error from an inferior court, that of Lynn, the error aſſigned was that the judgment given was on a Sunday, it appearing to be on the 26th February, 26 Eliz. and upon inſpection of the almanacs of that year, it was found that the 26th of February in that year actually fell upon a Sunday: this was held to be a ſufficient trial, and that a trial by a jury was not neceſſary, although it was an error in fact, and ſo the judgment was reverſed. (Cro. Eliz. 227.) But, in all theſe caſes, the judges, if they conceive a doubt, may order it to be tried by a jury. Blackſt. Com. vol. iii.

Examination *of witneſſes*, in the trial by jury, derives peculiar advantage from its being conducted openly, *vivâ voce*, in the preſence of all mankind. This mode of examination is much more conducive to the clearing up of truth, than the private and ſecret examination taken down in writing before an officer or his clerk, in the eccleſiaſtical courts, and all others that have borrowed their practice from the civil law, where a witneſs may frequently depoſe that in private, which he will be aſhamed to teſtify in a public and ſolemn tribunal. Beſides, the occaſional queſtions of the judge, the jury, and the counſel, propounded to the witneſſes on a ſudden, will ſift out the truth much better than a formal ſet of interrogatories previouſly penned and ſettled; and the confronting of adverſe witneſſes is alſo another opportunity of obtaining a clear diſcovery, which can never be had upon any other method of trial. Nor is the preſence of the judge, during the examination, a matter of ſmall importance; for, beſides the reſpect and awe with which his preſence will naturally inſpire the witneſs, he is able by uſe and experience to keep the evidence from wandering from the point in iſſue. In ſhort, by this method of examination, and this only, the perſons who are to decide upon the evidence have an opportunity of obſerving the quality, age, education, underſtanding, behaviour, and inclination of the witneſs; in which points all perſons muſt appear alike, when their depoſitions are reduced to writing, and read to the judge, in the abſence of thoſe who made them; and yet as much may be frequently collected from the manner in which the evidence is delivered as from the matter of it. See Evidence.

Examination *of witneſſes* in Chancery is done with a view to the proof of facts that are diſputed, and their depoſitions are taken in writing, according to the manner of the civil law. For this purpoſe interrogatories are formed or queſtions in writing; which, and which only, are to be propoſed to, and aſked of, the witneſſes in the cauſe. For the examination of witneſſes in or near London, there is an examiner's office appointed; but for ſuch as live in the country, a commiſſion is granted to four commiſſioners, two named on each ſide, or any three or two of them, to take the depoſitions there. And if the witneſſes reſide beyond ſeas, a commiſſion may be had to examine them there upon their own oaths, and (if foreigners) upon the oaths of ſkilful interpreters. And it hath been eſtabliſhed that the depoſition of an heathen who believes in the Supreme Being, taken by commiſſion in the moſt ſolemn manner according to the cuſtom of his own country, may be read in evidence. The commiſſioners are ſworn to take the examinations truly and without partiality, and not to divulge them till publiſhed in the court of chancery; and their clerks are alſo ſworn to ſecrecy. The witneſſes are compellable by proceſs of *ſubpœna*, as in the courts of common law, to appear and ſubmit to examination. And when their depoſitions are taken, they are tranſmitted to the court with the ſame care that the anſwer of a defendant is ſent. See Commission *to examine witneſſes*, and Interrogatories.

EXAMINERS, in *Chancery*, are two officers, whoſe buſineſs is to examine, on oath, the witneſſes produced on both ſides, upon ſuch interrogatories as the parties to the ſuit do exhibit for the purpoſe.

EXAMPLE, in *Rhetoric*, denotes an imperfect kind of induction or argumentation; whereby it is proved, that a thing which has happened on ſome other occaſion, will happen again, on the preſent one, from the ſimilitude of the caſes. That is uſually called an example, which is brought either to prove or illuſtrate ſome general aſſertion, as if one ſhould ſay, that "human bodies may be brought to ſuſtain the greateſt labours by uſe and exerciſe:" and in order to prove this ſhould relate what is ſaid of Milo of Croton, that "by the conſtant practice of carrying a calf ſeveral furlongs every day, he ſhould carry it as far after it was grown to its full ſize." (Eraſm. Chil. p. 193.) But the word example is uſed in oratory for any kind of ſimilitude; or, as Voſſius defines it (Orat. Partit. l. iii. c. 7. § 16.), "When one thing is inferred from another, by reaſon of the likeneſs which appears between them." Hence it is called an "imperfect induction," which infers ſomething from ſeveral others of a like nature. With regard to examples, we may obſerve, that thoſe have the greateſt force in reaſoning, which are taken from facts. See Induction.

EXANIA, from *ex*, *out of*, and *anus*, the complaint now more commonly named by practitioners in ſurgery prolapſus ani. See Prolapsus.

EXANNUAL Roll. In the old way of exhibiting ſheriff.'s accounts, the illeviable fines and deſperate debts were tranſcribed into a roll, under this name, which was yearly read, to ſee what might be gotten by it.

EXANTHEMA, in *Medicine*, ſynonymous with *effloreſcence*, from εξ, and ανθος, *a flower*, a term applied by the older writers nearly in the ſame ſenſe in which we now employ the word *eruption*, and comprehending every ſpecies of ſpot, diſcolouration, or elevation of the ſkin. The ſyſtematic noſologiſts at preſent underſtand by this word all eruptions on the ſkin, which are accompanied with fever; ſuch as the ſmall-pox, meaſles, ſcarlet fever, &c. Dr. Willan uſes the term in a more limited ſenſe, *viz.* to expreſs that appearance only which is in Engliſh denominated a *raſh*; which is a bluſh or "redneſs of the ſkin, varying as to extent, continuity, and brightneſs of colour, and occaſioned by an unuſual quantity of blood diſtributed to ſeveral of the cutaneous veins, in ſome inſtances with partial extravaſation." The exanthemata conſtitute the third order of Dr. Willan's claſſification of cutaneous diſeaſes, including the meaſles, ſcarlet fever, nettle-raſh, roſeola, purpura, and erythema. See Cutaneous *diſeaſes*, and theſe words reſpectively. See alſo Cullen Noſol. Method. claſs i. order iii. Willan on Cutan. Diſ. ord. iii.

EXARCH, Εξαρχος, in *Antiquity*, an appellation given, by the emperors of the Eaſt, to certain officers ſent into Italy, in quality of vicars, or rather prefects, to defend that part of Italy which was yet under their obedience; particularly the city of Ravenna, againſt the Lombards, who had made themſelves maſters of the greateſt part of the reſt.

The reſidence of the exarch was at Ravenna; which city, with that of Rome, were all that was left to the emperors. The firſt exarch was Longinus, who was ſent in the year 568 by the emperor Juſtin II. the ſucceſſor of Juſtinian, to govern Italy in the room of Narſes. Longinus, being inveſted with abſolute authority and power, ſuppreſſed the magiſtrates, who had been previouſly appointed to govern the provinces of Italy; and he himſelf took the title of exarch, which by the Greeks was given to thoſe who preſided over a dioceſe, and conſequently over the numerous provinces of which the dioceſe was compoſed. This title was adopted by the ſucceſſors of Longinus, who, reſiding, as he had done, at Ravenna, were on that account called the exarchs of Ravenna. They governed all Italy, naming and removing the magiſtrates, called dukes, at their pleaſure; and to them the people had recourſe in all matters of conſequence. Longinus was ſent by Juſtin to rule all Italy; but a great part of that country, in the firſt year of his government, was ſeized on by the Lombards, who had been called in by Narſes. This magiſtrate maintained the power and authority of the emperors of the Eaſt in Italy for the ſpace of 183 years, that is, from the year 568, when Longinus was ſent into Italy, to the year 751, when Eutychius, the laſt exarch, was expelled, and Ravenna taken by Aſtulphus, or Aſtolphus, king of the Lombards. See Lombards.

According to Gibbon (Decline and Fall of the Roman Empire, vol. vii.) Narſes was the firſt and moſt powerful of the exarchs, and adminiſtered above fifteen years the kingdom of Italy. A duke was ſtationed for the defence and military command of each of the principal cities of Italy; and the eye of Narſes pervaded the ample proſpect from Calabria to the Alps. During a period of 200 years, ſays the hiſtorian, (vol. viii.) Italy was unequally divided between the kingdom of the Lombards and the exarchate of Ravenna; and 18 ſucceſſive exarchs were inveſted, in the decline of the empire, with the full remains of civil, of military, and even of eccleſiaſtical power. Their immediate juriſdiction, which was afterwards conſecrated as the patrimony of St. Peter, extended over the modern Romagna, the marſhes or vallies of Ferrara and Commachio, five maritime cities from Rimini to Ancona, and a ſecond, inland Pentapolis, between the Adriatic coaſt and the hills of the Apennines. Three ſubordinate provinces, of Rome, of Venice, and of Naples, which were ſeparated by hoſtile lands from the palace of Ravenna, acknowledged, both in peace and war, the ſupremacy of the exarch. The remainder of Italy was poſſeſſed by the Lombards. When Aſtulphus, as we have already mentioned, had made himſelf maſter of the exarchate, he thought that he had a juſt title to all the places depending on that domain, and conſequently to the Roman dukedom and to Rome itſelf. He, therefore, required by a meſſenger the inhabitants of that city to acknowledge him for their ſovereign; and at the ſame time began his march towards Rome. The pope, Stephen II., was alarmed, and attempted to divert Aſtulphus from his declared purpoſe of plundering Rome and maſſacring the inhabitants, by a ſolemn embaſſy; but the king, rejecting the preſents accompanying this embaſſy, inſiſted upon being acknowledged by the pope and the Romans for their ſovereign. The pope in this diſtreſs applies to the emperor; but Conſtantine was not in a condition to aſſiſt him. He then determined to recur to the protection of France, which had been transferred, ſome years before, from the Merovingian to the Carlovingian line; and the celebrated Pepin, ſon to Charles Martel, was then king. Indeed Pepin had previouſly promiſed to pope Zachary, that he would protect his ſee againſt all its enemies, eſpecially againſt the Lombards. Pope Stephen viſited France in perſon; and having ſtated the deplorable condition to which he was reduced by the Lombards, and implored his aſſiſtance and protection, Pepin promiſed to aſſiſt him againſt the Lombards with the whole ſtrength of his kingdom, and to drive them out of the exarchate and Pentapolis, which were to be reſtored, as Pepin underſtood, to the emperor, from whom the Lombards had taken them; but the pope, finding the king well-diſpoſed, took advantage of this favourable opportunity for aggrandizing himſelf; and, therefore, inſinuated to Pepin, that he could not better acquit himſelf of his obligations to the apoſtolic ſee, conſult the welfare of his ſoul, or reward him for the dangers he had undergone, and the pains he had taken for the ſafety of Italy, and the church, than by granting both the exarchate and Pentapolis to St. Peter, that is, to himſelf. The pope, at the ſame time, pretended that Conſtantine had forfeited all right to thoſe countries, by forſaking the protection of Italy, and perſecuting the church. Pepin not only put him in poſſeſſion of the exarchate and Pentapolis, if he ſhould ſucceed in expelling the Lombards, but confirmed his promiſe with an oath, in which his ſons Charles and Carloman concurred. In conſequence of this engagement Pepin marched with his army againſt the Lombards, and having routed them, Aſtulphus fled precipitately to Pavia. Pepin purſued him, and having beſieged his capital, granted him peace on condition of his reſtoring the places which he had ſeized in the Roman dukedom, together with the exarchate and Pentapolis, to the pope. Hoſtages were alſo delivered in order to ſecure the fulfilment of this condition. Aſtulphus, regardleſs of his oath and hoſtages, invaded the Roman dukedom, ſeized ſeveral cities, and beſieged Rome itſelf. In this extremity, Stephen had again recourſe to his protector, who, highly incenſed at the treachery of Aſtulphus, marched again into Italy, and cloſely inveſted Pavia, into which the Lombard king had retired. Aſtulphus once more ſued for peace, which was granted him upon his promiſing to perform immediately the treaty made the year before, and, beſides, to ſurrender to the pope the city of Commachio, which was then a place of great importance. Pepin then renewed his donation; and having cauſed a new inſtrument to be drawn up, he cauſed it to be delivered, ſigned by himſelf, by his two ſons, Charles and Carloman, and by the chief barons and prelates of France, into the pope's hands. He then left Italy, and returned with his army to France. The exarchate compriſed, according to Sigonius (ad ann. 756) the following cities, *viz.* Ravenna, Bologna, Imola, Faenza, Forlimpopoli, Forli, Ceſena, Bobbio, Ferrara, Commachio, Adria, Servia, and Secchia, which were all delivered to the pope, except Faenza and Ferrara. Pentapolis, or Marca d'Ancona, comprehended Rimini, Peſaro, Conca, Fano, Sinigaglia, Ancona, Oſimo, Umana, Jeſi, Foſſombrone, Monteferetro, Urbino, the Balneſian territory, Cagli, Lucceoli, and Eugubio, with their territories and diſtricts, as appears by the donation of Lewis the Pious, by which Pepin's donation was confirmed. The pope committed the government of the exarchate to the archbiſhop of Ravenna, who thereupon took the title of exarch, not as archbiſhop, but as an officer of the pope, now a temporal prince. Thus was the ſceptre added to the keys, the ſovereignty to the prieſthood, and the popes were enriched with the ſpoils of the Lombard kings, and the Roman emperors. As thoſe countries belonged, without doubt, to Conſtantine their emperor, ſome authors have thought that this donation was made in his name, and that this gave riſe to the fable of the donation of Conſtantine the Great. Hence it appears that the popes by degrees became ſovereigns of Rome. The exarchate of Ravenna, ſays Petrus de Marca, being yielded to the pope, the government of Rome, of courſe, devolved upon him; for the Roman dukedom had been always ſubject to the exarch. The pope, therefore, when he became maſter of the exarchate, claimed the adminiſtration, and continued to govern Rome, not as ſovereign, but only with the authority that had been veſted in the exarch, till the year 876, when the authority of the emperors, ſucceſſors of Charlemagne, declining in Italy, Charles the Bald yielded all his claim to, and ſovereignty over Rome, to the apoſtolic ſee. Hence Conſtantine Porphyrogenitus, deſcribing the ſtate of Europe in his time, that is, about the year 914, writes, that Rome was ſubject to the pope, as its ſovereign. It was upon the decleuſion of the weſtern empire, when it was confined to Germany alone, that the pope, as well as the ſeveral princes of Italy, aſſumed the ſovereignty, which they afterwards enjoyed. The donation of Pepin was confirmed by Charlemagne at the requeſt of pope Adrian; for having ordered Iterius, his ſecretary, to draw up a new inſtrument, he ſigned it himſelf, cauſed it to be ſigned by the abbots, biſhops, and other great men, who had attended him to Rome, and, with his own hand, laid it on the altar of St. Peter.

F. Papebroch, in his Propylæum ad Acta Sanct. Maii, has a diſſertation on the power and office of the exarch of Italy, in the election and ordination of the pope.

The emperor Frederic created Heraclius, archbiſhop of Lions, a deſcendant of the illuſtrious houſe of Montboiſſier, exarch of the whole kingdom of Burgundy; a dignity, till that time, unknown any where but in Italy, particularly in the city of Ravenna. Meneſtrier. Hiſt. de Lyons.

Homer, Philo, and other ancient authors, give likewiſe the name exarchus to the choragus, or maſter of the ſingers, in the ancient choruſes, or him who ſung firſt; the word *αρχειν*, or *αρχομαι*, ſignifying equally *to begin*, and *to command*

Exarch *of a dioceſe*, was anciently the ſame with primate. This dignity was inferior to the patriarchal, yet greater than the metropolitan.

Exarch alſo denotes an officer ſtill ſubſiſting in the Greek church; being a kind of deputy or legate *a latere* of the patriarch, whoſe office it is to viſit the provinces allotted him, in order to inform himſelf of the lives and manners of the clergy; take cognizance of eccleſiaſtical cauſes; the manner of celebrating divine ſervice; the adminiſtration of the ſacraments, particularly confeſſion; the obſervance of the canons; monaſtic diſcipline; affairs of marriages, divorces, &c. but, above all, to take an account of the ſeveral revenues which the patriarch receives from ſeveral churches; and particularly as to what regards the collecting of the ſame.

The exarch, after having greatly enriched himſelf in his poſt, frequently riſes to the patriarchate itſelf.

Exarch is alſo uſed, in the *Eaſtern Church Antiquity*, for a general, or ſuperior over ſeveral monaſteries; the ſame that we otherwiſe call archimandrite: being exempted, by the patriarch of Conſtantinople, from the juriſdiction of the biſhops; as are now the generals of the Romiſh monaſtic orders.

In 493, Sebas was eſtabliſhed exarch, or chief, of all the anchorets within the territory of Jeruſalem. Du Bois.

EXA'RMA, from *εξαιρομαι*, *to be elevated*, in *Surgery*, a high, prominent, ſwelling.

EXARTHREMA, from *εξ*, *out of*, and *αρθρον*, *a joint*, an old term, having the ſame ſignification as the word diſlocation. See Luxation.

EXA'RTHROS, from *εξ*, *out of*, and *αρθρον*, *a joint*, a term denoting a perſon whoſe joints are ſo large and miſ-ſhapen, that they look as if they were luxated.

EXARTICULATION, a diſlocation of ſome of the jointed bones; or a breach of articulation. See Luxation.

EXAUCTORATIO, among the Romans, differed from *miſſio*, or a diſcharge. In the latter, the ſoldiers were quite diſmiſſed from the ſervice; and this was done after they had ſerved twenty years: but in the former caſe, they only loſt their pay, being ſtill kept under their colours or *vexilla*, though not under the eagle, *aquila*, which was the ſtandard of the legion. Whence, inſtead of *legionarii*, they were called *ſubſignani*, and were ſtill retained till they had either ſerved out their time, or had lands aſſigned them. The exauctoratio commonly took place after they had ſerved ſeventeen years.

EXAUDET, in *Biography*, a performer on the violin in the opera band at Paris from 1749 to 1760; remarkable for nothing as a compoſer, but for the minuet which bears his name in France, and which in England is better known by the title of "Marſhal Saxe's Minuet," the beſt "Minuetto per ballo," or for dancing, perhaps, that ever was compoſed.

EXCALCEATION, *ex*, *off*, and *calceus*, *ſhoe*, *diſcalceation*, or the act of putting off the ſhoes.

Among the Hebrews there was a particular law, whereby a widow, whom her huſband's brother refuſed to marry, had a right to ſummon him into a court of juſtice; and, upon his refuſal, might excalceate him, *i. e.* pull off one of his ſhoes, and ſpit in his face; which were both actions of great ignominy among that people.

The houſe of the perſon who had undergone them was thenceforward called the houſe of the excalceated.

EXALCED, Excalceati, different orders of friars, hermits, and nuns, who amongſt their other auſterities went barefooted, or wore nothing on their feet but ſandals, were diſtinguiſhed by the name of excalced, as the Franciſcans, Carmelites, Poor Clares, &c. whilſt other branches of the ſame inſtitute, but leſs rigid, were called calced, from their members wearing ſhoes. A particular branch of the Waldenſes, Vaudois, or poor men of Lyons, in the 12th century, laid great ſtreſs on the wearing of ſabots or wooden clogs inſtead of ſhoes, and therefore obtained the name of Sabatati and Inſabatati.

EXCAMBIATOR. See Excambio, and Exchange.

EXCAVATION, formed of *ex*, and *cavus*, *hollow*, or *cave*, a *pit*, &c. the act of hollowing or digging a cavity, particularly in the ground.

The excavation of the foundations of a building, by the

Italians called *cavatione*, is ſettled by Palladio at a ſixth part of the height of the whole building: unleſs there be cellars underground, in which caſe he would have it ſomewhat more.

EXCAVATION *of Vallies*, in *Geology*, is a ſubject which has exerciſed the thoughts of many ingenious men, the greater part of whom have ſuppoſed that theſe ſtupendous and important operations were effected by violent currents of water, which at ſome period made their way down them: but a more careful examination has ſhewn, that in ſcarcely any inſtances are the excavated materials to be found, or any part of them, as muſt inevitably have happened at the bends and junctions of vallies, particularly thoſe which lie far inland, had the mere waſhing of water been the cauſe of vallies: but Mr. Farey, and Dr. William Richardſon, have of late, and ſeparately as it ſhould ſeem, come to the concluſion (Philoſophical Magazine, vol. xxxiii. p. 204 and 262.) that theſe excavations were effected by cauſes acting "from above the ſurface of the earth," which completely carried off the matter which once filled up the vallies, and originally joined thoſe correſponding parts of ſtrata, whoſe edges are now in a great number of inſtances to be traced in their oppoſite ſides: theſe opinions of the former gentlemen have been already ſlightly noticed, and referred to, in our articles COAL, COLLIERY, and others.

EXCELLENCY, a quality, or title of honour given to ambaſſadors, and other perſons, who are not qualified for that of highneſs, as not being princes; and yet are to be elevated above the other inferior dignities.

In England, and France, the title is now peculiar to ambaſſadors: but it is very common in Germany and Italy. Thoſe to whom it was firſt appropriated were the princes of the blood of the ſeveral royal houſes; but they quitted it for that of highneſs, upon ſeveral great lords aſſuming excellency.

The ambaſſadors have only borne it ſince the year 1593, when Henry IV. of France ſent the duke de Nevers ambaſſador to the pope, when he was firſt complimented with excellency. After that, the ſame appellation was given to all the other ambaſſadors reſiding at that court; from whence the practice ſpread through the other courts.

The ambaſſadors of Venice have only had it ſince the year 1636, when the emperor and king of Spain conſented to allow it them.

The ambaſſadors of the crowned heads diſpute the giving of that title to the ambaſſadors from the princes of Italy; where the practice is not eſtabliſhed.

The court of Rome never allowed the quality of excellency to any ambaſſador who was a churchman, as judging it a ſecular title. The common rules and meaſures of excellency were a little variable, with reſpect to the court of Rome. The ambaſſadors of France, at Rome, anciently gave the title of excellency to all the relations of the pope then reigning; to the Conſtable Colonna; to the duke of Bracciano, and the eldeſt ſons of all thoſe lords; as alſo the dukes of Savelli, Ceſarini, &c. But they have been ſince more reſerved in this reſpect; though they ſtill honoured all the Roman princeſſes with excellency.

The court of Rome, in their turn, and the Roman princes, beſtowed the ſame title on the chancellor, miniſters, and ſecretaries of ſtate, and preſidents of the ſovereign courts of France; the preſidents of the councils in Spain; the chancellor of Poland; and thoſe of the firſt dignities of other ſtates, if they were not eccleſiaſtics.

The word excellency was, anciently, a title of kings and emperors; accordingly Anaſtaſius the library-keeper calls Charlemagne his excellency. The ſame title is ſtill given to the ſenate of Venice: where, after ſaluting the doge under the title of *ſereniſſimo*, the ſenators are addreſſed under thoſe of your *excellencies*. The Liber Diurnis Pontif. Rom. gives the title excellency to the exarch and patricians.

The Italian and French have improved on ſimple excellency; and made *excellentiſſimo*, and *excellentiſſime*, which have been beſtowed on certain popes, kings, &c.

EXCELSIS. See GLORIA *in excelſis*.

EXCENTRIC, in *Geometry*, is applied where two circles, or ſpheres, though contained, in ſome meaſure, within each other, yet have not the ſame centre; and, conſequently, are not parallel; in oppoſition to concentric, where they are parallel, having one and the ſame common centre. The ſun's orbit is excentric, with regard to the globe of our earth: Mars is very excentric, with regard to the ſun; that is, his motion is about a very different centre.

EXCENTRIC *Theory*, in *Ancient Aſtronomy*, one of the theories adopted by the ancient aſtronomers to explain and calculate the different irregularities which they had obſerved to take place in the motions of the heavenly bodies.

It is not exactly aſcertained at what period practical aſtronomy had attained ſufficient perfection to indicate the neceſſity of ſuch a theory. Probably both the Indian and Egyptian aſtronomers were early acquainted with the more obvious inequality in the ſun's orbit; but Hipparchus is the firſt aſtronomical writer who ſeems to have aimed at determining it with any degree of preciſion.

The theory embraced by Hipparchus is ſaid to have been firſt taught in Greece by the diſciples of Pythagoras. Though their knowledge on the ſubject is ſuppoſed to have been derived from the oriental nations, yet it is highly probable they contributed to ſtrengthen the prejudices in favour of circular and uniform motion, which afterwards proved the ſource of ſo much difficulty and error in all the ſyſtems of ancient aſtronomy. It was from this prejudice, early aſſumed as a principle, that nature could not, conſiſtently with the obſerved ſimplicity of her deſigns, adopt any other form for the celeſtial orbits than that of perfect circles, nor any other motion than what was perfectly uniform. The problem, therefore, that occupied the aſtronomers and philoſophers of thoſe days, was to explain the various irregularities which they obſerved in the planetary motions, without infringing on the above principle.

There were two theories choſen for this purpoſe, nearly equivalent in their principle, the concentric and the excentric.

In the concentric theory the earth was ſuppoſed to be placed in the centre of a circle, on the circumference of which the centre of another circle revolved, and on the circumference of this ſecond circle, called an epicycle, the planet was ſuppoſed to move. The firſt circle was called the *deferent*, and by aſſigning a ſuitable ratio to the deferent circle, and to its correſponding epicycle, ſome of the more obvious irregularities were pretty accurately repreſented. *Fig.* 110. *Plate* XIII. *Aſtronomy*, is the repreſentation of the concentric theory. Let C be the centre both of the earth and of the circle F B D, and let H G K be a ſmaller circle, or epicycle, whoſe centre B moves uniformly in the circumference F B D, from weſt to eaſt, or *in conſequentia*, while the ſun moves alſo uniformly and with the ſame velocity in the circumference of the epicycle, *in antecedentia* in the upper part, but *in conſequentia* in the lower part. If the point G of the epicycle, called its apogee, as being moſt diſtant from the earth, be ſuppoſed at the beginning of the anomaliſtic revolution to be placed in the point A of C F produced; and if when it comes to G, the arc G H be taken ſimilar to F B, the point H will be the place of the ſun when the centre of the epicycle has moved from F to B. If then in C F, to which B H is parallel, we take C E = B H, and on E as a centre, with the diſtance E A = C F, deſcribe the circle A H P, the ſun would be ſeen from E to move in this circle equably; for the angle A E H is equal to the angle F C B; but ſeen from C, the centre of the earth, it will appear to move in it inequably; for the angle A C H, in the firſt circle of anomaly, that is, in the paſſage of the ſun from A to P, is always leſs than A E H or F C B; and its true place H will be leſs advanced in longitude than its mean place B. When again the centre of the epicycle or the mean place of the ſun, having deſcribed a ſemicircle, ſhall have come to D, the ſun, having deſcribed a ſemicircle of the epicycle, will be found in P, the perigee of the orbit A H P, and its mean and true places B and H will be ſeen from C to coincide as they did in the apogee A. But in the ſun's paſſage from P to A, that is, in the ſecond ſemicircle of anomaly, his true place H, as ſeen from C, will be always more advanced in longitude than his mean place B: for in this ſemicircle the angle P C H is always greater than P E H or D C B. The angle E H C or B C H, which is the difference between the mean and true places of the ſun, is called the equation of the orbit, and it is evident that this equation will be greateſt in N or M, where the centre B of the epicycle is 90° diſtant from either of the apſides.

It was thus that the ancients originally proceeded in their repreſentation of the ſolar inequalities, and the repreſentation ſeemed to be ſufficiently juſtified by obſervation: at leaſt, till the days of T. Brahé, no obſervations had been made with ſufficient accuracy to ſubject it to ſuſpicion. Their ſucceſs alſo, while no lunar inequality except the ſimple anomaliſtical one was diſcovered, was equal in the application of the ſame concentric theory to the motions of the moon: and having, in two caſes, thus ſucceſsfully, by means of one ſubordinate ſphere or epicycle, reconciled apparent inequality of motion with real uniformity, it was natural to ſuppoſe that other inequalities, though more various and complicated, might be explained in a ſimilar manner, and required only the addition of other epicycles. The ſame method of procedure, therefore, was continued, and every new inequality which obſervation diſcovered, was accounted for by a new ſphere or epicycle producing it, till the whole number employed in the ſyſtem amounted to 34. Ariſtotle, on narrower examination, found theſe inſufficient, and added to them 22: but ſtill they were deemed inſufficient; and the number was at laſt increaſed to 72. But though it was not till long after the days of Ariſtotle, that the theory was carried to ſuch a degree of extravagance, the multiplication of epicycles rendered it, even in his time, almoſt as intricate and complex as the appearances which it was intended to explain. Some examples of this kind will occur on the revival of it by Copernicus and T. Brahé: and when Hipparchus and Ptolemy introduced excentric orbits, and by means of them ſomewhat diminiſhed the multiplicity of the ſpheres employed by their predeceſſors, they were thought to do a ſignal ſervice to aſtronomy.

The manner in which Hipparchus explained the ſolar inequalities, in his excentric theory, was to this purpoſe. Let O (*fig.* 111.) be the centre of the earth and of the ſtarry ſphere. Let B C D E be the ecliptic, or great circle in the *primum mobile* in which the ſun ſeems to perform his annual revolutions; and, in the ſame plane, but on a different centre Z, let the circle A L P be deſcribed. This is the circle, or orbit, in which the ſun is ſuppoſed actually to move, and to deſcribe round its centre equal arcs or angles in equal times: or rather, he is ſuppoſed to be carried round by the equable motion of the circle itſelf; which, becauſe its centre is not occupied by the earth, is called an excentric circle. It is evident, in this repreſentation, that if the earth were placed in Z, a ſpectator on it would perceive the ſun, ſince he is ſuppoſed to move uniformly in the excentric, to move alſo uniformly in the ecliptic. But the earth is placed in O, at the diſtance O Z from the centre of the excentric; and therefore, when his motions are referred to the ecliptic by a ſpectator in O, they muſt appear unequal. When, for example, he departs from A the apogee of the excentric, and comes to K, he would be ſeen from Z in the point R of the ecliptic; but from O, the centre of the earth, he is ſeen in C, a point leſs advanced in longitude. On the contrary, when he departs from P, the perigee of the excentric, and comes to N, his place in the ecliptic, as ſeen from Z, is the point V; but ſeen from O it is the point F, more advanced in longitude than V. Any line, as Z K, drawn from the centre of the excentric to the ſun, or any parallel to it drawn from O, is called the line of mean motion, and determines the mean anomaly A Z K; and any line, as O K, drawn from the ſun to the centre of the earth, is called the line of true motion, and determines the true anomaly A O K; and the angle O K Z, which is the difference between the mean and true anomalies, is the equation of the orbit. In the apogee and perigee this equation vaniſhes, in the ſame manner as in the concentric theory; becauſe there the lines of mean and true motion coincide; and at the points L, L, where a perpendicular to the line of apſides, drawn through O, meets the excentric, it comes to its greateſt amount. Thus, by the ſingle ſuppoſition that the ſolar orbit was excentric to the earth, Hipparchus ſupplied the place of the epicycle added to the concentric: nor is it difficult to perceive that the repreſentations, given by both theories of the ſolar inequalities, were in their effects preciſely the ſame.

In both theſe theories, it is evident that the inequalities of the ſun were conſidered as purely optical: and what was principally required was to find the point O, in the line A P of the apſides, in which the earth muſt be ſituated, in order to give to the ſolar motions the juſt inequality which obſervation required; and to determine the longitude A of the ſolar apogee, that is, the point B of the ecliptic to which it is referred from O. Without finding the juſt excentricity O Z, the calculated differences, or equations, between the ſun's mean and true places, would not correſpond with the obſerved differences: and without diſcovering the poſition of the apogee, the calculated equations, however accurate, would not be applied in their proper places. In theſe inveſtigations the procedure of Hipparchus was as follows.

Let B (*fig.* 112.) be the place of the ſun at the vernal equinox, B D an arc of the excentric equal to his mean motion for 94½ days, that is, from the vernal equinox to the ſummer ſolſtice, D F an arc equal to his mean motion for 92½ days, or from that ſolſtice to the autumnal equinox: let the chord B F be drawn, and from D another chord D E G perpendicular to B F. The point E of the interſection of theſe chords is evidently the point where the earth muſt be ſituated: for it is the only point from which B, D, F, G, can appear at the diſtance of 90° from one another, and as they appear actually in the heavens.

It was required, therefore, to determine the excentricity E C, or the diſtance of the point E from C, the centre of the ſolar orbit. Since the arc B D F of the mean motion, and which the ancients ſuppoſed to be the only real motion of the ſun, from B the vernal to F the autumnal

nal equinox, is given by means of the annual revolution, and conſiſts of 184° 20′, its half B H will conſiſt of 92° 10′. Through H draw the diameter H C; and through C the centre of the orbit, the diameter C K perpendicular to H C, and meeting D E in L; and join C E. If from B D, the mean motion for $94\frac{1}{2}$ days, and = 93° 9′ we ſubtract B H = 92° 10′, the remainder D H will be found = 59′: and if from B H we ſubtract the quadrant K H, the remainder B K will be = 2° 10′. Therefore C L and E L, the ſines of the arcs D H, B K, will be given in parts of C D = 10,000; the former to wit = 172, and the latter = 378. Therefore the excentricity E C, being the hypothenuſe of the right-angled triangle E L C, will be found in the ſame parts: for $EC^2 = CL^2 + EL^2$, and therefore E C = 415.

By producing E C to meet the excentric in A and P, we ſhall have the line A P of the apſides: and the longitude of A the apogee will be found from the ſame triangle E L C; for C E : E L :: R : ſin. E C L = K C A = B E A = 65° 30′. Since B therefore repreſents the point of Aries, the place A of the apogee fell ſhort of the ſolſtitial point D, 24° 30′, in the days of Hipparchus. It is now between 9° and 10° more advanced.

When the excentricity and the longitude of the apſides were thus determined, the equations of the orbit, or the differences between the mean and true places of the ſun, were obtained by a very ſimple trigonometrical computation. For in the excentric theory, (*fig.* 111.) when this equation comes to its greateſt magnitude, in the points L, L, or M, M, where perpendiculars to the line of apſides drawn through O or Z meet the excentric, the excentricity O Z becomes the tangent of the angle Z M O to the radius of the orbit Z M: and at any other point K, with the excentricity O Z, the radius Z K, and the angle K Z O the ſupplement of the mean anomaly A Z K, the equation Z K O will be found by the analogy K Z + Z O : K Z − Z O :: tan. $\frac{1}{2}$ A Z K : tan. $\frac{1}{2}$ (Z O K − Z K O). The calculation will be preciſely the ſame in the concentric theory if E C be taken in C A, (*fig.* 110.) equal to the radius of the epicycle, that is, to the excentricity O Z, (*fig.* 111.) and will produce the ſame reſults: and the excentric theory will be found to differ from the concentric only in ſimplicity. It is probably needleſs to obſerve that the parallels O L and Z M will mark the ſame point in the zodiac.

Though theſe theories were thought ſufficient to explain the ſolar motion, in that imperfect ſtate of practical aſtronomy, yet they were found entirely to fail when applied to the obſerved motions of the moon and planets. A new ſcheme was therefore adopted by Ptolemy, in which, however, the principle of uniform motion was in fact abandoned. This conſiſted in aſſuming an imaginary point as the centre of a new circle, called the equant; and it was ſuppoſed that to a ſpectator ſituated in that point the motion of the planet would appear to be uniform. It is not now exactly known if the Greek aſtronomers invented this theory, or if they received it by tradition from the eaſtern nations, but it is a curious circumſtance to obſerve, in the hiſtory of the ſcience of aſtronomy, how very near the truth the ancients arrived by trial and obſervation; for their deferent circle and epicycle reduced the figure of the orbit really to an oval form, and the two points in which they placed the earth and the centre of the equant were many centuries afterwards diſcovered to be no other than the foci of an elliptic orbit. The true theory was kept out of ſight by an obſtinate adherence to an ancient prejudice, for what a ſingular method was nature ſuppoſed to take, in order to adhere to this principle of uniform and circular motion; after a number of unmeaning efforts, ſhe only accompliſhed an *apparent* uniform motion round an imaginary point, in which no ſpectator could ever poſſibly be placed to admire the beauty of the contrivance:

The mode of determining the equant was as follows.

Let A be the centre of the earth, (*fig.* 113.) ſuppoſe the centre of the world D, the centre of the orbit of a planet, or of the excentric circle, F K M L E, called the deferent, (ſee Epicycle.) Upon the point F is deſcribed the epicycle G Q, and above D a point E is aſſumed, equal to the excentricity A D, and from the point E another circle is deſcribed, R K O L R, of the ſame magnitude as the deferent. This ſecond circle is called the equant, becauſe the centre of the epicycle, which moves upon the deferent, has nevertheleſs an equal motion round the centre E of the equant, for the epicycle deſcribes its deferent with an unequal motion, which ſhould diſappear when referred to the centre of the equant, ſo that the angle, ſuch as F E I, formed by the line of apſides A F, and by the line drawn to the centre of the epicycle, arrived at I, may be always equal in equal times; for this reaſon Ptolemy calls the point E the point of equality. The angle F A I is the true anomaly of the excentric, the angle F E I the mean anomaly, and which is always formed at the centre of the equant.

Kepler had endeavoured to explain phyſically the cauſe of the equant, that is, why there ſhould be a point E different from the point D, about which the motion was regular and uniform, (Myſter. Coſmogr. c. 22.) He was perſuaded the cauſe was general, and that the equant muſt take place in the orbit of the earth, as well as in the other planets. Neither Tycho nor Copernicus had employed an equant, but Kepler was perſuaded that the points E and D in an excentric were not the ſame, particularly when Tycho informed him that the annual orbit, or excentric of the ſun, appeared to him not to be always the ſame.

Kepler ſuſpected that this variation aroſe from the point of equality not being the centre of the circle; and in the courſe of his inveſtigation of this queſtion, he was led to the diſcovery of the biſection of the excentricity in the caſe of the earth, whereas the ancients only admitted it in the caſe of the ſuperior planets. See Excentricity, *biſection of.*

EXCENTRICITY *of the Orbit of a Planet*, in *Aſtronomy*, is the diſtance between the centre and the focus of the ellipſe in which it revolves. The diſcovery of the excentricity in the orbits of the ſun and moon is attributed to Hipparchus, who wrote a treatiſe on this ſubject 150 years before our era.

The excentricity of the orbit is computed from the greateſt equation of the centre, by the following proportion: As 57° 17′ 44.″8, (the arc = rad.) is to half the greateſt equation, ſo is rad. = 1 to the excentricity. See Equation, and Elliptic *Motion.*

But when the greateſt equation has been found, and accurately determined by obſervation, the excentricity may be practically deduced by uſing the rule of falſe poſition, or by ſuppoſing the excentricity known, and finding by trial the greateſt equation correſponding to it

The excentricities of the planetary orbits are uſually calculated on a ſcale which ſuppoſes the mean diſtance of the earth from the ſun divided into one hundred thouſand parts, and the excentricity is expreſſed in proportional parts of that ſcale.

The following formula for calculating the excentricity is given by Lambert in the Ephem. de Berlin.

Let E be the greateſt equation of the centre, e the excentricity, make $\frac{E}{57.} = \alpha$.

The excentricity will then be expreſſed by the following ſeries.

$$e = \frac{1}{2}\alpha - \frac{11}{768}\alpha^3 - \frac{587}{93040}\alpha^5 - \frac{40583}{2642411520}\alpha^7 -, \&c.$$

The quantity α is always a ſmall fraction, particularly for the ſun; if we ſuppoſe with La Place, $E = 2^{\circ}.1409$ decimal for 1750. Then,

$$\alpha = \frac{2.1409}{63.6620} = 0.033629$$

$$\frac{1}{2}\alpha = 0.016814.$$

The ſecond term, $\frac{11}{768}\alpha^3$, is leſs than 0.000001, and may therefore be entirely neglected.

Table *of Excentricities according to different Authors.*

Planets.	Kepler.	Caſſini.	Halley.	La Lande.	Log. of Excen. in parts of the mean diſtance
Mercury	8150	8092½	7970	7955.4	9.3128399
Venus	501	517	504.985	498	7.8378910
The Sun	1800	169	1691.90	1681.395	8.2253628
Mars	14115.5	14155	14170	14183.7	8.9688921
Jupiter	25074	2506	25078.6	25013.3	8.6819346
Saturn	54143.5	5432	54381.4	53640.42	8.7499109
Herſchel				90804	8.6774873

The following table of excentricities in parts of the major axis is taken from the "Syſtem of the World," by La Place.

Mercury	-	0.205513
Venus	-	0.006885
Earth	-	0.016814
Mars	-	0.093808
Jupiter	-	0.048877
Saturn	-	0.056223
Uranus	-	0.046683

The ſecular variation of theſe numbers is as follows: (the ſign — indicates a diminution.)

Mercury	-	+ 0.000003369
Venus	-	— 0.000062905
The Earth	-	— 0.000045572
Mars	-	+ 0.000090685
Jupiter	-	+ 0.000134254
Saturn	-	— 0.000261553
Uranus	-	— 0.000026228

Excentricity, *biſection of.* The biſection of the excentricity is a curious principle aſſumed by Ptolemy, and the ancient aſtronomers, to explain the irregularities of the planetary motions. It is thus deſcribed by Dr. Small.

The inequalities of the planets were ſo various and intricate, that the explications of them were for a long time extremely imperfect, and ſo partial, that no Grecian aſtronomer before Ptolemy had ſuppoſed it practicable to give a compleat theory of all. In the more ancient times the explications of them appear to have been made by orbits concentric to the earth, and charged with epicycles: but, as Ptolemy had found no method of repreſenting the ſecond inequalities, except by means of epicycles, ſo, to avoid the perplexity occaſioned by the multiplication of them, he gave the preference to an excentric orbit for the repreſentation of the firſt; and, by the ſuperior ſimplicity of the repreſentation, the authority of the excentric theory was for many centuries eſtabliſhed. With reſpect to thoſe firſt inequalities, at leaſt of the ſuperior planets, it appears to have been originally ſuppoſed, that they might be ſufficiently accounted for by the more ſimple ſolar hypotheſis. For, if the planet, in conſequence of its ſecond inequalities, be repreſented as moving in the circumference *a b c* (*fig.* 111) of an epicycle, the centre A L P Q, of this epicycle will repreſent the places which it would occupy, if it were diveſted of all ſecond inequality: and it was thought a ſufficient explication of the firſt inequality, to ſuppoſe that this centre moved equally round Z, the centre of the orbit, and conſequently inequably round O, the centre of the earth. But when, according to Kepler's conjectures on this ſubject, they endeavoured to account for the inequality of the latitudes in oppoſition, and of the digreſſions of the planets, eſpecially their greateſt digreſſions, from the point oppoſite to the ſun, by variations of their diſtances from O, it appeared that the point Z, round which the planet moved equably, could not be the ſame with the centre of the orbit; for, both the latitudes, and alſo the angles *a* O *c*, *d* O *f*, which the epicycle ſubtended at the centre of the earth, were found to be greater at the apogee, and leſs at the perigee than the limits of the excentric A L P Q permitted; and that, conſequently, the centre of the orbit occupied a place nearer than Z to the centre of the earth. It was therefore a matter of much greater difficulty to form an hypotheſis for the motions of the planets, than for thoſe of the ſun: for, if their firſt inequalities required one determined excentricity, or diſtance between the centre of uniform motion and the centre of the earth, the variations of their latitudes, and of their ſecond inequalities, ſhewed that this was not the excentricity of the orbit in which the epicycle moved, and that this orbit evidently required another. In what proportion the diſtance Z O between the centre of uniform motion and the centre of the earth ought to be divided by the centre of the orbit, appears to have been for a long time a matter of much uncertainty. But Ptolemy tells us that, on applying himſelf to inveſtigate the meaſure of the approach of the centre of the epicycle, within the circle A L P O at the apogee, and its conſequent withdrawing from it beyond the perigee, he found, by multiplied obſervations, that the centre of the orbit lay preciſely in the middle, between Z the centre of uniform motion, and O the centre of the earth. This is the famous principle, known by the name of the biſection of the excentricity: and, as Ptolemy gives no account of the means by which it was diſcovered, nor of the obſervations from which it was inferred, his aſſuming it has juſtly excited the wonder of all aſtronomers. The greater part believed him to have aſſumed it merely from conjecture, and not to have derived it, as Kepler more generouſly ſuppoſed, from any obſervations; and there ſeems to be ſome reaſon for thinking that it came to him by tradition, from the more ancient aſtronomy of the Eaſt.

EXCEPTIO, in the *Roman Law.* See Pleading.

EXCEPTION, ſomething reſerved, or ſet aſide, and not included in a rule.

It is become proverbial, that there is no rule without an exception; intimating, that it is impoſſible to comprehend all the particular caſes under one and the ſame maxim. But it is dangerous following the exception preferably to the rule.

Exception, in *Law*, is a ſtop or ſtay to an action.

The term is uſed indifferently, both in the civil and common law; and in each exceptions are divided into *dilatory* and *peremptory*.

In law proceedings, exception is a denial of a matter alleged in bar to the action; and in chancery it is that which is alleged againſt the ſufficiency of an anſwer, &c. Exception, in a general ſenſe, includes all the kinds of defence, or vindication, which a perſon, againſt whom a proceſs is brought, makes uſe of to prevent or retard its effect.

The civilians reckon three kinds of exceptions; *viz. declinatory*, whereby the authority of the judge or court is diſallowed; *dilatory*, intended to defer or prevent the thing from coming to an iſſue; and *peremptory*, which are proper and pertinent allegations, founded on ſome preſumption that ſtands for the defendant; as want of age, or other quality, in the party; or other matter that may be decided, without entering into a full diſcuſſion of the merits of the cauſe.

Exception *to evidence*, is where a demurrer is offered in any civil cauſe, on account of the inſufficiency of the evidence given, and the court does not agree to it; in which caſe the court or judge are required to ſeal a bill of exceptions, by ſtat. Weſtm. 2. 13 Edw. I. cap. 31. which is in the nature of an appeal, examined in the next immediate ſuperior court, upon a writ of error after judgment given in the court below. See Demurrer, and Evidence.

Exception, *in deeds and writings*, is the ſaving of a particular thing out of a general one granted by deed, as a room, ſhop, or cellar, out of a houſe; a field, or timber-trees, out of land, &c. Exceptions of this kind muſt not croſs the grant, nor be repugnant to it, or elſe they are void of courſe; yet there may be a kind of exception, or ſaving out of an exception, ſo as to make a thing as if never excepted; as where a leaſe is made of a rectory, excepting the parſonage-houſe, ſaving to the leſſee a chamber, this ſhall paſs by the leaſe.

EXCEPTIVE Conjunction. See Conjunction.

Exceptive *propoſitions*, are thoſe wherein ſomething is affirmed of a whole ſubject, abating ſome one of the parts thereof, which is *excepted* by a particle, thence called an exceptive particle, or particle of exception.

Thus, "All the ſects of the ancient philoſophers, except the Platoniſts, held God to be corporeal. Covetouſneſs is inexcuſable in reſpect of every thing, but time."

EXCESS is diſtinguiſhed into *natural* and *moral*: the firſt, is a part whereby one quantity is greater than another. Thus, we ſay, this line is longer than that; but the exceſs is inconſiderable.

The latter is an intemperance, or going beyond the juſt bounds and meaſures preſcribed for any thing. Thus, we ſay, exceſs in wine, women, &c. is prejudicial to the health.

EXCESSIVE, in *Muſic*, is uſed as a prefix to denote the exceſs of certain tempered intervals above the true intervals of the ſame name; it is generally oppoſed to defective, *viz.* when there is a deficiency to the ſame extent as there is here an exceſs; but their uſe is not limited to any certain quantity of exceſs or defect, they being ſometimes applied in conjunction with or to repreſent the diaſchiſm, ſometimes with enharmonic dieſis, at others with minimum ſemitone, &c.; whereas the prefixes, redundant and deficient, are uſed only with the major comma, and hence the word comma is ſometimes omitted; and in like manner the prefixes ſuperfluous and diminiſhed are confined to the minor ſemitone, which laſt word is therefore ſometimes omitted in naming the claſs of intervals, which are increaſed or leſſened by a minor ſemitone.

EXCHANGE, in *Commerce*, and *Political Economy*, is the act of paying or receiving money in one country for its equivalent in the money of another country, by means of bills of exchange.

This ſcience, therefore, comprehends both the reduction of monies, and the negociation of bills: it determines the relative value of the currencies of all nations, and ſhews how foreign debts are diſcharged, loans and ſubſidies paid, and other remittances made from one place to another, without the riſk or expence of tranſporting ſpecie.

This important ſubject may be conſidered under the five following heads, namely:

1. Bills of exchange.—2. Par of exchange.—3. Courſe of exchange.—4. Monies of exchange.—5. Arbitration of exchange.

Bills of exchange.—A bill of exchange is a written order for the payment of a certain ſum of money at an appointed time. It is a mercantile contract in which four perſons are moſtly concerned, *viz.* 1. The *drawer*, who receives the value. 2. His debtor in a diſtant place, upon whom the bill is drawn, who is called the *drawee*, and who is to accept and pay it. 3. The perſon who gives value for the bill, and who is called the *buyer* and *remitter*; and, 4. The perſon to whom it is ordered to be paid, who is called the *payee*, and who may, by indorſement, paſs it to any other holder.

Moſt mercantile payments are made in bills of exchange, which, until due, generally paſs from hand to hand, like any other circulating medium. The laws of all trading nations afford the moſt ready and effectual means of enforcing the payment of bills, and hence that credit which they ſo univerſally obtain, and which greatly facilitates the operations of commerce.—For the laws, cuſtoms, and regulations of bills of exchange, ſee Bill of *exchange*, and *Mercantile* Law. See alſo Agio, Usance, and Days *of Grace*.

Bills are diſtinguiſhed into inland and foreign, according as they are made payable in the country where they are drawn, or in a foreign country. Their functions, however, are ſimilar in both caſes, and therefore in explaining the theory of exchange, we ſhall begin with the operations of inland bills as the moſt ſimple and familiar.

Suppoſe A. of London is creditor to B. of Edinburgh 100*l.* and C. of London debtor to D. of Edinburgh 100*l.* theſe two debts may be diſcharged by the operation of one bill: thus, A. draws on B. and ſells his bill to C. who remits it to D. and the latter receives the amount from B. when due. Here, by a transfer of claims, the London debtor pays the London creditor, and the Edinburgh debtor the Edinburgh creditor.

By the foregoing example it appears that reciprocal and equal debts due between two places, may be diſcharged without any caſh remittance, and it may be ſuppoſed that ſuch an operation is of equal convenience to the parties concerned, in both places; but when debts are unequal, the advantage muſt be likewiſe different, as the obligation of remittance is no longer mutual; for the debtor place muſt pay its balance either by ſending caſh or bills; and as the latter mode is generally preferred for ſeveral reaſons, an increaſed demand for ſuch bills muſt be the conſequence; and this enhances their price, as it would that of any other ſaleable article.

This is the plain principle of exchange which is conſtantly exemplified in the premium paid for inland bills on London; for this city, being the grand emporium of commerce that furniſhes moſt other places of the kingdom with foreign merchandize, and being alſo the reſidence of numerous

numerous landlords whoſe rents muſt be remitted to them from the country, it has generally a large balance of debt in its favour, a great part of which muſt be ſent in bills; this creates a demand, and conſequently a premium which is moſtly commuted for time; thus, if A. of London be creditor to B. of Edinburgh 200*l.* and C. of London debtor to D. of Edinburgh only 100*l.* the balance of 100*l.* againſt Edinburgh cannot be cancelled by a transfer of claims, but muſt, we will ſuppoſe, be remitted by a bill, which can be only obtained at a certain number of days after date. The moſt general term for bills from Edinburgh on London is 40 days, and the intereſt for this time is about ½ *per cent.* The number of days here is called the exchange, which has been known to vary conſiderably according to the balance of debt, or the plenty or ſcarcity of bills. A ſimilar premium or date is allowed for bills from all other places of Great Britain on the capital, but bills at ſight on any of thoſe places may be generally had in London without any premium whatever.

Although the principle of foreign exchange is the ſame as that of inland, yet the former is more complicated in its operations than the latter, owing to the denominations of money not being the ſame. This cauſes a difference in the mode of paying the premium for bills; in which, however, the date is taken into conſideration as well as the comparative rates at which the monies are valued.

In foreign exchange one place always gives another a fixed ſum or piece of money for a variable price, which fluctuates according to the balance of debt, as before ſtated: the former is called the certain price, and the latter the uncertain price. Thus London is ſaid to give to Paris the certain for the uncertain; that is, the pound ſterling for a variable number of francs; and to give to Spain the uncertain for the certain; that is, a variable number of pence ſterling for the dollar of exchange.

Whatever the uncertain price is, at any time, is called the courſe of exchange. Now ſuppoſe Paris gives London 25 francs for the pound ſterling, and that this ſum is found to contain the ſame quantity of pure ſilver as 20 ſhillings, then the exchange is ſaid to be at par; but if France ſhould give a higher price, it is ſaid to be in favour of London, and *vice verſâ.* This is the common mode of judging whether the exchange be favourable or unfavourable to a place, though it is not always the correct method, nor that which merchants generally act upon. But before we enter into any further explanation of the courſe of exchange, or the cauſes of its fluctuation, it will be neceſſary to explain more fully what is to be underſtood by the par of exchange, a ſubject on which there is ſome difference of opinion, even among writers of the firſt authority.

Par of Exchange.

The par of exchange may be conſidered under two general heads; namely, the *intrinſic par,* and the *commercial par,* each of which admits of ſubordinate diviſions and diſtinctions.

The intrinſic par of exchange is the value of the money of one country compared with that of another, with reſpect both to weight and fineneſs. Thus, two ſums of different countries are intrinſically at par when they contain an equal quantity of the ſame kind of pure metal, ſeparated from its alloy, which is always deemed of no value. See Coin.

There ſhould be two intrinſic pars, the one between gold coins, and the other betweeen ſilver coins; and hence the intrinſic par of exchange can be only determined with accuracy between places which pay their bills in the ſame kind of metal, as between England and Portugal, that pay in gold coin; or between France and Spain, that pay in ſilver coin, for the relative value between theſe metals is ſcarcely ever the ſame in any two countries.

It may be even obſerved, that the value of the ſame metal differs conſiderably in different countries, and therefore this intrinſic par of exchange cannot be always conſidered as a true equality in the value of monies; thus in the caſe of France and Spain, where the latter country ſupplies the former with the materials of her ſilver coinage, ſilver muſt be moſt valuable in France, and the difference ſhould be equivalent to the charges attending the removal, ſuch as the duty paid (in time of peace) to the Spaniſh government, for the exportation of dollars, the expences of carriage, inſurance, commiſſion, intereſt, &c. all of which amount to nearly 7 *per cent.*

A ſimilar computation might be made between gold in England and in Portugal, as the latter country ſupplies the former with the materials of her gold coinage.

But where one country pays its bills in gold, and another in ſilver, no intrinſic par of exchange whatever can be permanently eſtabliſhed. An equivalency can be only aſcertained by valuing as merchandize the gold of one place, and the ſilver of the other, according to the market price of the day; but this is the commercial par, which ſhall be more fully explained below.

In aſcertaining the intrinſic par between coins of the ſame metal, a queſtion occurs, whether the computation ſhould be made according to the mint regulations of the reſpective countries where the monies are ſtruck, or according to actual aſſays. The former is the moſt general method, though the latter is certainly the moſt correct; for while ſome governments make coins according to their full ſtandard, as in England, others take advantage of the allowance for remedy, and ſometimes make it a ſource of conſiderable emolument.

There are ſome countries with which no par of exchange, either intrinſic or commercial, can be permanently fixed. Theſe are ſuch as pay their bills in paper, which muſt have a fluctuating and precarious value. Even the bank money of Amſterdam and Hamburgh comes in a certain degree within this deſcription, as it bears a fluctuating agio againſt currency.

The *commercial par* is the comparative value of the monies of different countries, according to the weight, fineneſs, and market price of the metals. This is the par which merchants generally conſider of importance in their exchange ſpeculations, and we cannot define it better than in the following paſſage, taken from the Minutes of the Committee of the Houſe of Commons, appointed in 1804, to enquire into the ſtate of exchange between Ireland and England. Several of the moſt intelligent merchants of both countries were examined on the occaſion, and their evidence produced much new and practical information.

In the examination of Benjamin Winthrop, eſq. governor of the bank of England, an intereſting enquiry and inveſtigation took place reſpecting the par of exchange, from which the following appropriate queſtion and anſwer are extracted.

Queſtion.—"When a ſum of Hamburgh currency, which will buy a pound of bullion of given purity in the market of Hamburgh, can purchaſe a bill for a ſum of Engliſh currency, which will buy a pound of bullion of the ſame ſtandard in the Engliſh market, is not then the exchange at par between thoſe two countries?"

Anſwer.—"I confeſs it does appear to be a complete par of exchange."

This par of exchange is variouſly denominated by different writers on political economy; thus it is called the *current*, the *momentary*, the *political*, and the *eventual par*; and though each of theſe terms ſeems to convey a correct idea of the ſubject, yet we have adopted the word *commercial* as equally appropriate and more generally underſtood.

Some notice might be here taken of what is called a *monetary par*, in which an allowance is made for ſeignorage and mint expences, and alſo of a *common* or *eſtimate par*, which generally differs from the true one; thus the pound ſterling of England is eſtimated at 11 guilders current of Holland; but ſuch definitions are of little utility in the illuſtration of exchange.

The following opinion on the par of exchange ſeems to deſerve quotation. It is tranſlated from the preface of a moſt elaborate work, entitled "Dictionaire des Arbitrages," by Francois Corbaux, publiſhed at Paris in 1802.

"Without dwelling any longer," ſays this author, "on the arbitrary notions which have been formed of the par of exchange, and without ſeeking to adopt new ones, which might be rendered very numerous, we ſhall conclude by obſerving, that although the intrinſic or pretended real par is made the foundation and principal element in the determination of the price of exchange, yet not being the ſame in the gold as in the ſilver coins, the pars of theſe two metals ſhould be kept totally diſtinct; and that beſides, as neither of them finds any direct application in the common courſe of exchange affairs, it is through ignorance that ſo much importance has been attached to them, and that they have been conſidered as the moſt correct expreſſion of the relative value of the monies of two countries. In ſhort to ſeek for a true and rational par is to ſuppoſe what cannot exiſt, that is, the fixing of different principles and elements which are ſubject to continual variation, and, after all, if this could be accompliſhed, it would preſent no object of real utility."

However well-founded the opinion of Monſieur Corbaux may be, we think it muſt be at leaſt ſatisfactory to merchants to underſtand the intrinſic par of exchange, and therefore we ſhall give new tables of it at the concluſion of the preſent article, computed both in gold and ſilver, with rules and examples for performing all ſuch calculations; and ſhall now proceed to the explanation of the courſe of exchange, which is a ſubject of great importance, whether we conſider it in a commercial or political point of view.

Courſe of Exchange.

The courſe of exchange is the current price or proportion between the monies of two places; which is always fluctuating according to circumſtances.

When merchants have occaſion to draw or remit foreign bills, they meet upon the Royal Exchange, where this kind of buſineſs in London muſt be tranſacted. The market is conſtantly attended by exchange-brokers, to whom the wants of the parties who wiſh to buy or ſell bills are privately communicated. Theſe brokers, whoſe confidential ſituation demands ſtrict impartiality, bring parties together; and ſettle the courſe of exchange for the day, as ſoon as they learn how the market ſtands with reſpect to the number of drawers and remitters. The commiſſion for this buſineſs throughout Europe, is one *per mille* (or thouſand) which is equally paid by the buyers and ſellers of bills.

When the courſe of exchange riſes above par againſt any country, it is then concluded that the balance of trade is againſt that place. Now, if England ſhould import from France goods to the value of 100,000 *l.*, and export only to the value of 80,000 *l.*, it may coſt England 120,000 *l.* to pay the whole debt, if it ſhould be publicly known that ſo great a balance exiſts, and therefore ſecrecy is of peculiar importance in this kind of buſineſs.

The fluctuations of exchange are moſtly greater or leſs according to the known amount of the balance, and the expence and difficulty of conveying ſpecie. By the expence of ſuch conveyance is meant the carriage and inſurance, and by the difficulty the hazard of evading thoſe prohibitory regulations which, in moſt countries, impede the exportation of coin; and ſo powerful is the operation of theſe cauſes, that the exchange is ſometimes very high, or unequal, even between neighbouring countries, affording room for very profitable ſpeculations for thoſe merchants who circulate bills in the way of arbitration of exchange.

An unfavourable ſtate of the exchange with a country furniſhes a motive for exporting commodities to it. The merchant under theſe circumſtances can afford to ſell his goods as much cheaper as the premium which he receives for his bill amounts to. Hence the courſe of exchange tends to correct itſelf, and, in peace, it ſeldom continues, for any length of time, more unfavourable than the amount of the expences which might be incurred by tranſporting bullion to pay the balance which is to be remitted; for bullion may be conſidered the univerſal currency of merchants, though it is not always of ready or immediate application.

Although an unfavourable balance of trade has been generally conſidered an invariable cauſe of an unfavourable courſe of exchange, yet recent experience has ſhewn that this is not always the caſe. Thus, in the inveſtigation already alluded to, which took place in the Houſe of Commons relating to the exchange between England and Ireland, it was demonſtrated that the balance of trade was in favour of Ireland, while the courſe of exchange was highly unfavourable; it was, however, ſhewn in ſubſequent publications on the ſubject by Meſſrs. Parnell and Forſter, that though the balance of trade was in favour of Ireland, the balance of debt was unfavourable, or, in other words, the balance of remittance, on account of the number of Iriſh abſentees reſident in England; but perhaps the political ſtate of the country was the chief cauſe.

In time of war the fluctuations of the courſe of exchange are ſometimes very great, particularly where large remittances are to be made in the way of foreign loans or ſubſidies. The exchange is likewiſe lowered by any debaſement of the coin of a country, or by the depreciation of any other circulating medium. Even an exceſs of currency has the effect of turning the rate of exchange againſt that place where it prevails, as the exceſs raiſes the price of all commodities beyond their value in thoſe places where no ſuch redundancy exiſts. It may, however, be obſerved, that the nature of exchange operates to effect the general diſtribution of the ſurplus ſpecie, and to maintain the level of money throughout the commercial world. In ſhort, in all caſes, the exchange tends to an equilibrium.

Although the depreciation of the circulating medium of a country raiſes the courſe of exchange againſt it, the circumſtance is not always a diſadvantage. Thus, before the reformation of our ſilver coinage, in the reign of William the Third, the exchange between England and Holland, computed by the ſtandard of their reſpective mints, was 25 *per cent.* againſt England, but the current coin of England was more than 25 *per cent.* below its nominal or ſtandard value; and therefore the exchange was virtually in favour of England, according to the ſtatement of Dr. Adam Smith.

It may be further obſerved, that the wealth of a country will ſometimes raiſe the courſe of exchange againſt it, on account of its importations of luxuries from abroad. Rich countries are likewiſe liable to have the courſe of exchange turned againſt them by the ſubſidies which they may have to remit to leſs opulent ſtates, as before noticed.

Thus in 1793, the trade between Holland and England was completely open; and yet the courſe of exchange was 10 or 12 *per cent.* againſt Amſterdam, owing probably to the balance of trade being ſo much in favour of London. But, in 1794, when England undertook to ſubſidize Pruſſia, large remittances of bills were made through Amſterdam, which cauſed an immediate fall in the courſe of exchange between that place and London, even below par: and therefore at ſubſequent periods of the war, it has been thought prudent by the Engliſh government to export ſpecie on ſuch occaſions, rather than to turn the courſe of exchange againſt London by the operation of remitting large ſubſidies in bills. During the preſent war between France and Auſtria (1809) the latter power has been ſubſidized by the Engliſh government, which has been chiefly done in bills, and this has tended to raiſe the exchange againſt England, in the places where thoſe bills were negociated. But the cauſe which has operated more powerfully to produce this effect is the great exportation of goods to England, from Germany, France, and Holland, without any adequate importation of Engliſh merchandize. Hence the exchange with London has been for ſome time greatly in favour of thoſe places, while between London and moſt of the other parts of Europe it has continued nearly at par.

From what has been ſaid reſpecting the cauſes, both commercial and political, which produce the fluctuations of exchange, and which frequently counteract each other, the following ſimple concluſion may be drawn; that whatever produces a demand for bills on any place tends to enhance their value, and therefore the courſe of exchange riſes and falls according to the proportion which exiſts between the plenty and ſcarcity of bills, that is, between the demand and the ſupply.

Monies of Exchange.

The following tables contain the monies of exchange of the principal trading places of Europe, in all their varieties and combinations. Explanations are alſo given of the quotations or liſts of the courſes of exchange, which are tranſmitted from one country to another for the government and advice of merchants. Theſe quotations ſeldom give more than the figures of the uncertain prices, omitting the denominations of money and the certain prices, all of which are here explained.

Note.—In all the uncertain prices the words *more or leſs* are to be underſtood.

AMSTERDAM.

Monies of Exchange.

Exchanges are computed in florins, ſtivers, and pennings; or in pounds, ſhillings, and pence Flemiſh.

16 Pennings = 1 Stiver
20 Stivers = 1 Florin or guilder
2 Grotes or pence Flemiſh = 1 Stiver
12 Grotes or 6 ſtivers = 1 Shilling Flemiſh
20 Shillings Flemiſh, or 6 florins = 1 Pound Flemiſh.

There are two ſorts of money in Holland; namely, *banco* and *currency:* banco generally bears a premium againſt currency of 4 or 5 *per cent.* which is called *agio.*

Quotation explained.

Amſterdam gives to	Uncertain prices.		Certain prices.
London	34 ſhillings 8 grotes Flemiſh	for	1 Pound ſterling
France	54 Grotes Flemiſh	—	3 Francs
Spain	99 Ditto	—	1 Ducat of exch.
Portugal	44 Ditto	—	1 Old cruſade
Genoa	86 Ditto	—	1 Pezza of 5¾ lire
Leghorn	92 Ditto	—	1 Pezza of 8 reals
Hamburgh	34 Stivers	—	2 Marks
Vienna	20 Ditto	—	1 Rixdollar
receives from			
Antwerp	104 Florins	—	100 Florins
Breſlau	144 Rixdollars	—	100 Rixdollars
Venice	96 Soldi piccoli	—	1 Florin

N. B. The exchanges of Amſterdam are always tranſacted in banco, unleſs otherwiſe expreſſed.

AUGSBURG.

Monies of Exchange.

Exchanges are computed in florins and creutzers, and alſo in rixdollars and creutzers.

60 Creutzers = 1 Florin
1½ Florin or 90 creutzers = 1 Rixdollar of account.

Two ſorts of money are uſed here; giro, that is, money of exchange, and currency.

100 Florins of exchange = 127 Florins current.

Quotation explained.

Augſburg gives to	Uncertain prices.		Certain prices.
Amſterdam	113 Rixdollars of exchange	for	100 Rixdollars
Hamburgh	118 Ditto Ditto	—	100 Ditto
Francfort	102 Rixdollars cur.	—	100 Ditto
Leipſic	99 Ditto Ditto	—	100 Ditto
London	10 Florins 45 creutzers	—	1 Pound ſterling
Paris	120 Florins current	—	300 Francs
Nuremberg	101 Florins Ditto	—	100 Florins
receives from			
Genoa	62 Soldi fuori banco	—	1 Florin
Leghorn	57 Soldi moneta buona	—	1 Ditto
Vienna	128 Florins	—	100 Ditto.

BERLIN.

Monies of Exchange.

Exchanges are computed in rixdollars, good groſchen, and pfenings currency.

12 Pfenings = 1 Good groſche
24 Good groſchen = 1 Rixdollar of account.

Quotation explained.

Berlin gives to	Uncertain prices.		Certain prices.
Amſterdam	154 Rixdollars	for	100 Rixdollars
Breſlau	100½ Ditto	—	100 Ditto
Hamburgh	158 Ditto	—	100 Ditto
Konigſberg	100½ Ditto	—	100 Ditto
Francfort	105 Ditto	—	100 Ditto
Leipſic	104 Ditto	—	100 Ditto
London	6½ Ditto 12 groſchen	—	1 Pound ſterling
Paris	83 Rixdollars	—	300 Francs
Augſburg	106 Ditto	—	100 Rixdollars
Vienna	60 Ditto	—	100 Ditto.

Bologna. See Rome.

Bremen.

Monies of Exchange.

Exchanges are computed in rixdollars, grotes, and ſwares

5 Swares = 1 Grote
72 Grotes = 1 Rixdollar of account.

Quotation explained.

Bremen gives to	Uncertain prices.		Certain prices.
Amſterdam	143 Rixdollars	for	100 Rixdollars
Hamburgh	142 Ditto	—	100 Ditto
Francfort	110 Ditto	—	100 Ditto
Leipſic	104 Ditto	—	100 Ditto
London	605 Ditto	—	100 Pounds ſterling
Nuremberg	104 Ditto	—	100 Rixdollars
Paris	20 Grotes	—	1 Franc
Vienna	90 Rixdollars	—	100 Rixdollars.

Breslau. See Berlin.

Cadiz.

Monies of Exchange.

Exchanges are computed in dollars, reals, and maravedis of old plate; alſo in ducats of exchange, and in dobloons of plate, or piſtoles of exchange.

34 Maravedis = 1 Real
8 Reals = 1 Dollar of plate
375 Maravedis of plate = 1 Ducat of exchange
4 Dollars of plate = 1 Piſtole of exchange.

N. B. Vellon, the current money of Spain, is to old plate as 17 to 32; that is,

32 Reals or maravedis vellon = 17 Reals or maravedis of old plate.

Quotation explained.

Cadiz gives to	Uncertain prices.		Certain prices.
Genoa	121 Dollars of plate	for	100 Pezze of $5\frac{3}{4}$ lire
Leghorn	130 Ditto	—	100 Pezze of 8 reals
Naples	290 Maravedis of plate	—	1 Ducat regno
receives from			
Amſterdam	97 Grotes Flemiſh	—	1 Ducat of exch.
London	42 Pence ſterling	—	1 Dollar of plate
Paris	78 Sous tournois	—	1 Ditto
Hamburgh	90 Grotes Flemiſh	—	1 Ducat of exch.
Liſbon	2470 Rees	—	1 Dobloon of plate

Constantinople.

Monies of Exchange.

Exchanges are computed in piaſtres, paras, and aſpers; or in piaſtres and aſpers.

3 Aſpers = 1 Para
40 Paras or 120 aſpers = 1 Piaſtre or dollar.

Quotation explained.

Conſtantinople gives to	Uncertain prices.		Certain prices.
London	17 Piaſtres	for	1 Pound ſterling
Vienna	50 Paras	—	1 Florin
Leghorn	145 Ditto	—	1 Pezza of 8 reals
Genoa	24 Ditto	—	1 Lirafuori banco
Amſterdam	65 Ditto	—	1 Florin current
Paris	200 Piaſtres	for	300 Francs
Venice	360 Paras	—	1 Sequin of 22 lire
receives from			
Marſeilles	1 Franc, 50 centimes	—	1 Piaſtre
Hamburgh	25 Grotes Flemiſh	—	1 Ditto
Smyrna	110 Piaſtres	—	100 Ditto.

Copenhagen.

Monies of Exchange.

Exchanges are computed in rixdollars, marks, and ſkillings Daniſh; and ſometimes in rixdollars, marks, and ſkillings lubs or Hamburgh. Pfenings are alſo ſometimes reckoned.

12 Pfenings = 1 Skilling
16 Skillings = 1 Mark
6 Marks Daniſh, or 3 marks lubs = 1 Rixdollar
2 Marks or ſkillings Daniſh = 1 Mark or ſkilling lubs.

Quotation explained.

Copenhagen gives to	Uncertain prices.		Certain prices.
Amſterdam	143 Rixdollars	for	100 Rixdollars
Hamburgh	149 Ditto	—	100 Ditto
London	6 Rixdollars 30 ſhillings	—	1 Pound ſterling
Paris	25 Skillings Daniſh	—	1 Franc.

Dantzic.

Monies of Exchange.

Exchanges are computed in florins, groſchen, and pfenings.

18 Pfenings = 1 Groſche
30 Groſchen = 1 Florin or gulden
3 Florins = 1 Rixdollar.

Quotation explained.

Dantzic gives to	Uncertain prices.		Certain prices.
Amſterdam	372 Groſchen	for	1 Pound Flemiſh
Hamburgh	169 Ditto	—	1 Rixdollar ſpecie
London	24 Florins	—	1 Pound ſterling
Paris	110 Rixdollars	—	300 Francs
Francfort	105 Groſchen	—	1 Rixdollar.
Leipſic	125 Rixdollars	—	100 Ditto.

Florence. See Leghorn.

Francfort.

Monies of Exchange.

Exchanges are computed in florins and creutzers; or in rixdollars and creutzers; alſo in florins and batzen.

4 Creutzers = 1 Batze
60 Creutzers, or 15 batzen = 1 Florin or gulden
90 Creutzers, or $1\frac{1}{2}$ florin = 1 Rixdollar of account.

Quotation explained.

Francfort gives to	Uncertain prices.		Certain prices.
Amſterdam	140 Rixdollars	for	100 Rixdollars current
Hamburgh	150 Ditto	—	100 Ditto banco Francfort

Francfort gives to	Uncertain prices.		Certain prices.
Augſburg	101 Rixdollars	for	100 Rixdollars banco
Vienna	60 Florins	—	100 Florins
France	79 Rixdollars	—	300 Livres
Leipſic	$100\frac{1}{2}$ Ditto	—	100 Rixdollars in louis d'or
Bremen	108 Ditto	—	100 Ditto
Baſil	101 Ditto	—	100 Ditto in new ecus.

GENEVA.

Monies of Exchange.

Exchanges are computed in livres, ſous, and deniers current; and in ecus, livres, &c.

12 Deniers = 1 Sou or ſol
20 Sous = 1 Livre
3 Livres = 1 Ecu.

Quotation explained.

Geneva gives to	Uncertain prices,		Certain prices.
Hamburgh	23 Sous	for	1 Mark
Leghorn	104 Ecus	—	100 Pezze of 8 reals
Genoa	95 Ditto	—	100 Pezze of $5\frac{3}{4}$ lire
Milan	98 Ditto	—	640 Current lire
Spain	44 Sous	—	1 Dollar of plate
receives from			
France	166 Francs	—	100 Livres
London	49 Pence ſterling	—	1 Ecu
Amſterdam	89 Grotes Flemiſh	—	1 Ditto
Augſburg	127 Rixdollars current	—	100 Ditto
Baſil	168 Livres tournois	—	100 Livres
Turin	84 Soldi	—	1 Ecu.

GENOA.

Monies of Exchange.

Exchanges are computed in lire, ſoldi, and denari di lira; or in pezze, ſoldi, and denari di pezza; all in currency, called *fuori banco.*

12 Denari di lira = 1 Soldi di lira
20 Soldi di lira = 1 Lira
12 Denari di pezza = 1 Soldo di pezza
20 Soldi di pezza = 1 Pezza
$5\frac{3}{4}$ Lire = 1 Pezza
4 Lire 12 ſoldi = 1 Scudio di cambio, or crown of exchange
10 Lire 14 ſoldi = 1 Scudo d'oro marche, or gold crown.

Quotation explained.

Genoa gives to	Uncertain prices.		Certain prices.
Leghorn	124 Soldi di lira	for	1 Pezza of 8 reals
Rome	128 Ditto	—	1 Roman crown
Naples	103 Ditto	—	1 Ducat regno
Hamburgh	45 Ditto	—	1 Mark
Vienna	30 Ditto	—	1 Florin
Augſburg	62 Ditto	—	1 Ditto
receives from			
Venice	33 Soldi piccoli	—	1 Lira
Palermo	36 Grani	—	1 Ditto
Amſterdam	85 Grotes Flemiſh	—	1 Pezza
France	94 Sous in francs	—	1 Ditto
Genoa receives from	Uncertain prices.		Certain prices.
Spain	620 Maravedis of plate	for	1 Gold crown
Liſbon	718 Rees	—	1 Pezza
Milan	87 Soldi	—	4 Lire
London	48 Pence ſterling	—	1 Pezza

HAMBURGH.

Monies of Exchange.

Exchanges are computed in marks, ſchilling lubs, and pfenings; or in pounds, ſhillings, and pence Flemiſh; alſo in rixdollars, marks, &c.

12 Pfenings = 1 Schilling lubs
16 Schillings = 1 Mark
3 Marks = 1 Rixdollar
6 Pfenings = 1 Grote or penny Flemiſh
12 Grotes = 1 Shilling Flemiſh
20 Shillings Flemiſh = 1 Pound Flemiſh
Thus, 6 Schilling lubs = 1 Shilling Flemiſh
$7\frac{1}{2}$ Marks = 1 Pound Flemiſh.

There are two ſorts of money in Hamburgh, called *banco* and *currency*. Banco bears an agio or premium againſt currency, which is generally from 20 to 25 *per cent.*

Quotation explained.

Hamburgh gives to	Uncertain prices.		Certain prices.
London	33 Shillings 7 Grotes Flem.	for	1 Pound ſterling
France	26 Schilling lubs	—	3 Francs
Spain	91 Grotes Flemiſh	—	1 Ducat of exch.
Portugal	43 Ditto	—	1 Old cruſade
Genoa	80 Ditto	—	1 Pezza of $5\frac{3}{4}$ lire
Leghorn	86 Ditto	—	1 Pezza of 8 reals
Baſil	25 Schilling lubs	—	1 Ecu of 3 francs
receives from			
Amſterdam	33 Stivers	—	2 Marks
Breſlau	139 Rixdollars	—	100 Rixdollars
Copenhagen	149 Ditto	—	100 Ditto
Vienna	310 Florins	—	100 Ditto
Venice	82 Soldi piccoli	—	1 Mark.

N. B. The exchanges of Hamburgh are always tranſacted in banco, unleſs otherwiſe expreſſed.

LEGHORN.

Monies of Exchange.

Exchanges are computed in pezze, ſoldi, and denari di pezza; ſometimes in lire, ſoldi, and denari di lira, moneta buona.

12 Denari di pezza = 1 Soldo di pezza
20 Soldi di pezza = 1 Pezza of 8 reals
12 Denari di lira = 1 Soldo di lira
20 Soldi di lira = 1 Lira
$5\frac{3}{4}$ Lire, moneta buona = 1 Pezza of 8 reals.

Quotation explained.

Leghorn gives to	Uncertain prices.		Certain prices.
Vienna	30 Soldi moneta buona	for	1 Florin
Novi	186 Pezze	—	100 Scudi d'oro marche.

Leghorn receives from	Uncertain prices.		Certain prices.
Rome	128 Bajocchi	for	1 Pezza of 8 reals
Naples	118 Ducats regno	—	100 Ditto
Palermo	11 Tari 15 grani	—	1 Ditto
Genoa	125 Soldi fuori banco	—	1 Ditto
Milan	136 Soldi correnti	—	1 Ditto
Florence	124 Soldi	—	1 Ditto
Turin	93 Soldi	—	1 Ditto
Venice	$10\frac{1}{2}$ Lire piccole	—	1 Ditto
France	104 Sous in francs	—	1 Ditto
London	54 Pence ſterling	—	1 Ditto
Amſterdam	95 Grotes Flemiſh	—	1 Ditto
Hamburgh	89 Grotes Flemiſh	—	1 Ditto
Liſbon	855 Rees	—	1 Ditto
Spain	140 Dollars of plate	—	100 Ditto
Augſburg	204 Florins current	—	100 Ditto
Bologna	96 Bolognini	—	1 Ditto
Ancona	132 Bajocchi	—	1 Ditto
Geneva	109 Ecus of 3 livres	—	100 Ditto
Peterſburg	190 Rubles	—	100 Ditto.

LEIPSIC. See BERLIN.

LISBON.

Monies of Exchange.

Exchanges are computed in rees and milrees, and alſo in old cruſades.

1000 Rees = 1 Milree
400 Rees = 1 Old cruſade.

Quotation explained.

Liſbon gives to	Uncertain prices.		Certain prices.
Paris	470 Rees	for	3 Francs
Genoa	746 Ditto	—	1 Pezza of $5\frac{3}{4}$ lire
Leghorn	810 Ditto	—	1 Pezza of 8 reals
Vienna	360 Ditto	—	1 Florin
Venice	66 Ditto	—	1 Lira piccola
Spain	2430 Ditto	—	1 Dobloon of plate
receives from			
London	66 Pence ſterling	—	1 Milree
Amſterdam	45 Grotes Flemiſh	—	1 Old cruſade
Hamburgh	43 Ditto	—	1 Ditto.

MADRID.

Monies of Exchange. See CADIZ.

Quotation of Madrid on Paris explained.

Madrid receives from	Uncertain price.		Certain price.
Paris	15 Francs 40 centimes	for	1 Dobloon of plate.

The other exchanges of Madrid are ſimilar to thoſe of Cadiz.

MILAN.

Monies of Exchange.

Exchanges are computed in lire, ſoldi, and denari correnti or imperiali.

12 Denari = 1 Soldo
20 Soldi = 1 Lira
106 Lire or ſoldi imperiali = 150 Lire or ſoldi correnti
117 Soldi imperiali = 1 Scudo or crown.

Quotation explained.

Milan gives to	Uncertain prices.		Certain prices.
France	55 Soldi imperiali	for	3 Francs
Genoa	86 Soldi correnti	—	4 Lire fuori banco
Rome	138 Ditto	—	1 Roman crown
Leghorn	135 Ditto	—	1 Pezza of 8 reals
Augſburg	66 Ditto	—	1 Florin current
Venice	84 Ditto	—	1 Ducat current
Vienna	55 Ditto	—	1 Florin current
Amſterdam	57 Ditto	—	1 Florin banco
London	31 Lire correnti	—	1 Pound ſterling
Hamburgh	49 Soldi correnti	—	1 Mark.

NAPLES.

Monies of Exchange.

Exchanges are computed in ducats and grains, or in ducats, carlins, and grains.

10 Grains = 1 Carlin
10 Carlins or 100 grains = 1 Ducat regno.

Quotation explained.

Naples gives to	Uncertain prices.		Certain prices.
Leghorn	120 Ducats regno	for	100 Pezze
Amſterdam	54 Grains	—	1 Florin
Spain	85 Ditto	—	1 Dollar of plate
Rome	125 Ducats	—	100 Roman crowns
Hamburgh	45 Grains	—	1 Mark
Sicily	120 Ditto	—	1 Sicilian crown
receives from			
London	42 Pence ſterling	—	1 Ducat regno
Genoa	102 Soldi fuori banco	—	1 Ditto
Venice	9 Lire 15 ſoldi piccoli	—	1 Ditto
France	84 Sous in francs	—	1 Ditto
Liſbon	670 Rees		1 Ditto.

PALERMO.

Monies of Exchange.

Exchanges are computed in ounces, tari, and grains; and alſo in ſcudi, tari, and grains.

20 Grains = 1 Taro
30 Tari = 1 Ounce
12 Tari = 1 Scudo or crown;
Thus 5 Crowns = 2 Ounces.

Quotation explained.

Palermo gives to	Uncertain prices.		Certain prices.
Amſterdam	$5\frac{1}{2}$ Tari	for	1 Florin
Genoa	40 Grains	—	1 Lira fuori banco
Leghorn	$12\frac{1}{2}$ Tari	—	1 Pezza of 8 reals
Liſbon	$6\frac{1}{4}$ Tari	—	1 Old cruſade
London	60 Tari	—	1 Pound ſterling
Paris	50 Grains	—	1 Livre
Rome	$12\frac{1}{2}$ Tari	—	1 Roman crown
Spain	$8\frac{1}{2}$ Tari	—	1 Dollar of plate.
receives from			
Naples	120 Grains	—	1 Sicilian crown.

PARIS.

Monies of Exchange.

Exchanges are computed in francs and centimes; or in livres, ſous, and deniers tournois.

100 Centimes = 1 Franc
12 Deniers = 1 Sou or ſol
20 Sous = 1 Livre
80 Francs = 81 Livres
3 Livres or 3 francs = 1 Ecu of exchange.

The 5 franc piece is alſo ſometimes divided into 100 ſous, which are diſtinguiſhed by ſaying, 100, or ſo many ſous in francs.

Quotation explained.

Paris gives to	Uncertain prices.		Certain prices.
London	24 Francs	for	1 Pound ſterling
Hamburgh	185 Francs	—	100 Marks
Genoa	465 Centimes	—	1 Pezza of 5¾ lire
Leghorn	524 Centimes	—	1 Pezza of 8 reals
Spain	15 Francs 40 cent.	—	1 Dobloon of plate
Geneva	162 Francs	—	100 Livres current
Baſil	101 Livres	—	100 Livres
Augſburg	249 Centimes	—	1 Florin current
Vienna	160 Centimes	—	1 Florin
Naples	4 Francs 20 cent.	—	1 Ducat regno
receives from			
Amſterdam	54 Grotes Flemiſh	—	3 Francs
Frankfort	75 Rixdollars cur.	—	300 Ditto
Liſbon	460 Rees	—	3 Ditto
Milan	8 Livres 6 ſoldi	—	6 Ditto.

PETERSBURGH.

Monies of Exchange.

Exchanges are computed in rubles and copecks.

100 Copecks = 1 Ruble.

Quotation explained.

Peterſburgh gives to	Uncertain prices.		Certain prices.
Conſtantinople	50 Copecks	for	1 Piaſtre.
receives from			
London	28 Pence ſterling	—	1 Ruble
Amſterdam	25 Stivers	—	1 Ditto
Vienna	125 Creutzers	—	1 Ditto
Leipſic	17 Groſchen	—	1 Ditto
Paris	270 Centimes	—	1 Ditto

ROME.

Monies of Exchange.

Exchanges are computed in ſcudi moneta, and bajocchi; or in ſcudi di ſtampa d'oro, ſoldi and denari d'oro; quattrini and mezzi quattrini are alſo ſometimes reckoned.

2 Mezzi quattrini = 1 Quattrino
5 Quattrini = 1 Bajocco or Bolognino
100 Bajocchi = 1 Scudo moneta, or Roman crown
1523 Mezzi quattrini, or $152\frac{3}{10}$ bajocchi = 1 Scudo di ſtampa d'oro, or gold crown
12 Denari d'oro = 1 Soldo d'oro
20 Soldi d'oro = 1 Gold crown.

Quotation explained.

Rome gives to	Uncertain prices.		Certain prices.
Florence	84 Gold crowns	for	100 Gold crowns
Milan	81 Roman crowns	—	100 Scudi imperiali
Ancona	99 Ditto	—	100 Crowns
Bologna	98 Ditto	—	100 Ditto
Leghorn	98 Bajocchi	—	1 Pezza of 8 reals
Amſterdam	44 Ditto	—	1 Florin

Rome receives from	Certain prices.		Uncertain prices.
Naples	122 Ducats regno	for	100 Roman crowns
Venice	11 Lire 10 ſoldi piccoli	—	1 Ditto
Genoa	124 Soldi fuori banco	—	1 Ditto
Paris	105 Sous in francs	—	1 Ditto
London	51 Pence ſterling	—	1 Ditto

ROTTERDAM.

Monies of Exchange. See AMSTERDAM.

Quotation on London explained.

Rotterdam gives to	Uncertain price.		Certain price.
London	11 Florence current	for	1 Pound ſterling.

For the other exchanges of Rotterdam, ſee AMSTERDAM.

STOCKHOLM.

Monies of Exchange.

Exchanges are computed in rixdollars, ſkillings, and fenings.

12 Fenings or Oers = 1 Skilling
48 Skillings = 1 Rixdollar.

Quotation explained.

Stockholm gives to	Uncertain prices.		Certain prices.
Amſterdam	44 Skillings	for	1 Rixdollar
Copenhagen	36 Ditto	—	1 Ditto
Dantzic	9½ Ditto	—	1 Florin
Hamburgh	47 Ditto	—	1 Rixdollar
Leghorn	40 Ditto	—	1 Pezza of 8 reals
London	4½ Rixdollars	—	1 Pound ſterling
Paris	24 Skillings	—	1 Ecu of 3 livres
Spain	42 Ditto	—	1 Ducat of exch.

TRIESTE. See VIENNA.

TURIN.

Monies of Exchange.

Exchanges are computed in lire, ſoldi, and denari.

12 Denari = 1 Soldo
20 Soldi = 1 Lira

Quotation explained.

Turin gives to	Uncertain prices.		Certain prices.
Amſterdam	37 Soldi	for	1 Florin
Augſburg	42 Ditto	—	1 Ditto
Geneva	82 Ditto	—	3 Livres
Genoa	9 Lire 8 ſoldi	—	1 Sequin
Leghorn	86 Soldi	—	1 Pezza of 8 reals
London	19 Lire 10 ſoldi	—	1 Pound ſterling
Milan	92 Soldi	—	7½ Lire correnti
Paris	20 Lire	—	24 Francs
Rome	87 Soldi	—	1 Roman crown
Venice	94 Ditto	—	1 Ducat current.

VENICE.

Monies of Exchange.

Exchanges are computed in lire, ſoldi, and denari, moneta piccola; and alſo in ducats.

12 Denari = 1 Soldo
20 Soldi = 1 Lira
6 Lire 4 ſoldi = 1 Ducat current, or of account
8 Lire = 1 Ducat effective

Quotation explained.

Venice gives to	Uncertain prices.		Certain prices.
London	56 Lire piccole	for	1 Pound ſterling
Amſterdam	4 Lire 18 ſoldi ditto	—	1 Florin
Augſburg	4 Lire 16 ſoldi ditto	—	1 Ditto
Conſtantinople	3 Lire 6 ſoldi	—	1 Piaſtre
Paris	2 Lire 5 ſoldi	—	1 Franc
Genoa	38 Soldi	—	1 Lira fuori banco
Hamburgh	4 Lire 6 ſoldi	—	1 Mark
Leghorn	11 Lire 18 ſoldi	—	1 Pezza
Milan	34 Soldi	—	1 Lira corrente
Naples	9 Lire 18 ſoldi	—	1 Ducat regno
Vienna	4 Lire 8 ſoldi	—	1 Florin
Rome	12 Lire 10 ſoldi	—	1 Roman crown.

VIENNA.

Monies of Exchange.

Exchanges are computed in florins and creutzers, or in rixdollars and creutzers; pfenings are ſometimes uſed.

4 Pfenings = 1 Creutzer
60 Creutzers = 1 Florin
90 Creutzers, or 1½ florin = 1 Rixdollar of account.

Quotation explained.

Vienna gives to	Uncertain prices.		Certain prices.
Amſterdam	286 Rixdollars	for	100 Rixdollars current
Augſburg	202½ Ditto	—	100 Ditto
Hamburgh	300 Ditto	—	100 Ditto banco
London	19 Florins	—	1 Pound ſterling
Paris	47 Creutzers	—	1 Franc
Conſtantinople	112 Florins	—	1 Piaſtre
Venice	184 Ditto	—	500 Lire piccole
Prague	99½ Ditto	—	100 Florins
receives from			
Genoa	30 Soldi fuori banco	for	1 Florin
Leghorn	28 Soldi moneta buona	—	1 Ditto
Milan	33 Soldi correnti	—	1 Ditto.

AMERICA.

Monies of Exchange.

Exchanges are computed in dollars, dimes, and cents; and in ſome places in pounds, ſhillings, and pence currency.

10 Cents = 1 Dime
10 Dimes, or 100 cents = 1 Dollar,
12 Pence currency = 1 Shilling ditto
20 Shillings currency = 1 Pound ditto.

American Quotations explained.

New York gives to	Uncertain prices.		Certain prices.
London	177 Pounds currency	for	1 Pound ſterling
Amſterdam	42 Cents	—	1 Guilder
Hamburgh	35 Cents	—	1 Mark
Bremen	78 Cents	—	1 Rixdollar
receives from			
Paris	5 Francs 30 cent.	—	1 Dollar.

Philadelphia gives to	Uncertain prices.		Certain prices.
Amſterdam	43 Cents	for	1 Guilder
Hamburgh	35 Cents	—	1 Mark
receives from			
London	4*s.* 6*d.* ſterling *at par*	—	1 Dollar

Baltimore gives to	Uncertain prices.		Certain prices.
Amſterdam	40 Cents	for	1 Guilder
Hamburgh	33 Cents	—	1 Mark
London	101 Cents	—	4*s.* 6*d.* ſterling.

Theſe American quotations have been copied from a New York paper of March 1809. All the other quotations may be likewiſe relied on, having been taken from genuine and recent authorities.

LONDON.

Monies of Exchange.

Exchanges are computed in pounds, ſhillings, and pence ſterling; and farthings are ſometimes reckoned.

4 Farthings = 1 Penny
12 Pence = 1 Shilling
20 Shillings = 1 Pound.

Lloyd's Liſt explained.

London gives to	Uncertain prices.		Certain prices.
Madrid	42 Pence ſterling	for	1 Dollar of plate
Genoa	47½ Ditto	—	1 Pezza of 5¾ lire
Leghorn	51½ Ditto	—	1 Pezza of 8 reals
Liſbon	68 Ditto	—	1 Milree
Naples	42 Ditto	—	1 Ducat regno
Palermo	90 Ditto	—	1 Ounce
receives from			
Amſterdam	34 Shillings Flem.	—	1 Pound ſterling
Rotterdam	11 Florins current	—	1 Ditto
Hamburgh	33 Shillings Flem.	—	1 Ditto
Paris	23 Livres 10 ſous	—	1 Ditto
Venice	52 Lire piccole	—	1 Ditto
Dublin	10 per cent, that is, 110*l.* Iriſh	—	100 Ditto.

Examples for calculating the exchanges of London with the above places are here given; whence the method of computing the exchanges of other places one with another may be eaſily comprehended, as all operations of this kind may be performed by the Rule of Three Direct.

LONDON and AMSTERDAM.

Engliſh money is reduced to Dutch by ſaying; as 1*l.* ſterling is to the rate of exchange, ſo is the given ſum to the ſum ſought.

Reduce 782*l.* 12*s.* 6*d.* ſterling to Dutch money, exchange at 34 ſhillings and 8 pence Flemiſh *per* pound ſterling.

```
     £.     s. d.              £.  s. d.   Flor. Stiv.
As   1  :   34 8 Flem.   ::   782 12 6  :  8139   6
            12                 20
           ----              -----
           416               15652
             8                  12
           ----              ------
           3328 Pennings     187830
                               3328
                            -------
                            1502640
                            375660
                           563490
                          563490         16
                    24,0)62509824,0(2604576 Pennings
                          48             -------
                          --        2,0)16278,6 Stivers
                          145, &c.      --------
                                        8139 Flor. 6 Stiv.
```

Dutch money is reduced to Engliſh by reverſing the foregoing operation; thus,

```
      s. d.           £.     Flor. Stiv.      £.  s. d.
As   34 8 Flem.   :   1  ::  8139  6    :   782 12 6
```

London and Hamburgh.

Engliſh money is reduced to that of Hamburgh by an operation ſimilar to the foregoing.

Reduce 106*l*. 17*s*. 6. ſterling to Hamburgh money; exchange at 35 ſhillings 4 grotes Flemiſh *per* pound ſterling.

```
   £.      s. d.              £.  s. d.     M. Sc. Pf.
As  1  :   35 4 Flem.   :   106 17 6  :  1416  1  6
           12                20
          ----             -----
          424              2137
            6                12
          ----             -----
          2544 Pfenings    25650
          ----              2544
                           ------
                          102600
                         102600
                        128250
                        51300         12
                      ---------     ------
                 24,0)6525360,0(271890 Pfenings
                        48          ------
                        --       16)22657 Schill. 6 Pfen.
                        172, &c.    ------
                        ---         1416 M. 1 Sc. 6 Pf.
                                    ----
```

Hamburgh money is reduced to Engliſh by reverſing the foregoing operation; thus,

```
      s. d.            £.      M.  Sc. Pf.      £.  s. d.
As   35 4 Flem.   :    1  ::  1416  1   6  :  106 17 6
```

London and Paris.

Engliſh money is reduced to French by ſaying; as 1*l*. is to the rate of exchange, ſo is the given ſum to the ſum ſought.

Reduce 728*l*. 15*s*. ſterling to French money, exchange at 23 livres 10 ſous *per* pound ſterling.

```
    £.    Liv. So.        £.  s.       Liv.  So. Den.
As  1  :  23  10   ::   728 15    :   17125  12  6
          20            ×20×470
          ---          ---------
          470       2,0)685025,0
          ---          ---------
                    2,0)34251,2½ Sous
                       ---------
                        17125 Liv. 12 Sous, 6 Den.
                        -----
```

But if the anſwer be required in francs, the livres muſt be multiplied by 80 and divided by 81; thus,

```
                         Liv.  So. Den.     Francs. Cen.
As  81  :  80  ::   17125  12  6   :   16914  19
```

French money is reduced to Engliſh by reverſing the foregoing operation; thus,

```
                       Francs. Cen.       Liv.  So. Den.
As  80  :  81  ::   16914  19    :   17125  12  6
     Liv. So.     £.        Liv.  So. Den.       £.  s.
And as 23 10  :   1   ::   17125  12  6    :   728 15
```

The exchauge of Paris on London is, however, generally expreſſed in francs, and then the reduction may be performed by a ſingle analogy; thus,

Reduce 4305 francs 95 centimes to ſterling; exchange at 24 francs 25 centimes *per* pound ſterling.

```
     Fr. Cen.     £.      Fr.  Cen.      £.  s. d.
As   24  25   :   1  ::  4305  95   :   177 11 3½
```

London and Spain.

Engliſh money is reduced to Spaniſh by ſaying; as the rate of exchange is to 1 dollar, ſo is the given ſum to the ſum ſought.

Reduce 391*l*. 1*s*. 3*d*. ſterling to Spaniſh money, exchange at 35½ ſterling *per* dollar of plate.

```
    d.    Doll.            £.  s. d.       Doll. R. M.
As 35½  :  1     ::     391  1  3    :   2643  6 14
    2      8           ×20×12×2
   --     --          ----------
   71      8          187710
   --     34           ×272
          --          ------  34
          272Ma. 71)51057120(719114 Maravedis.
          ---                ------
                           8)21150 Reals 14 Mar.
                             -----
                              2643 Doll. 6 R. 14 M.
                              ----
```

But if the anſwer be required in vellon, the reals of plate ſhould be multiplied by 32 and divided by 17; thus,

```
                Reals.  Mar. plate.   Reals.  Mar. vel.
As 17 : 32 :: 21150      14     :   39812     18
```

Spaniſh money is reduced to Engliſh by reverſing the foregoing operation: thus,

```
     Doll.      d.        Doll. R. Mar.       £.  s. d.
As    1    :   35½   ::   2643  6  14    :   391  1 3
```

London and Leghorn.

Engliſh money is reduced to that of Leghorn by ſaying; as the rate of exchange is to 1 pezza, ſo is the given ſum to the ſum ſought.

Reduce 392*l*. 18*s*. 4¼*d*. ſterling to money of Leghorn; exchange at 50¼*d*. *per* pezza of 8 reals.

```
     d.     Pezza.      £.  s. d.       Pezze Sol. De.
As  50¼  :   1   ::   392 18 4¼    :   1876  12  5
     4               ×20×12×4
    ---             ----------
    201         201)377201(1876 Pez. 12 Sol. 5 Den.
    ---             201
                    --- &c.
```

Money of Leghorn is reduced to Engliſh by reverſing the foregoing operation; thus,

```
     Pezza     d.        Pezze Sol. Den.       £.  s. d.
As    1    :  50¼   ::   1876  12  5    :   392 18 4¼
```

London and Genoa.

Engliſh money is reduced to money of Genoa by an analogy ſimilar to the foregoing.

Reduce 239*l*. 11*s*. 3*d*. to money of Genoa; exchange at 45*d*. ſterling *per* pezza of 5¾ lire fuori banco.

```
     d.    Pezza       £.  s. d.       Pezza Sol. Den.
As   45  :   1   ::   239 11 3    :   1277  13   4
                      ×20×12
                   -----------
                45)57495(1277 Pezze 13 Soldi 4 Den.
                   45
                   --
                   124, &c.
```

But if the anſwer be required in lire, the ſum thus found ſhould be multiplied by 23, and divided by 4; thus,

Pez. Sol. D. di Pez. Lire Sol. D. di Lira
As 4 : 23 :: 1277 13 4 : 7346 11 8

Money of Genoa is reduced to Engliſh by reverſing the foregoing operation; thus

Lire Sol. D. di Lira Pez. Sol. D. di Pez.
As 23 : 4 :: 7346 11 8 : 1277 13 4

Pezza *d.* Pezze Sol. Den. £. *s.* *d.*
And as 1 : $50\frac{1}{4}$ :: 1277 13 4 : 239 11 3

LONDON and LISBON.

Engliſh money is reduced to Portugueſe by ſaying: as the rate of exchange is to 1 milree, ſo is the given ſum to the ſum ſought.

Reduce 218*l.* 8*s.* $5\frac{1}{4}$*d.* to Portugal money; exchange at $63\frac{3}{8}$*d.* ſterling *per* milree.

d. Milree £. *s.* *d.* Mil. Rees
As $63\frac{3}{8}$: 1 :: 218 8 $5\frac{1}{4}$: 827 160
8 × 20 × 12 × 8

507 507)419370(827,160
4056
&c.

Portugal money is reduced to Engliſh by reverſing the foregoing operation; thus,

Milree *d.* Mil. Rees £. *s.* *d.*
As 1 : $63\frac{3}{8}$ :: 827 160 : 218 8 $5\frac{1}{4}$

LONDON and NAPLES.

Engliſh money is reduced to that of Naples by ſaying; as the rate of exchange is to 1 ducat, ſo is the given ſum to the ſum ſought.

Reduce 158*l.* 9*s.* 3*d.* to money of Naples; exchange at $37\frac{1}{2}$*d.* ſterling *per* ducat regno.

d. Ducat £. *s.* *d.* Ducats Grains
As $37\frac{1}{2}$: 1 :: 158 9 3 : 1014 16
2 × 20 × 12 × 2

75 75)76062(1014,16
75
&c.

Money of Naples is reduced to ſterling by reverſing the foregoing operation; thus,

Ducat *d.* Ducats Grains £. *s.* *d.*
As 1 : $37\frac{1}{2}$ :: 1014 16 : 158 9 3

LONDON and PALERMO.

Engliſh money is reduced to Sicilian by ſaying; as the rate of exchange is to 1 ounce, ſo is the given ſum to the ſum ſought.

Reduce 565*l.* 10*s.* 9*d.* ſterling to Sicilian money; exchange at 89*d.* ſterling *per* ounce.

d. Oz. £. *s.* *d.* Oz. Taro Grs.
As 89 : 1 :: 565 10 9 : 1525 1 7
× 20 × 12

89)135729(1525 Oz. 1 taro 7 grains.
89
&c.

Remainder 4 oz. × 30 × 20 ÷ 89 gives 1 taro 7 grains.

Sicilian money is reduced to Engliſh by reverſing the foregoing operation; thus:

Oz. *d.* Oz. Taro Grs. £. *s.* *d.*
As 1 : 89 :: 1525 1 7 : 565 10 9

LONDON and VENICE.

Engliſh money is reduced to Venetian by ſaying; as 1*l.* is to the rate of exchange, ſo is the given ſum to the ſum ſought.

Reduce 250*l.* 11*s.* 3*d.* to Venetian money; exchange at 59 lire piccole *per* pound ſterling.

£. Lire £. *s.* *d.* Lire Sol. Den.
As 1 : 59 :: 250 11 3 : 14783 3 9
× 20 × 12 × 59

24,0)354796,5(14783 Lire 3 Soldi 9 Denari.
24
&c.

Venetian money is reduced to Engliſh by reverſing the foregoing operation; thus,

Lire £. Lire Sol. Den. £. *s.* *d.*
As 59 : 1 :: 14783 3 9 : 250 11 3

LONDON and ROTTERDAM.

Engliſh money is reduced to Dutch currency by ſaying; as 1*l.* is to the rate of exchange, ſo is the given ſum to the ſum ſought.

Reduce 196*l.* 17*s.* 6*d.* ſterling to Dutch currency in Rotterdam; exchange at 12 florins 4 ſtivers *per* pound ſterling.

£. Fl. St. £. *s.* *d.* Fl. St. Pen.
As 1 : 12 4 :: 196 17 6 : 2401 17 8
20 × 20 × 12 × 244

244 20
24,0)1152900,0(4803,$7\frac{1}{2}$ Stivers.
96 2401 Florins $17\frac{1}{2}$ Stivers.
&c.

Dutch currency is reduced to Engliſh money by reverſing the foregoing operation; thus,

Fl. St. £. Flor. St. Pen. £. *s.* *d.*
As 12 4 : 1 :: 2401 17 8 : 196 17 6

LONDON and DUBLIN.

Engliſh money is reduced to Iriſh by ſaying; as 100 is to 100 more the rate of exchange, ſo is the given ſum to the ſum ſought.

Reduce 787*l.* 15*s.* Engliſh to Iriſh money; exchange at $11\frac{5}{8}$.

£. *s.* £. *s.* *d.*
As 100 : $111\frac{5}{8}$ :: 787 15 Eng. : 879 6 6 Ir.
8 8 × 893

800 893 8,00)7034,60*l.* 15*s.*
879
Rem. 2,60
20

8,00)52,15(6,51
12

6,12

Or thus:

787 15
$11\frac{5}{8}$
8665 5
$\frac{4}{8} = \frac{1}{2} =$ 393 17 6
$\frac{1}{8} = \frac{1}{4} =$ 98 9 $4\frac{1}{2}$
91,57 12 $10\frac{1}{2}$
20
11,52
12
6,35

£787 15*s.* 0*d.*
91 11 6
879 6 6

Iriſh money is reduced to Engliſh by reverſing the foregoing analogy; thus,

		£.	s.	d.		£.	s.
As $111\frac{5}{8}$	: 100 ::	879	6	6 Ir	:	787	15 Eng.

When the exchange between the two countries is at par, Engliſh money is turned to Iriſh by adding $\frac{1}{12}$, and Iriſh to Engliſh by ſubtracting $\frac{1}{13}$.

Thus reduce 787*l.* 15*s.* Engliſh to Iriſh money at par.

12)787 15 0 Engliſh
55 12 11
13)853 7 11 Iriſh
65 12 11
787 15 0 Engliſh.

Arbitration of Exchange.

Arbitration of exchange is a compariſon between the courſes of exchange of ſeveral places in order to aſcertain the moſt advantageous method of drawing or remitting bills. It is diſtinguiſhed into ſimple and compound arbitration; the former comprehends the exchanges of three places only, and the latter of more than three places.

Simple Arbitration

Is a compariſon between the exchanges of two places with reſpect to a third; that is to ſay, it is a method of finding ſuch a rate of exchange between two places, as ſhall be in proportion with the rates quoted between each of them and a third place. The exchange thus determined, is called the *arbitrated price*, and alſo *proportional exchange*; and the *proportional par*.

If, for example, the courſe between London and Paris be 24 francs for 1*l.* ſterling, and between Paris and Amſterdam 54*d.* Flemiſh for 3 francs, (that is, 36*s.* Flemiſh for 24 francs,) the arbitrated price between London and Amſterdam, through Paris, is evidently 36*s.* Flemiſh for 1*l.* ſterling: for as 3 fr. : 54*d.* Flem. :: 24 fr. : 36*s.* Flem.

Now when the actual direct price (as ſeen by a quotation or otherwiſe adviſed,) is found to differ from the arbitrated price, advantage may be made by drawing or remitting indirectly, that is, by drawing on one place through another, as on Amſterdam through Paris; which may be performed in three different ways.

1ſt. London may draw on Paris, and order his correſpondent there to draw on Amſterdam.

2d. London may draw on Paris, and order his correſpondent in Amſterdam to remit the ſame ſum to Paris.

3d. London may order his correſpondent at Paris to draw on Amſterdam, and to remit the value to London.

The operation of remitting indirectly, or of remitting to one place through another, may be likewiſe performed in three different ways:

1ſt. London may remit to Paris, and order his correſpondent there to remit the ſum to Amſterdam.

2d. London may remit to Paris, and order his correſpondent in Amſterdam to draw on Paris.

3d. London may take bills on Paris, and remit them to Amſterdam, there to be negociated.

To exemplify this by familiar illuſtrations, ſuppoſe the arbitrated price between London and Amſterdam to be as before ſtated, 36*s.* Flemiſh for 1*l.* ſterling; and ſuppoſe the direct courſe, as given in Lloyd's liſt, to be 37*s.* Flemiſh, then London, by drawing directly on Amſterdam, muſt give 37*s.* Flemiſh for 1*l.* ſterling; whereas, by drawing through Paris, he will give only 36*s.* Flemiſh for 1*l.* ſterling: it is therefore the intereſt of London to draw indirectly on Amſterdam through Paris.

On the contrary, if London remits directly to Amſterdam, he will receive 37*s.* Flemiſh for 1*l.* ſterling; whereas, by remitting through Paris, he will receive only 36*s.* Flemiſh: it is the intereſt of London therefore to remit directly to Amſterdam.

Example 2.—Suppoſe the exchange of London on Liſbon to be at 68*d.* *per* milree, and that of Liſbon on Madrid 500 rees *per* dollar, the arbitrated price between London and Madrid is 34*d.* ſt. *per* dollar; for as 1000 rees : 68*d.* :: 500 rees : 34*d.* But if the direct exchange of London on Madrid be 35*d.* ſterling *per* dollar, then London, by remitting directly to Madrid, muſt pay 35*d.* for every dollar; whereas by remitting through Liſbon he will pay only 34*d.*: it is therefore the intereſt of London to remit indirectly to Madrid through Liſbon.

On the contrary, if London draws directly on Madrid, he will receive 35*d.* ſterling *per* dollar; whereas, by drawing indirectly through Liſbon, he would receive only 34*d.*: it is therefore the intereſt of London to draw directly on Madrid.

From theſe examples, the two following rules are manifeſt.

Rule 1.—Where London gives the certain price, draw through that place which gives the loweſt arbitrated price, and remit through that which produces the higheſt.

Rule 2.—Where London gives the uncertain price, draw through that place which produces the higheſt arbitrated price, and remit through that which gives the loweſt.

What is ſaid here of London will equally apply to any other place from whence the operation is made.

Suppoſe the exchange of London on Amſterdam to be 34.6; on Genoa, 47; on Leghorn, 52; and the exchange of Amſterdam on Genoa, 86; on Leghorn, 93; what is the moſt advantageous method for London to remit to, or draw on Amſterdam?

1ſt.—Becauſe 47*d.* ſt. give 1 pezza in Genoa, and this pezza in Amſterdam gives 86*d.* Flemiſh, ſay, as 47*d.* ſt. : 86*d.* Flemiſh :: 240*d.* ſt. : 439*d.* Flemiſh, or 36*s.* 7*d.* Flemiſh, which is the arbitrated price through Genoa.

2d.—Becauſe 52*d.* ſt. give 1 pezza in Leghorn, and this pezza in Amſterdam gives 93*d.* Flemiſh, ſay, as 52*d.* ſt. : 93*d.* Flemiſh :: 240*d.* ſt. : 429*d.* Flemiſh, or 35*s.* 9*d.* Flemiſh, which is the arbitrated price through Leghorn.

Hence, according to the firſt rule, the intereſt of London is *to draw* directly on Amſterdam, inſtead of drawing through Genoa or Leghorn; and *to remit* through Genoa, inſtead of remitting directly to Amſterdam, or indirectly through Leghorn.

And according to the ſecond rule, the intereſt of Amſterdam would be *to remit* directly to London, and *to draw* on London through Genoa.

Compound

Compound Arbitration

Is a compariſon between the exchanges of more than three places in order to find how much a remittance paſſing through them all will amount to at the laſt place, or to find the arbitrated price between the firſt place and the laſt, and thus to determine on the moſt advantageous mode of negociating bills.

Compound arbitration is therefore a repetition of ſimple arbitration, and may be ſolved by a continuation of ſeveral ſtatings in the Rule of Three; but all ſuch operations are beſt performed by conjoint proportion; commonly called the "Chain rule," which ſhall be here explained and demonſtrated, after giving an example of compound arbitration by the Rule of Three.

Suppoſe the exchange between London and Amſterdam to be 35 ſhillings Flemiſh for 1 *l.* ſterling; between Amſterdam and Liſbon, 42 pence Flemiſh for 1 old cruſade; and between Liſbon and Paris, 480 rees for three francs, what is the arbitrated exchange between London and Paris?

1ſt. As 35*s.* Flem. : 1*l.* :: 42*d.* Flem., or 3½*s.* Flem. : 2*s.* ſt. = 1 old cruſade.

2dly. As 1 old cruſade, or 400 rees : 2*s.* ſt. :: 480 rees : 2*s.* 4⅘*d.* ſt. = 3 francs.

3dly. As 2*s.* 4⅘*d.* ſt. : 3 francs :: 240*d.* ſt. : 25 francs.

Hence the arbitrated price is 25 francs for 1 *l.* ſterling.

The Chain Rule explained and demonſtrated.

Diſtinguiſh the ſeveral courſes of exchange into antecedents and conſequents, and place them in two columns, the antecedents to the left and the conſequents to the right, by way of equation.

The firſt antecedent muſt be of the ſame denomination as the quantity of which the value is required.

The firſt conſequent muſt be of the ſame denomination as the ſecond antecedent, and the ſecond conſequent as the third antecedent; and ſo on throughout.

The laſt conſequent muſt be of that denomination in which the anſwer is required.

The terms being thus arranged, the antecedents muſt be multiplied continually for a diviſor, and the conſequents for a dividend; and the quotient will be the anſwer.

The calculation may be abridged by expunging ſuch antecedents and conſequents as are alike, and reducing ſuch their loweſt terms as admit of a common diviſor.

Example from the foregoing Queſtion.

1 *l.* Sterling = 35 Shillings Flemiſh.
3½ Shillings Flemiſh = 400 Rees
480 Rees = 3 Francs.

How many francs will 1 *l.* ſterling give?

$$\frac{3 \times 400 \times 35}{1 \times 480 \times 3\frac{1}{2}} = \frac{42000}{1680} = 25 \text{ francs.}$$

In this example, 480 and 400 have the common diviſors 8 and 10, and they may therefore be reduced to 5 and 6; again the antecedent 6 may be reduced to 2, by ſtriking out the firſt conſequent 3; the fraction is therefore reduced to $\frac{5 \times 35}{2 \times 3\frac{1}{2}} = \frac{175}{7} = 25$, as before.

Demonſtration of the Chain Rule.

Let A, B, C, D, &c. be ſeveral denominations of money, and *m. n, p, q,* &c. the numbers or quantities of thoſe denominations, and let them ſtand thus:

Antecedents. . . . *Conſequents.*
m A . . = . . n B
p B . . = . . q C
r C . . = . . s D
t D . . = . . v E

Now to find what number of the laſt denomination (E) is equal to a given number of the firſt denomination (A) let z times the laſt term = y times the firſt, that is, let $z\,\text{E} = y\,\text{A}$.

Multiply all theſe equations together, the antecedents by the antecedents, and the conſequents by the conſequents, which will give $m\,\text{A} \times p\,\text{B} \times r\,\text{C} \times t\,\text{D} \times z\,\text{E} = n\,\text{B} \times q\,\text{C} \times s\,\text{D} \times v\,\text{E} \times y\,\text{A}$, and this equation reduced is $mprtz = nqsvy$.

Now if the number of the laſt denomination be required, $z = \frac{nqsvy}{mprt}$; but if the number of the firſt denomination be required, $y = \frac{mprtz}{nqsv}$. *Q. E. D.*

Example 2.—If London remit 1000 *l.* ſterling to Cadiz by way of Holland at 35 *s.* Flemiſh *per* pound ſterling; thence to France at 58 *d.* Flemiſh *per* ecu of 3 francs; and thence to Cadiz at 15½ francs *per* doubloon of 4 dollars, what is the price between London and Cadiz reſulting from the operation? and how many dollars will the 1000*l.* amount to in Spain?

1 Pound ſterling = 35 Shillings Flemiſh
1 Shilling Flemiſh = 12 Pence Flemiſh
58 Pence Flemiſh = 3 Francs
15½ Francs = 1 Doubloon
1 Doubloon = 4 Dollars

How many dollars are equal to 1000 *l.* ſterling?

$$\frac{35 \times 12 \times 3 \times 4 \times 1000}{58 \times 15\frac{1}{2}} = \frac{5040000}{899} = 5606 \text{ dollars, 1 real,}$$

28 mar. which gives the exchange at 42¾ *d.* nearly.

The indirect courſe of exchange between London and Cadiz may be alſo found by an inverſe operation, called the *Doctrine of Contraries*: thus,

4 Dollars = 1 Doubloon
1 Doubloon = 15½ Francs
3 Francs = 58 Pence Flemiſh
12 Pence Flemiſh = 1 Shilling Flemiſh
35 Shillings Flemiſh = 240 Pence ſterling.

How many pence ſterling equal 1 dollar?

$$\frac{240 \times 58 \times 15\frac{1}{2}}{4 \times 3 \times 12 \times 35} = \frac{58 \times 15\frac{1}{2}}{3 \times 7} = \frac{899}{21} = 42\tfrac{17}{21}d.$$

Now if the direct courſe of exchange was above the indirect, the circular remittance would be moſt advantageous; but if under, the direct operation would be preferable.

In computing the profits or loſſes of exchange operations, allowance ſhould be made for the expences, commiſſion, and intereſt of money, all of which may be compriſed in the ſtatement by the Chain Rule; that is, by deducting them from thoſe terms of the conſequents to which they may relate; thus, in the following example, the *per centage* is ſubtracted from 100 in the laſt place of the conſequents.

Example 3.—London takes bills on Madrid at 33½*d. per* dollar of exchange, remits them to Amſterdam, with orders to negociate at 90¼ grotes *per* ducat of exchange, and make the returns in bills on Paris at 51⅜ grotes *per* ecu of 3 francs: what does London gain or loſe *per cent.* by this operation, ſuppoſing the bills on Paris are negociated at 25 livres 18 ſous *per* pound ſterling; and that all the charges, including intereſt for the time that London is out of its money, amount to 1⅛ *per cent.*?

33½ Pence ſterling = 272 Maravedis
125 375 Maravedis = 90¼ Grotes
51⅜

51⅛ Grotes = $\cancel{2}$ Francs
4 $\cancel{80}$ Francs = 81 Livres
1 Livre = $\cancel{20}$ Sous
259 $\cancel{518}$ Sous = $\cancel{240}$ Pence ſterling 120
$\cancel{100}$ Pence ſterling = 98⅞ On account of charges.

How much does $\cancel{100}$ *l.* ſterling give?

$$\frac{272\times 90\frac{1}{2}\times 81\times 98\frac{7}{8}}{33\frac{1}{2}\times 125\times 51\frac{1}{8}\times 4\times 259\times 100} = 105{,}853, \text{ anſwer.}$$

The profit is therefore 5*l.* 17*s.* 0¾*d.* *per* 100*l.* ſterling.

Operations in compound arbitration may be greatly facilitated by the help of logarithms: thus, "from the ſum of the logarithms of the conſequents, ſubtract the ſum of the logarithms of the antecedents; the difference will be the logarithm of the anſwer."

In this caſe, however, the reduction of the numbers as above is ſuperfluous, as it is as eaſy to find the logarithm of a large as of a ſmall number; but when equal terms are on both ſides they ſhould be ſtruck out; and if a common diviſor can be found which will reduce any term to unity, it will likewiſe ſhorten the operation.

In queſtions of this kind much time and labour may be ſometimes ſaved by making uſe of *fixed numbers*; thus, where ſeveral terms are unchangeable in both the antecedents and conſequents they can be reduced to one; and the conſtant logarithm of this number may be uſed with thoſe that vary; ſuch as the logarithms of the rate of exchange, the amount of the charges, &c.

Beſides the foregoing rules for facilitating the arbitration of exchange, various other methods have been propoſed for ſhortening and illuſtrating the ſubject; even triangles and other diagrams have been conſtructed for this purpoſe; (ſee Poſtlethwait's Commercial Dictionary, vol. i. p. 94.) but geometrical projections do not ſeem well adapted to elucidate this rule.

A graphic operation, however, of a very uſeful and ingenious deſcription, has been lately executed in London, in which ſcales of the monies of exchange of the principal places in Lloyd's liſt are ſo graduated and arranged, that the arbitrated price between any two of them, with reſpect to a third place, may be immediately found by the application of a right line. The invention is by William Wollaſton, M.D. S. and F.R.S.

We ſhall conclude this article by giving rules for calculating the intrinſic par of exchange, and alſo tables of the ſame in gold and ſilver according both to mint regulations, and to aſſays.

The intrinſic par of exchange may be calculated by the rules laid down for computing the value of coins. (See Coin.) But the operation may be performed with greater preciſion by the Chain rule, as in the following examples.

Example 1.—What is the intrinſic par between London and Liſbon, in *gold*, when taken from the Johaneſe of 6400 rees, which, according to the mint regulations of Portugal, contains 221⅖ grains of Engliſh ſtandard gold?

6400 Rees = 221⅖ Grains of ſtandard gold
480 Grains ſtandard gold = 934½ Pence ſterling.

How many pence ſterling will 1000 rees give?

Striking out the common diviſor 1000, $\frac{221\frac{2}{5}\times 934\frac{1}{2}}{64\times 48} =$ 67,35*d.* ſterling for the milree.

Example 2.—What is the intrinſic par between London and Madrid, in *ſilver*, the weight of the dollar being 17 dwt. 8 gr. Troy, and its fineneſs 8 dwt. worſe than Engliſh ſtandard, according to average aſſays lately made at his majeſty's mint at the Tower of London.

85 Dollars of exchange = 64 Hard dollars
1 Hard Dollar = 416 Grains Troy
222 Grains in dollars = 214 Grains ſtandard
480 Grains ſtandard = 62 Pence ſterling.

How many pence ſterling does 1 dollar of exchange give?

Striking out the common diviſor 64, $\frac{416\times 214\times 62}{85\times 111\times 15} =$ 39*d.* ſterling for the dollar of exchange.

Example 3.—What is the intrinſic par between London and Amſterdam, in *ſilver*, when taken from the rixdollar current, which weighs 18 dwt. Troy, and is (according to aſſays) 16 dwt. worſe than Engliſh ſtandard, taking the agio of banco on currency at 4 *per cent.*

62 Pence ſterling = 20 Dwt. ſtandard ſilver
202 Dwt. ſtandard = 222 Dwt. in rixdollars
18 Dwt. or 1 rixdollar = 50 Stivers currency
1 Stiver = 2 Grotes
12 Grotes = 1 Shilling Flemiſh
104 Shillings Flemiſh currency = 100 Shillings Flemiſh banco.

How many ſhillings Flemiſh banco do 240 pence ſterling give?

Brought down and reduced.

31	$\cancel{62}$	$\cancel{20}$	5
103	$\cancel{208}$	$\cancel{222}$	37
5	$\cancel{18}$	50	50
	$\cancel{12}$	$\cancel{2}$	.
13	$\cancel{104}$	$\cancel{100}$	25
		$\cancel{240}$	20

$\frac{5\times 37\times 50\times 25\times 20}{31\times 103\times 3\times 13} =$ 37*s.* 2*d.* Flemiſh for the pound ſterling.

Table of the intrinſic par of exchange between London and the principal places in Lloyd's liſt, gold againſt gold, and ſilver againſt ſilver, calculated according to the mint regulations of each place reſpectively.

	In Gold.	In Silver.
	ſ. d. Flem.	ſ. d. Flem.
Amſterdam, currency	37 4.9	38 1
———, banco (agio 4 *per cent.*)	35 11.6	36 7.5
	flor. ſtiv.	flor. ſtiv.
Rotterdam, currency	11 4.5	11 8.5
	ſ. d. Flem.	ſ. d. Flem.
Hamburgh, banco	34 3.5	35 1
	liv. ſ. den.	liv. ſ. den.
Paris in the old coins	25 9 11	25 1 9
—— in the new coins	25 10 6	25 0 9½
	fr. cents.	fr. cents.
	or 25 21	or 24 73
	d. ſter.	d. ſter.
Genoa - -	45.52	46
Leghorn - -	49.09	46.67
Naples - -	42.57	43.5
Liſbon - -	67.4	69.4
Madrid, Cadiz - -	37.3	39.22
	lire	lire
Venice - -	46.28	47.5

Table of the intrinſic par of exchange between London and the principal places in Lloyd's Liſt, gold againſt gold, and ſilver againſt ſilver, calculated from aſſays lately made both in London and Paris.

	In Gold.	In Silver.
	ſ. d. Flem.	ſ. d. Flem.
Amſterdam, currency	37 4	38 7½
————, banco (agio 4 *per cent.*)	35 10.8	37 1.7
	flor. ſtiv.	flor. ſtiv.
Rotterdam, currency	11 4	11 14
	ſ. d. Flem.	ſ. d. Flem.
Hamburgh, banco	34 2.4	35 1
	liv. ſ. den.	liv. ſ. den.
Paris, in the old coins	25 9 9	25 9 9
——, in the new coins	25 11 6.2	25 3 7½
	fr. cents.	fr. cents.
	or 25 26	or 24 87
	d. ſter.	d. ſter.
Genoa - -	45.52	45.82
Leghorn - -	49.05	46.57
Naples - -	42	41.25
Liſbon - -	66.5	68.4
Madrid, Cadiz - -	36.05	39
	lire	lire
Venice - -	46.38	48.9

From the two foregoing tables it appears, that the par in gold generally varies from that in ſilver, and in ſome places very conſiderably.

It alſo appears that the aſſays do not differ eſſentially from the mint regulations; but where any difference is found to exiſt, it is moſtly in deficiency.

The intrinſic par of exchange between any other places, beſides the above, may be determined by the foregoing rules, and from the money tables in the preſent article, with thoſe given in the article Coin.

It ſhould be obſerved, that in the calculation of the par for Amſterdam, the ducat is reckoned at 5 florins 5 ſtivers currency, but this price is ſubject to alteration, and therefore no permanent par in gold can be eſtabliſhed with Holland, even if the agio were fixed. It ſhould be alſo remarked, that in computing the par with Hamburgh the ducat is reckoned at 6 marks Hamburgh banco, and the Cologne mark of fine ſilver at $27\frac{5}{8}$ marks banco, which are the common, but not conſtant prices, and therefore no permanent par can be eſtabliſhed with Hamburgh, any more than with Amſterdam.

Authors on exchange are very numerous, though few can be mentioned that have produced full and accurate ſyſtems: the principal are, Kruſe of Hamburgh; Ricard of Amſterdam; Gerhardt of Berlin; Marien of Spain; Senebier of Geneva; Giraudeau, Ruelle, Reiſhammer, and Corbaux of France; and Duboſt of London. Among the productions of thoſe writers Kruſe's Hamburgh Contoriſt has been the moſt univerſally approved; an Engliſh tranſlation of this ſyſtem of exchanges, monies, weights and meaſures, with conſiderable additions and alterations, is now nearly printed, and will be ſhortly publiſhed, under the title of the "Univerſal Cambiſt;" from which the preſent article has been chiefly extracted.

Exchange alſo denotes a public place, in moſt conſiderable cities, wherein the merchants, negociants, agents, bankers, brokers, interpreters, and other perſons concerned in commerce, meet, on certain days, and certain times thereof, to confer, and treat together of matters relating to exchanges, remittances, payments, adventures, aſſurances, freightments, and other mercantile negociations both by land and ſea.

In Flanders, Holland, and ſeveral cities of France, theſe places are called *bourſes;* at Paris and Lyons, *places de change;* and in the Hanſe towns, *colleges of merchants.*

Theſe aſſemblies are held with ſo much exactneſs, and merchants and negociants are ſo indiſpenſably required to attend at them, that a perſon's abſence alone makes him be ſuſpected of a failure or bankruptcy.

The moſt conſiderable exchanges in Europe are that of Amſterdam, and that of London, called the Royal Exchange. For an account of the latter, ſee Royal *Exchange.*

The former is a large building, 230 feet long and 130 broad, round which runs a periſtyle or portico, 20 feet wide. The columns of the periſtyle, amounting to 46, are numbered, for the convenience of finding perſons.

That of Antwerp was little inferior to either of them, till a variety of circumſtances concurred to effect its ruin, and to transfer its trade to Amſterdam; the era of this important event in commercial hiſtory is about the year 1585.

Even in the time of the ancient Romans there were places for the merchants to meet, in moſt of the conſiderable cities of the empire. That ſaid by ſome to have been built at Rome in the year of the city 259, 493 years before our Saviour, under the conſulate of Appius Claudius and Publius Servilius, was called *collegium mercatorum;* whereof it is pretended there are ſtill ſome remains, called by the modern Romans *loggia*, the lodge; and now, uſually the "Place of St. George."

This notion of a Roman exchange is ſuppoſed to be founded on the authority of Livy, whoſe words are as follow; *viz.* "Certamen conſulibus inciderat, uter dedicaret Mercurii ædem. Senatus a ſe rem ad populum rejecit utri eorum dedicatio juſſu populi data eſſet, eum præeſſe annonæ, mercatorium collegium inſtituere juſſit." Liv. lib. ii. But it muſt be here remarked, that *collegium* never ſignified a building for a ſociety in the purer ages of the Latin tongue; ſo that "collegium mercatorum inſtituere" muſt not be rendered to build an exchange for the merchants, but to incorporate the merchants into a company. As Mercury was the god of traffic, this ædes Mercurii ſeems to have been chiefly deſigned for the devotions of this company or corporation.

Exchange, in *Law*, is a mutual grant of equal intereſts in lands or tenements, the one in conſideration of the other; and in our common law it more particularly denotes the compenſation which the warrantor muſt make the warrantee, value for value, if the land warranted be recovered from the warrantee. Bracton, lib. ii.

The word "exchange," is ſo individually requiſite and appropriated by law to the caſe now ſtated, that it cannot be ſupplied by any other word, or expreſſed by any circumlocution. (Co. Litt. 50, 51.) The eſtates exchanged muſt be equal in quantity (Litt. § 64, 65.), not of *value*, for that is immaterial, but of *intereſt;* as fee-ſimple for fee-ſimple, a leaſe for 20 years for a leaſe of 20 years, and the like. And the exchange may be of things that lie either in grant or in livery. (Co. Litt. 51.) But no livery of ſeiſin, even in exchanges of freehold, is neceſſary to perfect the conveyance

conveyance (Litt. § 62.); for each party ſtands in place of the other and occupies his right, and each of them hath already had corporal poſſeſſion of his own land. But entry muſt be made on both ſides; for, if either party die before entry, the exchange is void for want of ſufficient notoriety. (Co. Litt. 50.) And ſo alſo, if two parſons, by conſent of patron and ordinary, exchange their preferments; and the one is preſented, inſtituted, and inducted, and the other is preſented, and inſtituted, but dies before induction; the former ſhall not keep his new benefice, becauſe the exchange was not completed; and therefore he ſhall return back to his own. (Park, § 288.) For if, after an exchange of lands or other hereditaments, either party be evicted of thoſe, which were taken by him in exchange, through defect of the other's title, he ſhall return back to the poſſeſſion of his own, by virtue of the implied warranty contained in all exchanges. Blackſt. Comm. book ii. See Warranty.

Exchange *of goods and chattels*. See Sale.

Exchange, *the king's*, is the place appointed by the king for exchange of plate, or bullion for the king's coin. Theſe places have formerly been diverſe: but now there is only one, *viz.* that of the Tower of London, joined with the Mint.

Exchange, *bill of*. See Bill *of Exchange*.

What we call re-exchange, is the due, or premium of a ſecond exchange, when a bill is proteſted. See Re-exchange.

Exchange *brokers*. See *Exchange* Brokers.

Exchange *of Priſoners*. This meaſure, which is dictated both by humanity, and, in general, by mutual intereſt, is frequently adopted by two hoſtile nations, for the purpoſe of eaſing themſelves from the great charge incurred by the retention of priſoners of war in priſons, depots, &c. Sometimes an exchange becomes a conſideration while drawing up the articles of a capitulation; eſpecially where the beſiegers conſider it a matter of policy to get poſſeſſion of a fortreſs, without being too ſtrict in the conditions of ſurrender.

Thus we frequently obſerve, that a garriſon is allowed to retire, under the expreſs ſtipulation, that "no part thereof ſhall ſerve again until regularly exchanged." In ſuch caſe, an immediate liberation of an equal number of thoſe confined in the enemy's priſons ought inſtantly to take effect, and the perſons thus diſcharged ſhould be forwarded to their country; but if, as ſometimes occurs at the very commencement of a war, when one party has been extenſively ſucceſsful, the other may not have the means of equalization in regard to the liberation of priſoners, it may occur, that months, or even years, may elapſe, before ſuch reſtriction may be removed.

This, indeed, is not the only point on which the matter may reſt: it may ſometimes happen, that a prince may feel it to be his intereſt not to carry an exchange into effect; and this he may juſtify under the ordinary circumſtances attendant upon capitulation. Say, that an army ſurrenders ſimply under this condition; "that it ſhall not ſerve until duly exchanged." Here we ſee no obligation on the part of its ſuperiors to make any exchange: therefore, when policy dictates ſuch forbearance, we cannot affix any imputation on the prince, power, &c., if no exchange takes place.

If, indeed, the garriſon are allowed to return to their country, or to retire unmoleſted, on condition that "they *ſhall* be exchanged," then, we naturally expect, that no time will be loſt in liberating an equal number; adverting to the ſeveral claſſes of thoſe allowed to retire, and pairing them off in a correct manner.

We have heard of evaſions contrived for the expreſs purpoſe of detaining ſome individual, who, by his prowefs, or abilities, may have become highly obnoxious to the enemy. This, however, can only take place where there is no perſon of correſponding rank, againſt whom he can be paired off; then the exchange neceſſarily becomes in a degree arbitrary; though it is a matter of courteſy, to form ſome equivalent, in ſuch manner as may ſuit the wiſhes of his own government.

With a view to facilitate the exchanges occaſionally ordered, as well as to obviate the million of frivolous complaints which would elſe be made, it is cuſtomary for powers at war either to receive agents, or to appoint ſupervifors, whoſe duty is confined ſolely to ſuch matters as relate to the due ſubſiſtence of the priſoners, and to conducting whatever may relate to exchanges. Through this medium a government may always avail itſelf of the means of releaſing any particular perſons, confined as priſoners of war in the enemy's country; but, to effect this, at leaſt to be able to command it, there muſt be in its power ſome equivalent: for it would be unreaſonable to expect that a general officer ſhould be given up, when only a colonel could be offered in exchange; but a general may be liberated by any government, for the purpoſe of liberating any officer of inferior rank then in the power of the enemy: and ſo throughout.

EXCHANGERS are thoſe who return money beyond ſea, by bills of exchange, &c. called anciently alſo *excambiators*, and ſince *remitters*.

EXCHEQUER, or ſimply *Chequer*, originally denotes a cheſs-board; or a frame divided into ſixty-four ſquares, of two colours, whereon to play at draughts, cheſs, &c. See Chess, &c.

The word is formed from the French *eſchequier*, which ſignifies the ſame. Hence, trees are ſaid to be planted chequer-wiſe, *in quincuncem*, when diſpoſed ſo as to form diverſe ſquares repreſenting a chequer.

Exchequer is more particularly uſed for a chamber, or apartment, in Weſtminſter-hall, conſiſting of two parts; the court of exchequer and the lower exchequer. See Court *of Exchequer*, and Court *of Exchequer-chamber*.

Exchequer-*bills* are a ſpecies of paper firſt eſtabliſhed by Mr. Montague, in 1696, as a more convenient kind of ſecurity than the tallies and orders for repayment then in uſe, and alſo to ſupply the want of circulating caſh, during the re-coinage at that period. They were then taken at the exchequer for all payments of the revenue, and, when re-iſſued, they were allowed 7*l.* 12*s.* *per cent.* intereſt. They have ſince been iſſued yearly for anticipating the produce of particular taxes; and they have almoſt conſtantly formed the principal article of that part of the public debt called the unfunded debt. Of late years the total amount of outſtanding exchequer bills (excluſive of thoſe charged on ſpecific branches of the revenue) has uſually been about 12 millions. The bank of England, ever ſince the year 1706, have been the contractors for their circulation, at a certain premium. The commiſſioners of the treaſury are empowered, by various ſtatutes, to borrow money, within a ſpecific ſum, limited by thoſe ſtatutes, by iſſuing exchequer bills on the credit of certain duties; which bills, by 12 Anne, cap. 11. and 12 Geo. I. cap. 11. bear an intereſt of 2*d.* a day *per cent.* payable to the bearers. But the intereſt payable on them has differed according to the current rate of intereſt at the time when they have been iſſued. Thoſe now in circulation bear intereſt at the rate of 3½*d.* a day *per cent.* They are often made for 100*l.* each, but of late years they have been chiefly for 1000*l.* each, and ſometimes for larger ſums. Theſe bills are numbered arithmetically, and regiſtered accordingly, ſo that the principal ſums may be paid off in courſe, the time of which is notified by public advertiſement. The ſaid exchequer bills ſhall be current to all receivers and collectors of the cuſtoms, exciſe, or any revenue, and at the receipt of the exchequer; and as any of them are paid or lent into the exchequer, the officers there ſhall cauſe tallies to be levied and delivered to the payers or lenders, as if they had made ſuch payments or loans in ſpecie. The inſtalments on loans are paid into the receipt of the exchequer in exchequer bills, which are received again by the bank as caſh, either for the amount of dividends due, or in repayment of advances. When theſe bills are ſold at a conſiderable diſcount, or any other circumſtance indicates that too many of them are in circulation, it is uſual to fund a part of them, that is, to convert them into a permanent debt by offering the holders of them ſtock in lieu of their bills. This of late has been frequently done. The total amount of exchequer bills iſſued for the public ſervice between the 5th of January 1808 and the 5th of January 1809, and not redeemed within that period, was 39,735,200*l.* The unfunded debt in exchequer bills, outſtanding on the 5th of January 1809, was 40,093,200*l.* The amount of exchequer bills iſſued for the public ſervice in Ireland, between the 5th of January 1808 and the 5th of January 1809, and not redeemed within that period, was 541,666*l.* 13*s.* 4*d.* If any exchequer bills be loſt, upon affidavit before a baron of the exchequer, and certificate from him, and ſecurity given to pay the ſame if found, duplicates are to be made out; and when bills are defaced new ones ſhall be delivered. Forging of theſe bills, or of the indorſements on them, is felony.

Exchequer, *meſſenger of the.* See Messenger.

Exchequer, *Black Book of the*, is a book under the keeping of the two chamberlains of the exchequer; ſaid to have been compoſed in 1175, by Gervaiſe of Tilbury, nephew of king Henry II. and divided into ſeveral chapters.

Herein is contained a deſcription of the court of England, as it then ſtood, its officers, their ranks, privileges, wages, perquiſites, powers, and juriſdiction; and the revenues of the crown, both in money, grain, and cattle. Here we find, that for one ſhilling, as much bread might be bought as would ſerve a hundred men a whole day; that the price for a fat bullock was only twelve ſhillings, and a ſheep four, &c. Larrey, p. i. p. 394. See alſo Domesday.

EXCISE, an inland duty, or impoſition, charged on commodities of general conſumption, and paid ſometimes upon the conſumption of the commodity, or frequently upon the retail ſale, which is the laſt ſtage before the conſumption. This mode of taxation was adopted among the Romans; for Auguſtus, after the civil wars, introduced an exciſe, which, though very moderate, was general. It ſeldom exceeded one *per cent.* but it comprehended whatever was ſold in the markets or by public auction, from the moſt conſiderable purchaſes of lands and houſes, to thoſe minute objects which can only derive a value from their infinite multitude and daily conſumption. Such a tax, however, as it affects the body of the people, has ever been the occaſion of clamour and diſcontent. Auguſtus was obliged to declare by a public edict, that the ſupport of the army depended in a great meaſure on the produce of the exciſe; and Tiberius diminiſhed the exciſe to one-half, though the relief was of very ſhort duration. It has been adopted, in more modern times, as the moſt economical mode of taxing the ſubject; the charges of laying, collecting, and managing the exciſe duties being conſiderably leſs in proportion than in other branches of the revenue. Beſides, it renders the commodity cheaper to the conſumer than charging it with cuſtoms to the ſame amount would do, becauſe this tax is generally paid in a much later ſtage of it. Nevertheleſs, the rigour and arbitrary proceedings of exciſe-laws ſeem hardly compatible with the temper of a free nation. For the frauds that might be committed in this branch of the revenue, unleſs a ſtrict watch is kept, makes it neceſſary, wherever it is eſtabliſhed, to give the officers a power of entering and ſearching the houſes of ſuch as deal in exciſeable commodities, at any hour of the day, and, in many caſes, of the night likewiſe. And the proceedings in caſe of tranſgreſſions are ſo ſummary and ſudden, that a man may be convicted in two days' time in the penalty of many thouſand pounds by two commiſſioners or juſtices of the peace; to the total excluſion of the trial by jury, and diſregard of the common law. Obnoxious as the exciſe duty has always been, it was firſt ſuggeſted by the earl of Bedford, lord treaſurer to king Charles I., but never actually introduced in that prince's reign. Its original eſtabliſhment took place in the year 1643, when it was introduced, on the model of the Dutch prototype, by the long parliament after its rupture with the crown; and its progreſs has been gradual. It was at firſt laid upon thoſe perſons and commodities, where it was ſuppoſed the hardſhip would be leaſt perceivable, *viz.* the makers and venders of beer, ale, cyder, and perry; and though it originated with the long parliament, the royaliſts at Oxford ſoon followed the example of their brethren at Weſtminſter, by impoſing a ſimilar duty; both parties, however, proteſting that it ſhould be continued no longer than to the end of the war, and then be utterly aboliſhed. But the parliament at Weſtminſter ſoon after impoſed it on fleſh, wine, tobacco, ſugar, and ſuch a multitude of other commodities, that it might be fairly denominated general. This was done in purſuance of the plan laid down by Mr. Pymme, who had been intended for chancellor of the exchequer under the earl of Bedford, and who ſeems to have been the father of the exciſe. In his letter to ſir John Hotham (30 May, 1643) he intimates, "that they had proceeded in the exciſe to many particulars, and intended to go on farther; but that it would be neceſſary to uſe the people to it by little and little." Having accuſtomed the people to it for ſome years, the ſucceeding champions of liberty boldly and openly declared (Ord. 14th Auguſt, 1649, ch. 50.) "the impoſt of exciſe to be the moſt eaſy, and indifferent levy that could be laid upon the people;" and accordingly it was continued during the whole uſurpation. Upon the reſtoration of king Charles II., as it had been long eſtabliſhed, and its produce was well known, ſome part of it was given to the crown, in 12 Car. II., by way of purchaſe for the feodal tenures and other oppreſſive parts of the hereditary revenue. (See Revenue.) Notwithſtanding its general unpopularity, it has been impoſed on abundance of other commodities in the reigns of king William III. and of every ſucceeding prince, towards ſupporting the enormous expences occaſioned by our wars on the continent. In the year 1732, the groſs produce of the exciſe-duty amounted to 2,964,617*l.* About this time ſir Robert Walpole, being of opinion, that taxes on conſumable commodities, to which every citizen contributes in proportion to his conſumption, and which, being included in the price of the commodity, are inſenſibly paid, conſtituted the moſt eligible mode of raiſing the revenue neceſſary for the public ſervice, formed a project for the gradual abolition, not only of the taxes on land, houſes, and windows, but alſo of the cuſtoms, by the ſubſtitution of productive exciſe duties. Fully apprized of the abuſes and frauds to which the collection of the cuſtoms was ſubject, and which he had no hope of remedying, he thought that the ſcheme of converting

ing the greater part of the cuſtoms into duties of exciſe, would be equally advantageous to government and to the fair trader; and that the exciſe laws might be ſo ameliorated, that, notwithſtanding the odium generally attached to them as arbitrary and oppreſſive, no juſt ground of complaint ſhould remain. With a view to the execution of this plan, he obtained a revival of the ſalt-duties, which had been repealed ſome years before; but upon propoſing, in the following year, to transfer the duties on wine and tobacco to the exciſe, "faction," ſays Dr. Smith (Wealth of Nations, vol. iii. p. 358.) "combined with the intereſt of ſmuggling merchants, raiſed ſo violent, though unjuſt a clamour againſt that bill, that the miniſter thought proper to drop it." The defeat of this ſcheme was celebrated by general rejoicings, as a deliverance from the greateſt political danger.

The ſeveral commodities now ſubject to exciſe duties are ale, beer, cyder, perry, mum, metheglin, and mead; things ſold by auction; bricks and tiles; candles; coaches and coachmakers; coffee, tea, chocolate, and cocoa-nuts; glaſs; hops; leather; linen cloths, ſilks, cottons, and callicoes; malt; paper; plate; ſalt; ſoap; ſpirituous liquors; ſtarch, hair-powder, and ſtone-blue; ſweets; tobacco and ſnuff; vinegar and verjuice; wine; and wire. See each of theſe articles.

In the year 1787 the various rates of duty which had been impoſed at different times were conſolidated; and other regulations were alſo adopted, by which the produce of the revenue was augmented, and the expence of collecting it materially reduced.

By 24 Geo. II. c. 40, all fines, penalties, and forfeitures, impoſed by this or any other act relating to the duties of exciſe, ſhall be ſued for, levied, recovered, or mitigated by ſuch ways and means as any fine, penalty, or forfeiture is or may be recovered or mitigated by any law or laws of exciſe, or in the courts at Weſtminſter, and ſhall be half to the king and half to him that ſhall inform or ſue:—that is to ſay, if within the limits of the chief office in London, the offence ſhall be determined by the commiſſioners (or any three of them, 1 Geo. II. ſt. 2. c. 16.) or, in caſe of appeals, by the commiſſioners of appeals; in all other places they ſhall be heard and determined by any two or more juſtices of the peace, reſiding near the place where the offence was committed, or forfeiture incurred; and in caſe of neglect or refuſal of ſuch juſtices, for the ſpace of fourteen days next after complaint made, and notice thereof given to the offender; then the ſub-commiſſioners may hear and determine the ſame; and if the party find himſelf aggrieved by the judgment given by the ſaid ſub-commiſſioners, he may appeal to the next quarter-ſeſſions, whoſe judgment therein ſhall be final. The ſaid commiſſioners for appeals, and chief commiſſioners for exciſe, and all juſtices of the peace and ſub-commiſſioners aforeſaid, are required, upon any complaint or information exhibited of any ſuch forfeiture made or offence committed, to ſummon the party accuſed, and upon his appearance or contempt to proceed to the examination of the fact, and on due proof thereof either by the voluntary confeſſion of the party, or by the oath of one credible witneſs, to give judgment or ſentence, and to iſſue warrants under their hands, for levying the ſame on the goods and chattels of the offender, and to cauſe ſale to be made thereof, if not redeemed in (not leſs than four, nor more than eight days, 27 Geo. II. c. 20.); and for want of ſufficient diſtreſs, to impriſon the party offending till ſatisfaction be made. The juſtices, commiſſioners, or ſub-commiſſioners, reſpectively, where they ſhall ſee cauſe, may mitigate, compound, or leſſen, the forfeiture, penalty, or fine; ſo as the ſame be not made leſs than double the value of the duty of exciſe which ought to have been paid, beſides the reaſonable coſts and charges of ſuch officers, or others as were employed therein, to be to them allowed by the ſaid juſtices. (12 C. II. c. 24.) No appeal in any cauſe of exciſe ſhall be admitted, till the appellant hath depoſited the ſingle duty with the commiſſioners or ſub-commiſſioners, and given ſecurity to the commiſſioners of appeal, or juſtices of the peace, where the cauſe is to be finally adjudged, for ſuch forfeiture as was adjudged againſt him. (15 C. II. c. 13.) By the ſame ſtatute all differences and appeals about the exciſe ſhall be heard in the proper county, and not elſewhere, and appeals within London and its limits, ſhall be within two months after judgment, and notice given or left at the dwelling houſe of the party, in all other places in four months and not otherwiſe.

By 43 Geo. III. c. 69, after fifth of July 1803, all duties, allowances, bounties and drawbacks of exciſe, and other duties under the management of the commiſſioners, granted by any act of parliament then in force, ſhall ceaſe; except in caſes relating to the recovery of arrears, or of any fine, &c. previouſly incurred. Provided that the act ſhall not extend to alter the duties upon malt, mum, cyder, and perry, granted by 43 Geo. III. c. 3. or upon malt, tobacco, and ſnuff, continued by 43 Geo. III. c. 4; (except as to the duties on tobacco licences, and on tobacco of Spain and Portugal): nor ſhall the act extend to the countervailing duties on importation from Ireland, or the drawbacks payable on exportation thither, according to the "Act of the Union;" (except thoſe in reſpect of beer, ale, and wines, bricks and tyles, cyder and perry, hops, mead or metheglin, ſpirits, vellum and parchment, gilt and ſilver wire, and gold and ſilver thread, lace or fringe.) And in lieu thereof ſhall be raiſed and collected upon the ſeveral goods, wares, merchandize, and commodities, deſcribed in ſchedules annexed to the ſaid act, and for the ſales by auction, and upon licences mentioned in one of theſe ſchedules, the ſeveral ſums and duties reſpectively ſet forth in the ſaid ſchedules; and that there be allowed in reſpect of goods, &c. for which any duty of exciſe is impoſed, the ſeveral drawbacks of exciſe as ſet forth in another ſchedule, and alſo all allowances directed to be made by any act in force on the ſaid 1ſt of July 1803, except as herein altered. And by 43 Geo. III. c. 81. certain additional duties inſerted in an annexed ſchedule are directed to be paid, and the drawbacks in another ſchedule ſhall be allowed; to commence from July 5, 1803, where no date is inſerted in the act, and the amount of the additional duties may be added to the price of articles contracted for prior to the act. And the ſaid new duties ſhall be raiſed, levied, collected, conſumed, paid, recovered, adjudged, mitigated, and allowed, (except where altered by theſe acts or either of them) in the like manner, and by ſuch means, ways, and methods as the former duties. And all conditions, regulations, rules, reſtrictions, and forfeitures; and every pain, penalty, fine, or forfeiture of any nature or kind whatſoever, for any offence againſt any act of parliament then in force; and the ſeveral clauſes, powers, and directions therein contained, (unleſs altered hereby,) ſhall extend to and be applied in the execution of theſe acts, in as full and ample manner as if the ſame were repeated and re-enacted in the body of theſe acts, 43 Geo. III. c. 69. § 4. c. 81. § 3. And in all caſes where duties are impoſed or drawbacks allowed by theſe acts on any ſpecific quantity of goods, the ſame ſhall apply after the ſame rate to any leſs quantity. Id.

The exciſe duties of England are under the management of nine commiſſioners, who ſit in the general "Exciſe office," having ſalaries of 1200*l.* a-year each, and they are obliged, by oath, to take no fee or reward, but from the king only. From theſe commiſſioners there lies an appeal to five others, called "Commiſſioners of Appeal." The commiſſioners of exciſe in Scotland are five in number, and have ſalaries of 600*l.* *per annum* each.

The number of officers employed in this branch of the revenue is very great. Beſide the commiſſioners above-mentioned, and their ſubordinate officers, as regiſters, meſſengers, &c. there is an auditor of the exciſe, and an auditor of hides, with their clerks, &c. A comptroller of caſh, and another of accompts, with their clerks; a regiſter; ſecretary; ſolicitor; receiver-general, with his clerks; clerk of ſecurities; ſtore-keeper; houſe-keeper; door-keepers; general accomptants, with their aſſiſtants; accomptant for fines, and two accomptants for the London brewery; clerk of the bills of exchange; examiners; clerk for ſuperviſors diaries; five general ſurveyors; general ſurveyors of diſtillery; and brandy; examiners of the diſtillery, of the brewery, and of ſoap and candles; ſurveyors of glaſs, of coaches, and plate licences; inſpector of ſpirituous liquors, licences, and coaches; inſpectors general of coffee, tea, &c. and of brewery through England and Wales. Beſide which, there are in England and Wales, excluſive of the bills of mortality, within which is the principal head office of exciſe, to which all other offices in the kingdom are ſubordinate and accountable, about fifty collectors, who go their reſpective rounds once in ſix weeks: the province of a collector comprehends ſeveral diſtricts, within each of which there is a ſuperviſor, under the inſpection of the collector; and each diſtrict is parcelled out into out-rides and foot-walks, within each of which there is an inferior officer, conſtituted under the hands and ſeals of the commiſſioners, or ſub-commiſſioners, in their reſpective diviſions, as neceſſity requires, and called gauger, or exciſeman, under the inſpection of the ſuperviſor, who every ſix weeks draws out a diary of every day's buſineſs, with remarks, and tranſmits it to the chief officer. Every perſon, previous to his appointment to the office of gauger, muſt procure a certificate of his age, which muſt be between 21 and 30; he muſt underſtand the four firſt rules of arithmetic, ſtate what buſineſs he hath followed, and that he is not encumbered with debts, be of the communion of the church of England, and, if married, not have more than two children; he muſt nominate two able perſons to be his ſureties; and the certificate, containing theſe particulars, and written by himſelf, muſt be ſigned by the ſuperviſor of the diſtrict where he lives, and accompanied with an affidavit, that he has uſed no bribes for obtaining this office. He is then ordered for inſtruction, under the care of an experienced officer, and to wait, under the denomination of an "expectant," till a vacancy happens. Upon admiſſion of officers of every kind relating to the exciſe, the oaths of allegiance and ſupremacy, and an oath of faithfulneſs in the execution of the particular office, muſt be taken, and the declaration againſt tranſubſtantiation muſt be ſubſcribed. The officers of exciſe are appointed, and may be diſmiſſed, replaced, or altered by the commiſſioners under their hands and ſeals; their ſalaries are allowed and eſtabliſhed by the treaſury: and by 1 William and Mary, c. 24. § 15. if it be proved by two witneſſes that any officer has demanded or taken any money, or other reward whatever, except of the king, ſuch offender ſhall forfeit his office. Officers of exciſe, taking a bribe, are liable to a forfeiture of 10*l.* 15 Car. II. cap. 11: and a perſon liable to exciſe duties offering them a bribe, &c. ſhall forfeit 500*l.* 11 Geo. cap. 30. Officers meddling in elections are ſubject to a penalty of 100*l.* and an incapacity of holding any office under the king, 5 W. cap. 20. And an officer, either of the exciſe or cuſtoms, dealing in exciſeable liquors, ſhall forfeit 50*l.* and be incapable of any office in the revenue, 12 Geo. cap. 28. The concealment of exciſeable goods is ſubject to a forfeiture of thoſe goods, and treble value, 11 Geo. cap. 30. Any perſon obſtructing an officer in the execution of his duty, ſhall forfeit 10*l.* 6 Geo. cap. 21. Actions of aſſault upon any officer may be tried in any county, 9 Geo. II. c. 35. And if any perſon ſhall diſturb or oppoſe any exciſe officer in the execution of the powers and authorities by this act granted, or any or either of them, except where other penalties are by the act provided, he ſhall forfeit 200*l.* 42 Geo. III. c. 38. And the ſame penalty is inflicted by 43 Geo. III. c. 81, in relation to that act. Officers of exciſe are empowered to ſearch at all times of the day, enter warehouſes, &c. And if officers ſuſpect that exciſeable goods are concealed in any place within the limits of the chief office of exciſe in London, upon oath by ſuch officers before the commiſſioners, or any two or more of them; or if ſuch place be in any other part of Great Britain, on oath before one or more juſtices of the county, &c. or ſuſpected place, ſetting forth the ground of ſuſpicion, the ſaid commiſſioners, or the ſaid juſtice or juſtices may, by ſpecial warrant, authoriſe ſuch officers by day or night (but if in the night, in preſence of a conſtable or other peace officer) to enter into ſuch place and to ſeize all ſuch goods; and if any perſon ſhall obſtruct any ſuch officers ſo authoriſed, or any one acting in the execution of ſuch warrant, he ſhall forfeit 100*l.* 42 Geo. III. c. 93. The officers, in their permits for removing exciſeable goods, ſhall expreſs as well the time for which they ſhall be in force for removing ſuch goods, as the time within which they ſhall be received into ſtock by the perſon to whom they are ſent; and if not removed within the time limited (unavoidable accidents excepted), or, in default of ſuch removing, if the permit ſhall not be returned to the officer who granted the ſame, the perſon procuring the permit ſhall forfeit treble value of the goods: and if not received into ſtock, within the time limited, by the perſon to whom they were permitted to be ſent, they ſhall be deemed goods removed without a permit. 21 Geo. III. c. 55. No writ ſhall be ſued out againſt any officer of exciſe, or his aſſiſtant, for any thing done in the execution of his office, until one calendar month's notice ſhall have been delivered to him, or left at his uſual place of abode, clearly and explicitly containing the cauſe of action, the name and place of abode of the perſon who is to bring ſuch action, and the name and place of abode of his attorney or agent: and the officer may at any time within ſuch month tender amends, and plead ſuch tender in bar of the action; and if, upon iſſue joined, the jury ſhall find the tender to have been ſufficient, they ſhall give a verdict for the defendant; but if the jury find that no amends, or ſuch as were not ſufficient, were tendered, they ſhall give a verdict for the plaintiff, and ſuch damages as they ſhall think proper with coſts of ſuit. 23 Geo. III. c. 70. If any action ſhall be brought againſt an officer, &c. it ſhall be brought within three months after the cauſe of action ſhall ariſe, and not afterwards, and ſhall be laid in the proper county; and if the plaintiff ſhall be nonſuited, or diſcontinue, or if upon a verdict or demurrer judgment ſhall be given againſt him, the defendant ſhall recover treble coſts.

The additional duties, which the progreſs of the public expenditure has rendered it neceſſary to impoſe, have greatly increaſed the produce of the exciſe, and rendered it the moſt important branch of the public revenue. The duties which it comprehends are divided into the permanent conſolidated duties, the temporary war taxes, and the annual duties; the latter conſiſt of the old annual malt duty, and of an additional malt duty, which, with ſome duties on tobacco and ſnuff, and ſome cuſtom duties, have, ſince the project for ſelling the land-tax, been granted annually in lieu thereof.

EXCISE.

An Account of the Groſs Actual Receipt in Money, Charges of Management, and Taxes repaid to Officers, Exp
Temporary War Taxes, and Malts and Tobacco, Annual in England, for the Year en
Exchequer, on each Article;—together with the Balance in the Hands of

Articles.	Groſs Actual Receipt in Money.			Charges of Management.			Rewards to Officers and Charges on Seized Spirits, 45th and 47th Geo. III.			Taxes.			Exports.			Allowances.			Bounties.		
	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d
Auctions - - -	281,795	10	11¼	1,621	8	10	-	-	-	108	3	9	-	-	-	-	-	-	-	-	-
Beer - - - -	2,956,224	3	11½	202,052	16	2¼	-	-	-	11,140	2	6½	43,355	12	1	-	-	-	-	-	-
Bricks and Tiles - -	291,243	11	0¼	2,649	16	9	-	-	-	119	6	3	1,917	9	11¼	-	-	-	-	-	-
Candles - - -	302,888	5	10	43,248	7	6¼	-	-	-	2,631	1	6	5,503	17	0	-	-	-	-	-	-
Cocoa Nuts and Coffee -	139,888	0	1	7,134	15	3	-	-	-	51	17	6	78	15	0	-	-	-	-	-	-
Cyder and Perry - -	54,272	2	8	962	17	9	-	-	-	45	3	6	5,248	4	8¾	-	-	-	-	-	-
Glaſs - - -	428,307	19	5¾	10,901	0	7	-	-	-	474	19	4	81,303	14	11½	-	-	-	-	-	-
Hides and Skins - -	311,005	8	8	23,247	8	1	-	-	-	1,579	15	0	7,416	7	5¾	-	-	-	-	-	-
Hops - - - -	172,103	5	0½	5,206	12	11	-	-	-	72	1	9	22,468	19	8½	-	-	-	-	-	-
Licences - - -	313,471	10	2½	3,898	12	2¼	-	-	-	291	13	6	-	-	-	-	-	-	-	-	-
Malt - - - -	1,147,672	2	2¾	326	11	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metheglin or Mead -	1	11	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paper - - -	403,129	13	5¾	7,742	16	9	-	-	-	705	12	10	18,198	15	10	4,315	10	6	-	-	-
Printed Goods - -	712,245	1	5¾	19,029	7	7¾	-	-	-	640	19	6½	401,889	11	0	-	-	-	-	-	-
Salt - - - -	1,449,200	11	0½	23,526	11	2½	-	-	-	1,445	2	9	42,943	8	0¼	22,747	13	5	5,019	2	
Soap - - - -	592,688	2	10¾	26,111	8	2	-	-	-	1,299	3	9½	12,761	17	9¾	26,154	11	10¼	-	-	-
Spirits { Britiſh - -	1,346,962	14	8½	12,710	6	11	-	-	-	687	1	0	-	-	-	-	-	-	-	-	-
Spirits { Foreign -	1,849,330	5	11	55,982	0	6¾	38,462	15	0½	953	1	0¾	-	-	-	-	-	-	-	-	-
Starch - - -	52,626	5	6½	4,892	14	11½	-	-	-	229	17	6	2,097	5	0½	521	12	11¼	-	-	-
Sweets - - -	27,420	7	5½	157	2	4	-	-	-	5	10	3	-	-	-	-	-	-	-	-	-
Tea - - - -	2,003,479	7	11½	31,372	1	0	-	-	-	823	2	6	36,758	18	6¾	-	-	-	-	-	-
Tobacco and Snuff -	194,436	3	6¾	-	-	-	-	-	-	-	-	-	1,412	0	0½	-	-	-	-	-	-
Verjuice - - -	63	16	9¼	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinegar - - -	41,013	2	10¾	390	8	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wine - - -	1,222,946	9	4½	40,221	13	3	-	-	-	960	4	7½	52,192	18	4	26,645	5	2¼	-	-	-
Wire - - -	14,016	17	9¾	328	9	0	-	-	-	0	13	2½	1,749	3	10½	-	-	-	-	-	-
Total conſolidated Duties.	16,310,432	12	5¾	523,718	8	4¼	38,462	15	0½	24,254	13	8¼	737,296	19	5	80,384	13	10¾	5,019	2	
Temporary War Taxes.																					
Malt, per Act 43 Geo. III. ch. 81. - - -	2,251,761	0	11	639	16	3½	-	-	-	-	-	-	15,275	10	5¼	-	-	-	-	-	-
Spirits { Britiſh - do. -	665,956	7	2¼	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirits { Foreign do. -	914,245	15	6	10	10	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sweets - - - do. -	4,471	1	7¼	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tea - - - - do. -	2,005,370	18	2¼	-	-	-	-	-	-	-	-	-	36,758	18	6¾	-	-	-	-	-	-
Tobacco and Snuff, per Act 46 Geo III. ch. 39.	291,154	5	6	-	-	-	-	-	-	-	-	-	2,111	2	6¾	-	-	-	-	-	-
Brandy, &c. per Act 47 Geo. III. ch. 27. -	266,352	8	10¾	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total temporary war taxes £	6,399,611	17	9¾	650	6	3½	-	-	-	-	-	-	54,145	11	6¾	-	-	-	-	-	-
Annual Duties.																					
Tobacco and Snuff, commenced 26th March -	437,774	0	7½	22,703	13	1	-	-	-	770	10	3¼	3,288	19	9¼	-	-	-	-	-	-
Malt, additional - do. -	911,993	6	8½	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Malt, Old, commenced 24th June - -	554,975	9	9¼	100,957	0	7¼	-	-	-	6,618	10	3½	-	-	-	-	-	-	-	-	-
Total Annual Duties - £.	1,904,742	17	1¼	123,660	13	8¼	-	-	-	7,389	0	6¾	3,288	19	9¼	-	-	-	-	-	-
Totals Collected:																					
Conſolidated Duties -	16,310,432	12	5¾	523,718	8	4¼	38,462	15	0½	24,254	13	8¼	737,296	19	5	80,384	13	10¾	8,019	2	
Temporary War Taxes -	6,399,611	17	9¾	650	6	3½	-	-	-	-	-	-	54,145	11	6¾	-	-	-	-	-	-
Annual Duties - -	1,904,742	17	1¼	123,660	13	8¼	-	-	-	7,389	0	6¾	3,288	19	9¼	-	-	-	-	-	-
Grand Total - £.	24,614,787	7	4¾	648,029	8	4	38,462	15	0½	31,643	14	3	794,731	10	9	80,384	13	10¾	5,019	2	

EXCISE.

Allowances, Bounties, Penſions, Net Produce, and Payments into the Exchequer, of the Exciſe Conſolidated Duties, 5th January 1809; diſtinguiſhing the Groſs Receipt, Net Produce, and Net Payments into the Receiver-General, at the Commencement and Termination of the Year.

Overcharges, Overpayments, Repayments per Treaſury, Warrant, &c.	Annual Payments to Officers of the late Wine Licence Office, and of the late Salt Duties.	Penſions	Net Produce of each Article.	Net Payments into the Exchequer.	Exchequer Payments leſs than Net Produce.	Reſting on the 5th January 1808.	Exchequer Payments more than Net Produce.	Reſting on the 5th January 1809.	Impreſts.
£ s. d	£ s. d	£	£ s. d.	£ s. d.	£ s d.	£ s. d.	£ s. d.	£ s. d	£ s. d
2,975 5 6¼	- - -	- -	277,087 12 10	277,088 0 0	- - -	0 15 2	0 7 2	0 8 0	—
1,535 15 11½	- - -	14,000	2,686,139 17 2¼	2,671,140 0 0	14,999 17 2¼	0 4 6¼	- - -	15,000 1 8½	—
61 14 1½	- - -	- -	286,495 3 11½	286,495 0 0	0 3 11½	0 5 1	- - -	0 9 0½	—
- - -	- - -	- -	251,504 19 9¾	251,505 0 0	- - -	0 4 2¾	0 0 2¼	0 4 0¼	—
5 6 1	- - -	- -	132,617 6 3	132,618 0 0	- - -	0 16 6½	0 13 9	0 2 9½	—
- - -	- - -	- -	48,015 16 8¼	48,045 0 0	- - -	30 2 10¼	29 3 3¾	0 19 7	—
12,814 12 11	- - -	- -	322,813 11 8¼	322,814 0 0	- - -	0 16 3½	0 8 3¾	0 7 11¾	—
51 12 0	- - -	- -	278,710 6 1¼	278,711 0 0	- - -	0 17 9¼	0 13 10¾	0 3 10½	—
73 1 0	- - -	- -	144,282 9 7¾	144,282 0 0	0 9 7¾	0 9 10¾	- - -	0 19 6½	—
- - -	480 0 0	- -	308,801 4 6¼	308,802 0 0	- - -	0 17 11	0 15 5¾	0 2 5¼	—
366 8 4	- - -	- -	1,146,979 2 3¾	1,146,979 0 0	0 2 3¾	0 15 5¼	- - -	0 17 9	—
- - -	- - -	- -	1 11 6	- - -	1 11 6	42 7 1½	- - -	43 18 7½	—
- - -	- - -	- -	372,166 17 6¾	372,167 0 0	- - -	0 15 9	0 2 5¼	0 13 3¾	—
149 16 2½	- - -	- -	290,535 7 1	290,536 0 0	- - -	0 18 9¼	0 12 11	0 5 10¼	—
22,192 15 5½	7,911 3 7¼	- -	1,320,414 14 4¼	1,320,415 0 0	- - -	0 7 10½	0 5 7¾	0 2 2¾	—
19 13 9	- - -	- -	526,351 7 6¼	526,323 0 0	28 7 6¼	0 1 4¾	- - -	28 8 11	—
- - -	- - -	- -	1,333,565 6 9½	1,333,565 0 0	0 6 9½	0 7 5	- - -	0 14 2½	Impreſt repaid
163 1 11¾	- - -	- -	1,753,769 7 3¼	1,753,812 0 0	- - -	0 1 9¼	42 12 8¾	0 8 11½	42 19 11
- - -	- - -	- -	44,884 15 1¼	44,885 0 0	- - -	0 15 11	0 4 10¾	0 11 0¼	—
- - -	- - -	- -	27,257 14 10½	27,253 0 0	4 14 10½	0 15 8½	- - -	5 10 7	—
- - -	- - -	- -	1,934,525 5 10¾	1,934,464 2 6	61 3 4¾	0 9 10	- - -	61 13 2¾	—
19 5 0	- - -	- -	193,004 18 6¼	193,004 0 0	0 18 6¼	0 0 1¾	- - -	0 18 8	—
- - -	- - -	- -	63 16 9¼	- - -	63 16 9¼	31 12 6	- - -	95 9 3¼	—
28 3 9½	- - -	- -	40,594 10 2¼	40,595 0 0	- - -	0 14 11¼	0 9 9¾	0 5 1½	—
354 0 2½	- - -	- -	1,102,572 7 9¼	1,102,572 0 0	0 7 9¼	0 3 5½	- - -	0 11 2¾	—
- - -	- - -	- -	11,938 11 8¾	11,939 0 0	- - -	0 9 6¼	0 8 3¼	0 1 3	—
40,810 12 3¾	8,391 3 7¼	14,000	14,835,094 3 11½	14,820,009 2 6	15,162 0 3	116 7 10½	76 18 9¾	15,244 9 2¾	42 19 11
817 17 6¼	- - -	- -	2,235,027 16 7½	2,235,028 0 0	- - -	0 16 7½	0 3 4½	0 13 3	—
- - -	- - -	- -	665,956 7 2¼	665,957 0 0	- - -	0 12 11	0 12 9¾	0 0 1¾	—
- - -	- - -	- -	914,235 5 6	914,235 0 0	0 5 6	0 12 1	- - -	0 17 7	—
- - -	- - -	- -	4,471 1 7½	4,458 0 0	13 1 7½	10 18 3¾	- - -	23 19 11¼	—
- - -	- - -	- -	1,968,611 19 7½	1,968,611 2 6	0 17 1½	0 2 6½	- - -	0 19 8	—
28 17 6	- - -	- -	289,314 5 5¼	289,314 0 0	0 5 5¼	0 11 1½	- - -	0 16 6¾	—
278 19 0	- - -	- -	266,073 9 10¾	266,073 0 0	0 9 10¾	0 2 0¾	- - -	0 11 11½	—
1,125 14 0¾	- - -	- -	6,343,690 5 10¾	6,343,676 2 6	14 19 7	13 15 8	0 16 2¼	27 19 0¾	—
- - -	- - -	- -	411,010 17 6	411,011 0 0	- - -	0 9 7	0 2 6	0 7 1	—
239 7 1	- - -	- -	911,753 19 7½	911,738 0 0	15 19 7½	7 1 5¾	- - -	23 1 1¼	—
180 8 9¾	- - -	- -	447,219 10 0¾	447,278 0 0	- - -	84 5 7	58 9 11¼	25 15 7¾	—
419 15 10¾	- - -	- -	1,769,984 7 2¼	1,770,027 0 0	15 19 7½	91 16 7¾	58 12 5¼	49 3 10	—
0,810 12 3¾	8,391 3 7¼	14,000	14,835,094 3 11¼	14,820,009 2 6	15,162 0 3	116 7 10½	76 18 9¾	15,244 9 2¾	42 19 11
1,125 14 0¾	- - -	- -	6,343,690 5 10¾	6,343,676 3 6	14 19 7	13 15 8	0 16 2¼	27 19 0¾	—
419 15 12¾	- - -	- -	1,769,984 7 2¼	1,770,027 0 0	15 19 7½	91 16 7¾	58 12 5¼	49 3 10	—
2,356 2 3¼	8,391 3 7¼	14,000	22,948,768 17 0¼	22,933,712 5 0	15,192 19 5½	222 0 2¼	136 7 5¼	15,321 12 1¼	42 19 11

"The produce, &c. of the exciſe duties in Scotland for the period above ſtated appears from the following abſtract:

	£.	s.	d.
Caſh reſting to be accounted for at 5th of January, 1808 - - - - -	38,653	1	2¼
Groſs receipt from 5th January, 1808, to 5th January 1809 - - -	2,086,283	19	3¼
	2,124,937	0	6

	£.	s.	d.
Charges of management, exports, and allowances - - - - - - -	325,768	0	10½
Diſburſements out of the net produce - - - - - - - - - - -	88,012	12	3½
Remitted to London - - - -	1,623,000	0	0
Reſting to be accounted for at 5th January, 1809 - - - - - - -	83,156	7	4
	2,124,937	0	6

The total payments out of the revenue of exciſe, under the authority of warrants from the barons of exchequer, to the receiver-general of crown rents and caſualties in Scotland, from January 5, 1808, to January 5, 1809, are as follow:

	£.	s.	d.
Salaries to the judges and officers of the three courts of ſeſſion, juſticiary, and exchequer, and of the admiralty and commiſſary courts - - - - - - - -	50,340	12	10¾
Paid to thoſe on his majeſty's civil liſt eſtabliſhment, not belonging to the three courts - - - - - - - - - - -	22,727	10	10½
To Francis lord Napier, commiſſioner to the general aſſembly of the church of Scotland - - - - - - - - - - -	2,000	0	0
To John Connel, procurator for the church of Scotland, to be diſtributed by him among itinerant preachers - - -	1,000	0	0
To A. Mundell, without account	1,208	17	6
Total - -	77,277	1	3¼

The total revenue of inland exciſe and licences, together with other fees received by revenue exciſe collectors in Ireland, for one year, ending the 5th of January, 1809, amounted to 1,659,838*l.* 8*s.* 9¼*d.* and the total payments for management, militia, bounties, &c. out of the groſs and net revenue of exciſe, during the ſame period, amounted to 531,910*l.* 9*s.* 5*d.* If we add to the above ſum 1,659,838*l.* 8*s.* 9¼*d.* the amount of the inland duties, *viz.* 429,824*l.* 11*s.* 0⅜*d.* the groſs produce will amount to 2,089,662*l.* 19*s.* 9⅝*d.* and the amount of the net produce was 1,772,615*l.* 16*s.* 2⅞*d.*

EXCISION, in *Surgery*, is a word often uſed to ſignify the operation of cutting any tumour, or any foreign ſubſtance, off, or out of, a part of the body.

EXCITABILITY, in Dr. John Brown's hypotheſis, or the *Brunonian* hypotheſis, as it has been called, is nearly ſynonymous with the *vital principle* of medical writers in general, and ſignifies that quality or property of living beings, on which the phenomena of life depend.

Life itſelf is, in the opinion of Brown, a *forced ſtate*, ariſing altogether from the action of certain agents, which he denominates *exciting* powers, upon the *excitability*; for death enſues equally, whether the exciting powers are withdrawn, or the excitability is loſt. The exciting powers conſiſt of heat, air, food, drink, and other ſubſtances taken into the ſtomach, the blood, and the fluids ſecreted from it; as well as of certain functions of the ſyſtem itſelf, ſuch as muſcular exertion, ſenſation, thought, and paſſion or emotion. The effect of the exciting powers acting upon the excitability, is denominated *excitement.*

This word "excitability" is to be conſidered as a general term, expreſſive of the facts aſcertained by obſervation, but of the eſſential nature of which we muſt remain ignorant; as in the caſe of gravitation, &c. "We know not what excitability is," ſays Dr. Brown, "or in what manner it is affected by the exciting powers. But whatever it be, whether a quality or a ſubſtance, a certain portion is aſſigned to every being upon the commencement of its living ſtate." He obſerves, however, that ſuch expreſſions as a determinate portion of excitability in each living being, the exhauſtion, or the accumulation of excitability, are neceſſarily borrowed from the qualities of material ſubſtances, in conſequence of the poverty of language; and are not to be received in a ſtrict and literal ſenſe.

Every power, then, that acts on the living frame, according to this doctrine, is ſtimulant, or produces excitement by expending excitability; whence "it follows, that the whole phenomena of life, every ſtate and degree of health and diſeaſe, are alſo owing to ſtimulus, and no other cauſe." By too great ſtimulation weakneſs is induced, becauſe the excitability becomes defective; this is ſaid to conſtitute a ſtate of *indirect debility;* when the exciting powers or ſtimulants are withheld or diminiſhed, weakneſs is likewiſe induced, the excitability being accumulated, or in exceſs; and this is denominated a ſtate of *direct debility.* (See DEBILITY.) For "this mutual relation obtains betwixt excitability and excitement; that the more weakly the powers have acted, or the leſs the ſtimulus has been, the more abundant the excitability becomes;—the more powerful the ſtimulus, the excitability becomes the more exhauſted." It is only then, when a mean degree of ſtimulus operates upon excitability at a medium, that perfect health is produced: in illuſtration of which a ſcale was drawn by Brown, (See Elements of Medicine, chap. iii. § 39. *note*) divided into 80 degrees of excitability oppoſed inverſely to 80 degrees of exciting power, at each end of which is *death*; there being, in the one caſe, 80 degrees of excitability, and no exciting power; and in the other, 80 degrees of ſtimulus and no excitability; whereas *perfect health* holds the middle ſtation, where there are 40 degrees of ſtimulus and of excitability reſpectively. Good health, however, may be conſidered to exiſt within a range of 30 or 40 degrees (15 or 20 on each ſide of the mean) in conſequence of the conſtant variation of ſtimulus, to which man is expoſed, in his food, drink, paſſions of the mind, &c.; but every departure from the mean of perfect health conſtitutes a pre-diſpoſition to diſeaſes of direct or indirect debility. As life is entirely regulated by excitement, and the exciting powers have a ſtimulating effect only, Dr. Brown affirms, that "the notion of health and diſeaſe being different ſtates is diſproved;" the operation of the powers producing or removing each ſtate being perfectly identical: and efficacious remedies being ſuch as oppoſe deficient ſtimulus to exceſſive excitement, and exceſſive ſtimulus to deficient excitement. In a word, there are but *two* forms of diſeaſes; and both are always preceded by pre-diſpoſition; thoſe which ariſe from exceſſive excitement are called *ſthenic* (from σθενος, *ſtrength,*) and thoſe which originate from a deficient excitement, *aſthenic.* The direct tendency of this hypotheſis, therefore, was to reduce the art of medicine to the ſimple regulation of ſtimuli, or of the exciting powers; it required us only to increaſe the quantity of ſtimulation on the one hand, or to withdraw, or rather diminiſh, the ſtimuli on the other, as the excitement happened to be too great or too little, above or below the medium of the ſcale of health.

As this conciſe ſtatement of a medical hypotheſis, which has excited great attention and much controverſy, may, perhaps, be obſcure to thoſe who are unaccuſtomed to the ſtudy of the phenomena of animal life, we ſhall cite an illuſtration of Brown's ſyſtem, drawn up by one of his pupils from a familiar operation, by which a conception of his fundamental principles may be facilitated.

"Suppoſe a fire to be made in a grate filled with a kind of fuel not very combuſtible, and which could only be kept burning by means of a machine, containing ſeveral tubes, placed before it, and conſtantly pouring ſtreams of air into it. Suppoſe alſo a pipe to be fixed in the back of the chimney, through which a conſtant ſupply of freſh fuel was gradually let down into the grate, to repair the waſte occaſioned by the flame, kept up by the air-machine.

The grate will repreſent the human frame; the *fuel* in it the *matter of life* (the *excitability* of Brown, and the *ſenſorial power* of Darwin): the tube behind, ſupplying freſh fuel, will denote the power of all living ſyſtems conſtantly to regenerate or reproduce excitability; while the air-machine, of ſeveral tubes, denotes the various *ſtimuli*, or exciting powers, applied to the excitability of the body; and the flame, drawn forth in conſequence of that application, repreſents *life*, the product of the exciting powers acting upon excitability.

As Dr. Brown has defined *life* to be "a forced ſtate," it is fitly repreſented by a flame, *forcibly* drawn forth, from fuel little diſpoſed to combuſtion, by the conſtant application of ſtreams of air poured into it from the different tubes of a machine. If ſome of theſe tubes are ſuppoſed to convey pure, or *oxygenous* air, they will denote the higheſt claſs of exciting powers, ſuch as opium, muſk, camphor, ſpirits, wine, &c. (the diffuſible ſtimuli of Dr. Brown) which bring forth for a time a greater quantity of life than uſual, as the blowing in of pure air into a fire will temporarily draw forth an uncommon quantity of flame. If others of the tubes be ſuppoſed to convey common or atmoſpheric air, they will repreſent the ordinary exciting powers, or ſtimuli, applied to the human frame, ſuch as heat, light, air, food, drink. &c.; while ſuch as convey impure airs may be uſed to denote what have formerly been termed ſedative powers, ſuch as poiſons, contagious miaſmata, foul air, &c. (Sedatives are deemed by Brown ſtimulants of a minor force.)

The reader will now be at no loſs to underſtand the ſeeming paradox of the Brunonian ſyſtem, that food, drink, and all the exciting powers applied to the body, though they *ſupport* life, yet they *conſume* it; for he will ſee, that the application of theſe powers, though it brings forth *life*, yet at the ſame time it waſtes the excitability, or *matter of life;* juſt as air blown into the fire brings forth more *flame*, but waſts the *fuel*, or *matter of fire*. This is conformable to the common ſaying, "the more a ſpark is blown, the brighter it burns, and the ſooner it is ſpent." A Roman poet has given us an excellent illuſtration of the Brunonian ſyſtem, when he ſays,

> "Balneæ, vina, Venus, conſumunt corpora noſtra;
> Sed vitam faciunt balnea, vina, Venus."
>
> "Wine, warmth, and love our vigour drain;
> Yet wine, warmth, love our life ſuſtain."

It will be equally eaſy to illuſtrate the two kinds of *debility*, termed *direct* and *indirect*, which, according to Brown, are the cauſes of all diſeaſes; if the quantity of ſtimulus, or exciting power, is proportioned to the quantity of excitability; that is, if no more excitement is drawn forth, than is equal to the quantity of excitability produced, the human frame will be in a ſtate of health; juſt as the fire will be in a vigorous ſtate, when no more air is blown in, than is ſufficient to conſume the freſh ſupply of fuel, conſtantly poured down by the tube behind. If a ſufficient quantity of ſtimulus is not applied, or air not blown in, the excitability in the man, and the fuel in the fire, will accumulate, producing *direct debility;* for the man will become *weak*, and the fire *low*. This, carried to a certain degree, will occaſion death to the firſt, and extinction to the laſt. If again, an over proportion of ſtimulus be applied, or too much air blown in, the excitability will ſoon be waſted, and the matter of fuel almoſt ſpent: hence will ariſe *indirect debility*, producing the ſame weakneſs in man, and lowneſs in the fire as before, and equally terminating, when carried to a certain degree, in death and extinction."

The ſimplicity of this doctrine, contraſted with the complicated hypotheſes of preceding phyſicians, and its happy illuſtration of ſome of the phenomena of life, (which we have noticed under the word Debility,) ſpeedily obtained for it a number of proſelytes, in the ſchools of medicine, wherever it was introduced. A generalization ſo ſweeping was, indeed, well calculated to arreſt the attention, and gratify the ardour of young minds; and accordingly it was eſpouſed with enthuſiaſm by the moſt ſanguine and ſpeculative ſtudents, and was debated and defended with a vehemence and intolerance of oppoſition, almoſt unknown in ſcientific diſcuſſions; and this not only at Edinburgh, where the doctrine originated, but ſucceſſively in the different univerſities of the continent to which it was carried. To learn that there were but two forms of diſeaſe, and therefore but two indications of cure, and two ſets of remedies, was particularly gratifying to thoſe who preferred indolent hypotheſis to the labour of obſervation. It ſuperſeded at once the practice and maxims of the Hippocratic ſchool of experience and unremitting inveſtigation, and reduced the art of medicine within the compaſs of a nut-ſhell.

But, true as this doctrine of excitement may be, in its application to many of the phenomena of life, it is by no means adequate to the explanation of the whole, and eſpecially of the cauſes and remedies of numerous diſeaſes: it is, moreover, inconſiſtent with itſelf in ſome points, and its advocates are not agreed in the interpretation of theſe difficulties.

There is one inconſiſtency ſo groſs and obvious, in the Brunonian doctrine, that it is inconceivable how the author could have been inſenſible of it, or have perſevered in maintaining it. In the illuſtration above quoted, a tube or chimney is provided, by which the fuel, or excitability, is ſuppoſed to be conſtantly repleniſhed: but no ſuch proviſion is mentioned by Brown. He affirms that "a certain portion of excitability is aſſigned to every being at the commencement of its exiſtence, that the action of ſtimuli neceſſarily exhauſts it, and that life conſiſts in the inceſſant action of ſtimuli upon this excitability;" *i. e.* in the inceſſant exhauſtion of it. With this ſtatement the notion of accumulated excitability (which is ſaid to conſtitute *direct* debility) is altogether incompatible: non-conſumption, or rather diminiſhed conſumption, might preſerve the excitability, but ſurely could never increaſe it: though ſomewhat might be ſaved, nothing could be gained, by the abſtraction of ſtimuli; and on the re-application of the diſcontinued ſtimuli, the excitability ſhould never be found increaſed or accumulated, but ſhould be ſtationary at the point of interruption; or, more correctly ſpeaking, it muſt always be found ſomewhat waſted, ſince, while life remains, it muſt be acted upon in ſome degree; while, on the other hand, every violent ſtimulation ſhould, upon the ſame principle, rapidly waſte, and haſten the irrecoverable exhauſtion of the powers of life. The propoſition, then, that a determinate portion of excitability is aſſigned to every individual, being equally inconſiſtent with the ſubſequent theorems of the ſyſtem, and with matter of fact, has been either given up, or explained away, by the pſeudo-Brunonians of the preſent day. They admit that the excitability may be partially reſtored or renewed by reſt and food. But to make the hypotheſis conſiſtent with common ſenſe, it requires that the proceſs of *generating* excitability be conſtantly going; for even during the moſt profound ſleep, ſtimuli, or, in other words, exhauſting powers, are inceſſantly applied, the ceſſation of all excitement being ſynonymous with death.

Another inconſiſtence in the hypotheſis, ſcarcely leſs palpable, is the ſtatement, that *indirect* debility, which conſiſts in exhauſtion of the excitability from exceſſive ſtimulation, is to be cured, *i. e.* the excitability is to be reſtored, by a continuance of ſtrong ſtimuli; namely, by ſtimuli "*little ſhort* of thoſe which produced the over-excitement." But, however managed, it is obvious from the hypotheſis, that they muſt exhauſt excitability, if they act at all; they muſt, therefore, wear out what remains of the excitability more and more, and ultimately exhauſt the power. No attempts to explain away this incongruity of language can be conſidered ſucceſsful; the alleged loſs of power in the ſtimuli, in conſequence of repetition, will only account for the leſs rapidity of the complete exhauſtion; but exhauſtion of excitability cannot be ſeparated from the notion of ſtimulation.

In its application to the practice of medicine, as well as to the explanation of the action of many cauſes of diſeaſe, the Brunonian ſyſtem is marked by a groſs neglect or defiance of obſervation and experience. The connections and dependencies of the different functions, the local derangements which take place in the different organs, and the curative indications deduced from theſe, are altogether overlooked; and the variety of phenomena which reſult from the ſpecific operation of various agents on the animal economy, is equally neglected. The aſſertion that all powers, which influence the animal body, whether productive or curative of diſeaſe, are *ſtimulant*, is an abuſe of language not often equalled by the framers of theories. There is not only not an identity in their action;—there is ſcarcely any thing in common. "With regard to contagions," to uſe the words of an intelligent critic, "when we conſider the regular and progreſſive ſeries of actions, induced by theſe on the ſyſtem; when we have obſerved that each contagion gives riſe to a train of peculiar and characteriſtic phenomena, defining the diſeaſe whence the contagion originated, and terminating often in the formation and ſeparation of a quantity of morbid matter, alone capable of propagating the ſame diſeaſe in others, we cannot acknowledge that identity in the operation of the exciting powers, which the Brunonians contend for. In diſeaſes induced by contagions, in the ſmall-pox, for example, or in lues venerea, we perceive ſomething more than ſimple excitement and unvaried ſtimulation. Individuals of every deſcription, whether prediſpoſed to ſthenia or aſthenia, whether labouring under direct or indirect debility, may be infected; and when the diſeaſe has taken place, it runs its courſe under every poſſible modification of the excitability, &c." (See Edinburgh Med. and Surg. Journal, vol. i. p. 369.) And again, with reſpect to the agents of the Materia Medica, beſides their action upon the excitability, or the degree of excitement and exhauſtion which they produce, there are various other peculiarities in their mode of operation. "They differ in the ſucceſſion of phenomena to which they give occaſion; the intoxication produced by wine, opium, and ſome other narcotics, cannot be imitated by aromatics, by the preparations of antimony or of mercury; nor the effects of theſe by narcotics: they differ in their power of ſpecifically affecting particular organs and functions, as the ſtomach, inteſtines, kidnies, ſkin, ſalivary glands, abſorbent or vaſcular ſyſtem, by emetics, purgatives, diuretics, ſudorifics, mercury, digitalis, &c. They differ in their power of oppoſing and inducing particular organic changes and morbid affections of the ſyſtem; as ſyphilis and biliary diſeaſes are cured by mercurials, ſcurvy by vegetable acids, and uric diſeaſes by alkalis: they differ in the durability of effect or change produced; as is obvious by comparing the momentary and fleeting effects of the diffuſible ſtimuli, with the permanent excitement and vigour produced by tonics, as by cinchona and preparations of iron, by wholeſome food and pure air." Loc. cit.

In ſhort, it is obvious that the word ſtimulant, as applied to all theſe various actions upon the living ſyſtem, no longer retains any definite meaning; but produces a jargon which may be interpreted by each individual according to his own notions. In this reſpect, the theory poſſeſſes an univerſal fitneſs, like Bayes' prologue, and will do for any practice that may be found moſt expedient. Thus mercury will be conſidered as the proper *ſtimulant* for ſyphilis, cinchona and arſenic for intermittents, citric acid for ſcurvy, and ſo on; for fortunately mankind have ſtill good ſenſe enough to accommodate their hypotheſes to the reſults of experience: hence we do not apprehend, that many of the moſt implicit believers in this jargon would endanger their patients by applying the ſame remedies to typhus, gout, and dropſy, becauſe they ſtand in the ſame numerical portion of the ſcale; or by treating phthiſis, apoplexy, and the plague alike, becauſe they are claſſed together in the ſame way!

Notwithſtanding its many inconſiſtencies and defects, however, the Brunonian doctrine has had ſome beneficial influence on medical ſcience, by inducing a particular attention to the degree of excitement, which accompanies many diſeaſes, although it cannot be conſidered as the cauſe or eſſence of them. The regulation of the excitement often conſtitutes the moſt uſeful means of conducting theſe diſeaſes through their courſe to a ſafe termination, by moderating ſymptoms, and keeping action within due bounds on the one hand, or ſupporting the languid forces of the ſyſtem on the other. This is eſpecially true with regard to contagious febrile diſeaſes.

The doctrines of Brown are contained in the "Elementa Medicinæ," which were firſt publiſhed in Latin, and afterwards tranſlated by himſelf. After his death a reviſed edition of this tranſlation was publiſhed by Dr. Beddoes, in 2 vols. 8vo. 1795; and another by the author's ſon, Dr. William Cullen Brown, in 3 vols. 8vo. in 1804. See BROWN.

EXCITATION, (from the Latin *excito*, I excite,) denotes the act of awakening, of rouſing, or of producing ſome power or action; thus we hear of the excitation of motion, excitation of heat, excitation of paſſions, &c. In natural philoſophy this word is principally uſed in the ſubjects of electricity and of heat; and of theſe two kinds of excitation the particulars are as follows.

When a piece of amber, or of glaſs, or of ſulphur, or in ſhort, of any other ſolid, called *electric*, or *non-conductor*, is obſerved in common, it does not appear to have any particular power; but if it be rubbed with a dry hand, or with ſomething elſe, then after a few ſtrokes it will be found that it has acquired the electric virtue, ſo that now it will attract ſmall bodies that are preſented to it, and it will alſo exhibit other electrical phenomena (for which ſee the article Electricity.) In this caſe the electric power in the amber, or glaſs, or ſulphur, is ſaid to have been *excited* by the friction of the hand or other body, which therefore is called the *rubber*; for, previous to the friction, the amber, or ſulphur, &c. ſhewed no ſigns of electricity, that power being, as it were, dormant in it.

Rubbing is the moſt general, and upon the whole, the moſt effectual method of exciting electrics, but there are ſeveral other modes of excitation, and indeed hardly any action, or any motion, takes place among natural bodies, which is not attended with the excitation of electricity. In general, however, the electricity is not produced in quantity ſufficient to affect our ſenſes, without the aid of proper inſtruments, and of courſe it paſſes unnoticed. The principal cauſes of the excitation of electricity are rubbing or friction, heating and cooling, melting or coagulating, evaporation and condenſation, expanſion and contraction, the mere juxtapoſition or contact of certain bodies, ſolution and efferveſcence, and laſtly ſome unknown action of the body in certain aquatic animals. But theſe methods are not indiſcriminately applicable to all ſubſtances. They are confined within certain limits of application as well as of effect; and of theſe particulars we ſhall now give a regular account.

Rubbing, or *friction*.—In the ſcience of electricity the various bodies of the earth are diſtinguiſhed into electric and conductors (ſee Electrics and Conductors;) and whenever two bodies are rubbed againſt each other, unleſs they be both very good conductors, ſome electricity is always produced; that is, one of the bodies acquires the poſitive or vitreous, and the other acquires the negative or reſinous electricity; for by this means one kind of electricity cannot be produced without the other. The circumſtance which, in the ſuperficial manner of performing the experiment, makes it appear as if one kind only of electricity were produced, is that the beſt conductor of the two bodies concerned, being not inſulated, loſes its electricity as ſoon as it receives it; but when both bodies are inſulated, each of them will become electrified by the friction, one of them acquiring the poſitive, and the other the negative electricity. Even two inſulated perfect conductors, by the leaſt contact or friction againſt each other, acquire a ſlight degree of electricity; but of this hereafter. The friction which is required for this excitation of electricity is not that which can ſcrape off or injure the ſurface, but a gentle preſſure progreſſively applied with a pretty quick motion. The former hard kind of friction generates heat, but little or no electricity.

The very ſame body, by changing the rubber, may be cauſed to acquire either the poſitive or the negative kind of electricity; and the change is often produced by a remarkably ſlight alteration of circumſtances, ſuch as altering the direction of the friction, increaſing or diminiſhing the temperature by a few degrees, and ſo forth. The following table exhibits the principal caſes of this kind of change, *viz.* it ſhews what kind of rubber is required for exciting a given body poſitively, and what kind for exciting it negatively. Thus it appears that ſealing-wax acquires the poſitive electricity when rubbed with a metallic body, and that it acquires the negative electricity when rubbed with furs, leather, woollen cloth, &c. Thus alſo it ſhews that baked wood is excited poſitively by ſilk, and negatively by flannel.

Subſtance rubbed.	*Electricity.*	*Rubber.*
The fur on the back of a cat.	Poſitive	Every ſubſtance with which it has hitherto been rubbed.
Smooth glaſs.	Poſitive	Every ſubſtance hitherto tried, excepting
	Negative	The fur on the back of a cat.
Rough glaſs.	Poſitive	Dry oiled ſilk, ſulphur, metals.
	Negative	Woollen cloth, quills, wood, paper, ſealing-wax, white-wax, the human hand.
Tourmalin.	Poſitive	Amber, air, *viz.* by blowing with the bellows upon it.
	Negative	Diamond, the human hand.
Hare's ſkin.	Poſitive	Metals, ſilk, loadſtone, leather, hand, paper, baked wood.
	Negative	Other finer furs.
White ſilk.	Poſitive	Black ſilk, metals, black cloth.
	Negative	Paper, hand, hairs, weaſel's ſkin.
Black ſilk.	Poſitive	Sealing-wax.
	Negative	Hare's, weaſel's, and ferret's ſkin, the load ſtone, braſs, ſilver, iron, the human hand.
Sealing-wax.	Poſitive	Metals.
	Negative	Hare's, weaſel's, and ferret's ſkin, the hand, leather, woollen cloth, paper.
Baked wood.	Poſitive	Silk.
	Negative	Flannel.

When two electric ſubſtances, equal in every reſpect, are rubbed againſt each other, that ſubſtance which ſuffers the greater degree of friction acquires the *negative*, and the other acquires the *poſitive* electricity. Thus, if a piece of ſilk, A, be drawn acroſs another piece of ſilk, B, in every reſpect equal to A, ſo that the ſurface of the whole piece, A, (*viz.* of one ſide of it,) be ſucceſſively drawn over one part of the piece B, then A will acquire the *poſitive*, and B the *negative* electricity. The reaſon of this probably is the greater degree of heat which the rubbed part of B acquires by the friction, it having been obſerved by Bergman, that heat rather diſpoſes bodies to acquire the negative electricity.

Glaſs, when warmed a little, as about the temperature of 110° of Fahrenheit's ſcale, may be excited more eaſily and more powerfully than at a lower temperature. A great part of this effect probably depends upon the glaſs being leſs apt to attract moiſture in that elevated temperature.

Mr. Henly inſulated ſeveral bodies, and in that ſtate rubbed them, one by one, againſt his woollen garments, or againſt ſilk, by which means they became electrified; but he obſerved very great irregularities in the effects which were produced by ſubſtances much allied to each other, or of the ſame claſs. Thus, a guinea, a ſix-pence, and a piece of tin, became negative; a piece of copper, a ſteel button, and a ſilver button, poſitive, at leaſt when the cloth was warm; animal ſubſtances, excepting ſhells, generally acquired the poſitive electricity; vegetables became almoſt always negative; but the ſmooth ſkins of bears became poſitive; common pebbles, marble, coal, and jet, acquired the negative electricity; gems and cryſtals, the poſitive; glazed wares and writing paper, the poſitive; tobacco pipe, elaſtic gum, a tallow candle, oiled ſilk, Indian ink, and blue vitriol, (*viz.* ſulphate of copper,) acquired the negative electricity. Other perſons have extended the liſt conſiderably farther, but it is uſeleſs to ſpecify the particulars.

The principal requiſite in the ſubject of electricity, is to determine the proper conſtruction of the rubber, and the method of employing it, ſo as to excite the greateſt poſſible power in a given electric.

The beſt rubber for a tube of ſmooth glaſs, Mr. Cavallo ſays, (Treatiſe on Electr.) is the rough ſide of black oiled ſilk, eſpecially when a little amalgam has been rubbed upon it; but the beſt rubber for a rough glaſs tube, a ſtick of baked wood, ſealing-wax, or ſulphur, is ſoft new flannel. The rubbers of common electrical machines, wherein a glaſs globe, or cylinder, or circular plate is revolved, has been varied and improved progreſſively. The more common conſtruction conſiſts of nothing more than a ſilk cuſhion ſtuffed with hair, over which is placed a piece of leather, and upon this leather ſome amalgam, (ſee AMALGAM *for electrical purpoſes*,) is ſpread ſo as to adhere pretty faſt to it. Some time ago it was cuſtomary, (and the practice even at preſent is not entirely laid aſide,) to make the rubber of red baſil ſkin ſtuffed with hair; but the above-mentioned ſilk one, which was contrived by Dr. Nooth, is much preferable. If this ſilk cuſhion, on account of adapting it to the ſurface of the glaſs, is to be fixed upon a metallic plate, then care ſhould be taken to render the plate free from ſharp points, edges or corners, and it ſhould be concealed or covered over with the ſilk. In ſhort, to conſtruct the rubber properly, it muſt be made ſo, that the ſide of it which the ſurface of the glaſs enters in whirling, may be as perfect a conductor as can be made, in order to furniſh an ample and ready ſupply of electricity, and the oppoſite part ſhould be as much a non-conductor as poſſible, in order that none of the electricity that has been accumulated upon the glaſs may go back to the rubber. A piece of ſilk is generally fixed to the extremity of the leather which ſtands againſt the ſurface of the glaſs. The rubber of Mr. Nairne's electrical machine (ſee ELECTRICAL *Machine*,) conſiſts of ſilk only put over the leather cuſhion, the piece of ſilk projecting a conſiderable way beyond the cuſhion, and very little amalgam is uſed with it: in truth no amalgam at all is put upon the rubber of this machine; but whilſt the clean rubber is on, and the cylinder is turning, a piece of leather, with ſome amalgam ſpread upon it, is applied for a few ſeconds to the under part of the cylinder, by which means a ſufficient number of particles of amalgam will fly along the ſurface of the glaſs, from the leather to the rubber.

The rubber ſhould be ſupported by a ſpring, by which means it may eaſily adapt itſelf to the inequalities of the ſurface of the glaſs, which, with cylinders, often are very conſiderable. It ſhould likewiſe be inſulated in whatever manner it may be moſt convenient; for whenever inſulation is not wanted, a chain or wire may be occaſionally hung upon it, by which means it will communicate with the ground or with any other body at pleaſure: when there is no poſſibility of inſulating the rubber, ſeveral of the moſt intereſting experiments in electricity cannot be performed with the machine.

Mr. Nicholſon made a great variety of experiments, reſpecting this mode of excitation, which are deſcribed at large in the Philoſophical Tranſactions for the year 1789, and from thoſe experiments he deduces the following inferences.

"Thoſe experiments," he ſays, "ſhew that the office of the ſilk is not merely to prevent the return of electricity from the cylinder to the cuſhion, but that it is the chief agent in the excitation, while the cuſhion ſerves only to ſupply the electricity, and perhaps increaſe the preſſure at the entering part. There likewiſe ſeems to be little reaſon to doubt but that the diſpoſition of the electricity to eſcape from the ſurface of the cylinder, is not prevented by the interpoſition of the ſilk, but by a compenſation after the manner of a charge, the ſilk being then as ſtrongly negative as the cylinder is poſitive; and, laſtly, that the line of light between the ſilk and the cuſhion in weak excitations, does not conſiſt of returning electricity, but of electricity which paſſes to the cylinder, in conſequence of its not having been ſufficiently ſupplied, during its contact with the rubbing ſurface.

"When the excitation was very ſtrong in a cylinder newly mounted, flaſhes of light were ſeen to fly acroſs its inſide, from the receiving ſurface to the ſurface in contact with the cuſhion, as indicated by the bruſh figure. Theſe made the cylinder ring as if ſtruck with a bundle of ſmall twigs: they ſeem to have ariſen from part of the electricity of the cylinder taking the form of a charge. This appearance was obſerved in a nine-inch, and a twelve-inch cylinder, and the property went off in a few weeks. Whence it appears to have been chiefly occaſioned by the rarity of the internal air produced by handling, and probably reſtored by gradual leaking of the cement."

In order to determine what takes place in the inſide of the cylinder, Mr. Nicholſon undertook a ſeries of experiments with a plate machine, (ſee ELECTRICAL *Machine*,) and from their reſult it appears, "that no advantage is gained by rubbing both ſurfaces, but that a well-managed friction on one ſurface will accumulate as much electricity as the preſent methods of excitation ſeem capable of collecting; but that when the excitation is weak, on account of the electric matter not paſſing with ſufficient facility to the rubbed ſurface, the friction enables the oppoſite ſurface to attract or receive it, and if it be ſupplied, both ſurfaces will paſs off in the poſitive ſtate, and either ſurface will give out more electricity than is really induced upon it, becauſe the electricity of the oppoſite ſurface forms a charge. It may be neceſſary to obſerve, that I am ſpeaking of the facts or effects produced by friction; but how the rubbing ſurfaces act upon each other to produce them, whether by attraction or otherwiſe, I do not here enquire."

From farther experiments with the cylinder, Mr. Nicholſon deduced the following concluſions: "the line, he ſays, of light on a cylinder departing from a ſimple cuſhion, conſiſts of returning electricity. 2. The projecting part of the cuſhion compenſates the electricity upon the cylinder, and by diminiſhing its intenſity prevents its ſtriking back in ſuch large quantities as it would otherwiſe do. 3. That if there were no ſuch compenſation, very little of the excited electricity would be carried off; and, 4. That the compenſation is diminiſhed, or the intenſity increaſed, in an higher ratio than that of the diſtance of the compenſating ſubſtance; becauſe if it were not, the electricity which has been carried off from an indefinitely ſmall diſtance, would never fly back from a greater diſtance, and from the edge of light.

“ I hope the conſiderable intenſity I ſhall ſpeak of will be an apology for deſcribing the manner in which I produce it. I wiſh the theory of this very obſcure proceſs were better known; but no conjecture of mine is worth mentioning. The method is as follows:

“ Clean the cylinder and wipe the ſilk.

“ Greaſe the cylinder by turning it againſt a greaſed leather till it is uniformly obſcured. I uſe the tallow of a candle.

“ Turn the cylinder till the ſilk flap has wiped off ſo much of the greaſe as to render it ſemi-tranſparent.

“ Put ſome amalgam on a piece of leather, and ſpread it well, ſo that it may be uniformly bright. Apply this againſt the turning cylinder. The friction will immediately increaſe, and the leather muſt not be removed until it ceaſes to become greater.

“ Remove the leather, and the action of the machine will be very ſtrong.

“ My rubber conſiſts of the ſilk flap paſted to a leather, and the cuſhion is preſſed againſt the ſilk by a ſlender ſpiral ſpring in the middle of its back. The cuſhion is looſely retained in a groove, and reſts againſt the ſpring only in ſuch a manner, that by a ſort of libration upon it as a fulcrum, it adapts itſelf to all the irregularities of the cylinder, and never fails to touch in its whole length. There is no adjuſtment to vary the preſſure, becauſe the preſſure cannot be too ſmall when the excitation is properly made. Indeed, the actual withdrawing of the cuſhion to the diſtance of one-tenth of an inch from the ſilk, will not materially affect a good excitation.

“ The amalgam is that of Dr. Higgins, compoſed of zinc and mercury. If a little mercury be added to melted zinc, it renders it eaſily pulverable, and more mercury may be added to the powder to make a very ſoft amalgam. It is apt to cryſtallize by repoſe, which ſeems in ſome meaſure to be prevented by triturating it with a ſmall proportion of greaſe: and it is always of advantage to triturate it before uſing.”

The following curious fact may, perhaps, be referred to the action of friction.—If a ſtick of ſealing-wax be broken into two pieces, the fractured parts, that is, thoſe extremities of the pieces which were contiguous to each other, will be found electrified, one of them poſitively, and the other negatively.

Heating and cooling.—The property of exhibiting electrical phenomena by means of heating and cooling, was firſt obſerved in a hard ſemi-pellucid foſſil, known under the name of tourmalin (called *aſchentrickker* by the Dutch, from its property of attracting aſhes, &c. when laid near the fire. Linnæus, in his Flora Zeylonica, calls it *lapis electricus.*) This ſtone, which generally is of a deep red or purple colour, and ſeldom exceeds the ſize of a ſmall walnut, is common in ſeveral parts of the Eaſt Indies, and eſpecially in the iſland of Ceylon. Tourmalins are alſo found in a great many other parts of the world, and often in pretty large maſſes, but they are moſtly opaque, and then they hardly ever ſhew any peculiar electric properties. (See its mineralogical characters under the article TOURMALIN.) The tourmalin's properties with reſpect to electricity are as follows.

1. The tourmalin, while kept in the ſame degree of heat, ſhews no ſigns of electricity; but it will become electrical by increaſing or diminiſhing its heat, and ſtronger in the latter than in the former circumſtance. An exceedingly ſmall variation of temperature is often ſufficient to render it ſenſibly electrical.

2. The electricity of the tourmalin does not appear all over its ſurface, but only on two oppoſite ſides, which may be called its *poles*, and they are always in one right line with the centre of the ſtone, and in the direction of its ſtrata; in which direction the ſtone is abſolutely opaque, though on the other ſemi-tranſparent.

3. Whilſt the tourmalin is heating, one of its ſides (diſtinguiſhed by A) is electrified plus, or poſitively, and the other ſide B, minus; but when it is cooling A is minus, and B is plus.

4. If it be heated and ſuffered to cool without either of its ſides being touched, then A will appear poſitive, and B negative, all the time of its heating or cooling.

5. If this ſtone be excited by friction, like any other electric, then each of its ſides, or both at once, may be made poſitive.

6. If the tourmalin be heated or cooled upon ſome other inſulated body, that body will be found electrified as well as the ſtone; and will be found poſſeſſed of the electricity contrary to that which is acquired by that ſide of the ſtone which was laid upon it.

7. The electricity of each ſide, or of both, may be reverſed by heating or cooling the tourmalin in contact with various ſubſtances; thus if it be cooled, or heated, in contact with the palm of the hand, that ſide of it, which would have been poſitive if cooled in the open air, is now negative; and that which would have been negative is now poſitive.

8. If a tourmalin be cut into ſeveral parts, each piece will have its poſitive and negative poles, correſponding to the poſitive and negative ſides of the ſtone from which it was cut.

9. Theſe properties of the tourmalin are alſo obſervable in vacuo, but not ſo ſtrongly as in the open air.

10. If this ſtone be covered all over with ſome electric ſubſtance, as ſealing-wax, oil, &c. it will in general ſhew the ſame appearances with this coating as without it.

11. Mr. W. Canton obſerved a very vivid light upon the tourmalin while heating in the dark; and this is ſufficient to point out which end of the ſtone is become poſitive, and which negative. Alſo, when the ſtone is ſtrongly excited, it emits very ſtrong flaſhes from the poſitive to the negative end, in the dark. That ſtone which is commonly called the “Braſilian emerald” from its colour, but which in fact is a tourmalin, alſo emits the abovementioned electrical light.

12. Laſtly, it is to be remarked that the power of the tourmalin is ſometimes injured by the action of a ſtrong fire, at other times it is improved, and frequently it is not at all affected by it. The laws, however, of ſuch uncertain effects, have not yet been inveſtigated.

Moſt of the above-mentioned properties, which were firſt obſerved in the tourmalin, have been found to belong to ſome other bodies; *i. e.* there are ſome other ſubſtances which have the electric virtue excited in them by heating and cooling. It is to be obſerved that ſuch bodies are generally, if not always, in a cryſtallized ſtate; alſo it has been remarked that the parts which exhibit the different ſtates of electricity differ from each other with reſpect to their form, although they are ſimilarly ſituated: while in thoſe cryſtals that are not electric, the ſimilarly ſituated parts correſpond alſo in form. If a cryſtal, for inſtance, conſiſt of a priſm terminated at each extremity by a pyramid,

mid, and theſe pyramids differ as to the kind of electricity they are capable of acquiring, it will be found that they alſo differ in their form ; one conſiſting of a greater number of ſurfaces than the other ; and the part which has the greater number of faces acquires the poſitive electricity ; the other the negative. Kidd's Outlines of Miner. vol. i.

The Abbé Haüy ſays, that the electricity which is produced by heat has been obſerved in ſix ſpecies of minerals, *viz.* the tourmalin, the borated magneſia or boracite, the topaz, whether from Brazil, from Saxony, or from Siberia, the meſotype of Haüy, or zeolite, the prehnite, and the oxydated zinc, or electrical calamine. See the nature of theſe minerals under the articles of their peculiar names. We are informed, however, that lately a gentleman, highly verſed in electrical experiments, examined a vaſt number of ſpecimens of the above-mentioned ſix minerals, and among them, (independent of the tourmalin,) he found two only that became electrical by heating and cooling ; namely, the boracite and the oxydated zinc ; with reſpect to a ſpecimen of the latter, which had a pyramid at one end, and was truncated at the other end, he particularly obſerved that whilſt cooling, the pyramid became negative, and the truncated ſide poſitive ; but whilſt heating, the pyramid became poſitive, though ſlightly ſo, and the truncated ſide did not manifeſt any ſenſible degree of electricity.

Melting or coagulating.—Melting or pouring a melted electric ſubſtance into another, excites electricity in various inſtances, and with peculiar phenomena.

If ſulphur be melted in an earthen veſſel, and be left to cool upon conductors ; then if taken out of the veſſel, when cold, it will be found ſtrongly electrical ; but not at all ſo, if it be left to cool upon electrics.

If ſulphur be melted in glaſs veſſels, and afterwards left to cool, they will both acquire a ſtrong electricity, the ſulphur negative, and the glaſs poſitive, whether they be left to cool upon electrics or upon conductors ; however, they always acquire a ſtronger power in the former caſe than in the latter ; and a ſtronger ſtill, if the glaſs veſſel is coated with metal. It is to be remarked, that the ſulphur acquires no electricity till it begins to cool ; its power increaſes in proportion as it contracts, and is the ſtrongeſt when in the ſtate of greateſt contraction ; but then the electricity of the glaſs veſſel is at the ſame time the weakeſt.

If melted ſulphur be poured into a veſſel of baked wood, it acquires the negative electricity, and the wood the poſitive ; but if it be poured into ſulphur, or rough glaſs, it does not acquire any ſenſible degree of electricity.

Melted ſulphur poured into a metal cup, and there left to cool, ſhews no ſigns of electricity whilſt remaining in the cup ; but if ſeparated, they will then appear ſtrongly electrified, the ſulphur poſitively, and the cup negatively. If the ſulphur is replaced in the cup, every ſign of electricity will vaniſh, but, if whilſt they are ſeparate the electricity of either of them is taken off, then, on being replaced, they will both appear poſſeſſed of that kind of electricity which had not been taken off.

Melted wax, poured into glaſs or wood, acquires the negative electricity, and leaves the glaſs or wood poſitive. But ſealing-wax poured into ſulphur acquires the poſitive electricity, and leaves the ſulphur negative. The wax-chandlers, in making their candles, often find it extremely difficult to prevent the attraction and adheſion of duſt and other light bodies, in conſequence of the electrified ſtate of the wax.

Chocolate freſh from the mill, as it cools in the pans in which it is received, becomes ſtrongly electrical. When turned out of the pans, it retains for ſome time this property, but ſoon loſes it by handling. Mr. Henly, who made theſe obſervations upon chocolate, found that by melting it again in an iron ladle, and pouring it into the tin pans as at firſt, would for once or twice more renew its power ; but when the maſs became very dry and powdery in the ladle, the electricity could no longer be revived by ſimple melting. However, he found that if in that ſtate a little olive oil be added and mixed well with the chocolate in the ladle, then on pouring it into the tin pan as at firſt, the electric power will be found to be completely recovered.

Evaporation and *condenſation.*—It was Mr. Volta who firſt diſcovered that the evaporation of water, and of moſt other bodies either ſolid or fluid that can be converted into ſmoke or vapour produced electricity, and not long after it was diſcovered that the condenſation of vapour alſo produced electricity, but of the contrary kind. Thus when water is evaporated from an inſulated veſſel, that veſſel remains electrified negatively, and if the vapour be received and condenſed upon an inſulated ſurface, that ſurface will acquire the poſitive electricity. Theſe diſcoveries, beſides their affording an eaſy explanation of the origin of the electricity in the clouds, fogs, &c. ſeem to point out a general law of nature ; namely, that the capacity of water or other fluids for holding the electric fluid, is increaſed by the expanſion of thoſe bodies into the form of vapour ; and is diminiſhed by the contrary operation, *viz.* by the contraction of the vapour into the form of water. Therefore, in the firſt caſe, by imbibing an additional quantity of electric fluid the vapour would leave the bodies from which it departed in a negative ſtate ; and in the ſecond caſe, *viz.* in the converſion of vapour into water by giving out a quantity of electric fluid, would leave the bodies that touched it in a poſitive ſtate. And this is analogous to what takes place with reſpect to caloric and vapour.

The eaſieſt way of ſhewing the production of negative electricity by evaporation is, to place a metallic cup upon a delicate electrometer, and to put a red-hot coal in it ; then on pouring a few drops of water upon the coal, a ſudden evaporation takes place, and the electrometer opens with negative electricity. In order to ſhew the poſitive electricity which is produced by the condenſation of vapour, let a pretty long wire (*viz.* about a foot long) proceed from the top of the electrometer, and fix ſome pieces of paper to the farther end of the wire, then if the ſteam of water which iſſues out of the ſpout of a boiling kettle be directed towards the paper, the ſteam will be condenſed upon it, and the electrometer will open with poſitive electricity.

The production of electricity by evaporation is not, however, always proportional to the quantity of evaporation ; for inſtance, when water is evaporated from certain ſubſtances it produces a conſiderable quantity of negative electricity, but when evaporated from certain other ſubſtances, it produces little of it or none at all. Thus the ſlaking of quicklime produces a copious evaporation, but no electricity ; and ſuch is likewiſe the caſe with a few other ſubſtances.

All the experiments that were made, during ſome years ſubſequent to the original diſcovery, ſhewed, that if evaporation produced any electricity at all, this was of the negative kind ; but at laſt two remarkable exceptions from this general rule were diſcovered, *viz.* one by a learned profeſſor of the academy of Mantua, and the other by Mr. Cavallo ; and theſe exceptions ſeem to point out a more intimate connection between the electric fluid and other bodies.

The firſt of the above-mentioned gentlemen found that when water is evaporated by being poured over a red-hot piece of very *ruſty* iron, it would leave the iron and veſſel upon which it ſtood electrified poſitively ; and the ſame would be the caſe if the red-hot piece of ruſty iron was thrown into the water : ſuppoſing that the latter is contained in an inſulated veſſel. If the iron be clean and free from ruſt, the electricity will be negative ; if very ruſty, the electricity will be poſitive, and if partially ruſty, it will acquire little or no electricity ; for in this laſt caſe the negative electricity which ariſes from the evaporation of water from over the clean part of the iron, is balanced by the poſitive electricity, which is produced by the evaporation from over the ruſty part. In conſequence of this, a ruſty piece of iron will not ſerve for more than one or two experiments, for, by rendering it red-hot, part of the ruſt is ſhaken off, and at laſt it will act like a piece of clean iron. Gardenii Diſſert. de Electrici Ignis Natura. § 84, 85, 86.

The other exception (which was diſcovered by Mr. Cavallo, and is publiſhed in the 4th edit. of his Treat. on El.) is ſhewn by means of red-hot glaſs. "The various degrees," Mr. C. ſays, "of electric powers that are produced by the evaporation of water from different ſubſtances induced me to diverſify the experiments as much as I could, in order to diſcover, if poſſible, the reaſon why thoſe different effects took place when the evaporation ſeemed to be equally quick and copious. Amongſt other ſubſtances I tried glaſs, and found that it generally produced little or no electricity. The water was ſometimes poured upon the hot glaſs, but in general the hot glaſs was dropped into the inſulated water which was contained in a tin cup. However, the difference of effect was found not to be occaſioned by thoſe two different modes of proceeding. Having repeated this experiment a great many times, I at laſt found that the effect depended upon the different nature of the glaſs. If white and clean flint glaſs be made red-hot, and in that ſtate be dropped into the veſſel of water, a quick evaporation will enſue, and the veſſel is electrified poſitively. If the flint glaſs be not very clear, there will not be any electricity generated by the evaporation. And, laſtly, if the experiment be tried with glaſs more impure, as that of which wine bottles are made, then the negative electricity will be produced.

"In performing this experiment, it is neceſſary to take care that no pieces of coal adhere to the glaſs, which will frequently happen when a piece of glaſs is heated in a common fire ; for in that caſe negative electricity will be produced by the evaporation, though the beſt flint glaſs be uſed."

Expanſion and *contraction*.—The mere expanſion of parts produces electricity in various inſtances ; ſuch as the diſperſion of powders by projection or blowing ; and the electrometer is affected by the ſame. It is owing to this electrified ſtate of the powders, that ſeveral curious phenomena are exhibited by them, which could not otherwiſe be explained. Thus the configurations which are produced by projecting powders upon an electrophorus, or upon any electrified ſurface, are owing, in great meaſure, to this cauſe ; thus alſo the duſt upon the roads when properly attended to is often found to expand itſelf more than it apparently ſhould, and to aſſume peculiar movements, in conſequence of its actual electrified ſtate, which may be eaſily diſcovered by means of a very delicate electrometer. For further particulars reſpecting this kind of excitation, ſee the article ELECTRICAL *Experiments*, and the deſcription of Mr. Bennet's gold-leaf electrometer, under the article ELECTROMETER. Mr. Cavallo, in his Treatiſe on Electricity, gives the following directions for exciting powders. "Inſulate," he ſays, "a metal plate upon an electric ſtand, and connect with it a cork-ball electrometer ; then the powder which is required to be tried, being held in a ſpoon, or other thing, at about ſix inches above the plate, is to be let fall gradually upon it. In this manner the electricity acquired by the powder, being communicated to the metal plate, and to the electrometer, is rendered manifeſt by the divergency of the threads ; and its quality may be aſcertained in the uſual manner."

"It muſt be obſerved, that if the powder is of a conducting nature, like the amalgam of metals, or ſand, &c. it muſt be held in ſome electric ſubſtance, as a glaſs phial, a plate of ſealing-wax, or the like. Sometimes the ſpoon that holds the powder may be inſulated ; in which caſe, after the experiment, the ſpoon will be found poſſeſſed of the electricity contrary to that of the powder."

It is, however, proper to remark with reſpect to this kind of excitation, that the production of the electricity is in ſome meaſure due to the friction ; for in the act of pouring any ſubſtance in powder from a plate, a veſſel, &c. a degree of friction between the latter and the former muſt neceſſarily take place.

Contact, or *juxtapoſition*.—That the mere contact of two perfect conductors would generate, or excite electricity, is a diſcovery of a very late date. Mr. Cavallo ſeems to have been the firſt who proved that by dropping a piece of metal upon another, a ſlight degree of electricity was thereby produced. (See the 4th edition of his Treatiſe on Electricity, publiſhed in 1795, third vol. Experiments on Metallic Subſtances.) Mr. Bennet alſo, independent of Mr. Cavallo's experiments, ſeems to have a claim to this diſcovery. The electricity thus produced was ſo very ſlight, that it could only be diſcovered by the niceſt methods ; but it was the forerunner of a moſt aſtoniſhing diſcovery. In ſhort Mr. Volta, by repeating the contact of metallic ſubſtances, and at the ſame time expoſing them to the action of a ſaline ſubſtance, produced a moſt powerful electrical inſtrument, which has opened a new field of ample and promiſing aſpect, and has furniſhed the chemical philoſopher with the moſt active engine of decompoſition.

This, and the other modes of excitation that have been mentioned ſubſequent to it, *viz.* by means of ſolution, or efferveſcence, and by the action of the animal body, cannot be well explained, nor thoroughly underſtood, without a full, hiſtorical, and circumſtantial account of that new and admirable branch of electricity, which is now commonly called *Galvaniſm ;* but which in juſtice ought rather to be called *Voltaiſm ;* and as it would be uſeleſs to fill this Cyclopædia with repetitions, we muſt refer our readers to the articles of the two laſt mentioned denominations, wherein thoſe other modes of excitation are particularly deſcribed.

EXCITATION *of Heat*.—The temperature of bodies is raiſed either by the approach of a body hotter than themſelves, or by the extrication of heat from the bodies themſelves, occaſioned by ſome particular action or diſpoſition. The former of theſe methods of elevating the temperature is a mere communication of heat ; for that principle continually tends to diſperſe itſelf amongſt ſurrounding bodies, until they all acquire the ſame degree of temperature. The latter is called the *excitation* of heat, ſince an elevation of temperature takes place amongſt bodies which were not hotter than the ſurrounding bodies a ſhort time before. Thus, when a perſon ſtands before a common fire, heat is ſaid to be communicated to him, but with reſpect to the fire itſelf, the heat is ſaid to be excited, or produced by that particular decompoſition of fuel which is called combuſtion. Thus alſo heat is excited by friction, by the mixture of water with ſulphuric acid, and by a great many other means; but it is communicated by the rays of the ſun.

The means by which various degrees of ſenſible heat are produced and communicated, are not more than eight; *viz.* 1. Animal heat, or that power in animals which keeps them warm, and enables them to communicate heat to other bodies. 2. Compreſſion. 3. Friction, or percuſſion of hard bodies. 4. Electricity. 5. Mixture. 6. Fermentation, or putrefaction. 7. The ſun's rays; and, 8. The inflammation of fuel. However, by excluding the conſideration of the ſun's rays for reaſons already aſſigned; by comprehending animal heat, fermentation, and inflammation under the general denomination of decompoſition; and by referring the action of electricity to friction; the various modes of exciting heat, which demand our conſideration in the preſent article, may be reduced to four; namely, compreſſion, friction, mixture, and decompoſition, and even this number may be diminiſhed by two, ſince, as it will appear in the ſequel, both friction and mixture may be comprehended under the head of compreſſion; for in theſe two caſes the excitation of heat ſeems to be occaſioned by the compreſſion or concentration of the integrant parts. We ſhall, however, for the ſake of perſpicuity, treat diſtinctly of the above-mentioned four modes.

The flattening or ſtretching of metallic ſubſtances, whether it be effected by means of the hammer, or ſcrew preſſes, or flattening mills, or wire drawing, or any other ſuch like means, is conſtantly attended with an excitation of heat, and a compreſſion of the metallic ſubſtance. The former of theſe effects is perceived by the feel, or, more accurately, by the thermometer; the latter by an increaſe of ſpecific gravity in the ſubſtance that has been operated upon. Not only the metals, but all other ſubſtances that are ſuſceptible of compreſſion, ſuch as wood, cotton, the aerial fluids, &c. are likewiſe heated by the ſame means. On the other hand, water, hard ſtones, and all ſuch bodies as cannot be condenſed into a ſmaller ſpace, at leaſt not in any conſiderable degree, will not be heated by the above-mentioned means.

The heat, which is thus excited, differs in degree according to the nature of the ſubſtance, the violence of the preſſure, and the quickneſs of the operation; thus a metallic ſubſtance, powerfully and quickly compreſſed, becomes hotter than a piece of wood ſimilarly treated, and hotter than if it were preſſed gently or ſlowly; for with a gentle preſſure little heat is excited, and when the preſſure is applied ſlowly, the heat is diſſipated nearly as faſt as it is excited.

A dexterous blackſmith, by giving a dozen or twenty ſmart ſtrokes with a hammer, to the extremity of a ſlender iron rod upon an anvil, will render that extremity of the rod viſibly red-hot, even in the day light; and this is the way by which ſeveral blackſmiths light the fire of their forges when they go to work in the morning. With reſpect to this operation, Dr. Black, in his Lectures, remarks, that the ſame extremity of the iron rod cannot be rendered red-hot a ſecond time by hammering, unleſs it be firſt annealed, or ſoftened in the fire. "On account," he ſays, "of this and other facts, I began to ſuſpect that malleability and ductility of metals depend on a certain quantity of latent heat exiſting in them, which being extricated by hammering, the metals remain rigid, and require to be placed in the fire or annealed, in order to recover that latent heat."

A mixture of oxygen and hydrogen gaſes, if compreſſed, takes fire, and explodes with great violence. The mechanical condenſation of vapour, and of all the aerial fluids, is attended with a conſiderable elevation of temperature. The condenſation of common air excites a conſiderable degree of heat, and, when quickly performed, it fires a variety of combuſtibles, ſuch as cotton, charcoal previouſly warmed, tinder, &c.; and upon this principle a curious inſtrument has of late been contrived, by which a candle or fire may be lighted. It is nothing more than a ſmall ſyringe, or little condenſer, about ſix inches long, and not much above a quarter of an inch in diameter, (meaning the diameter of its cylindrical cavity.) It has a piſton, the rod of which comes out at one end, and a ſtop-cock at the other end; this ſtop-cock is not perforated quite through, but only little more than half way, ſo that its cavity may either be expoſed to the external air, or it may be turned towards the cylindrical cavity of the ſyringe. The operation is performed in the following manner: the piſton is firſt drawn out as far as the extremity of the ſyringe, a little bit of *amadue*, (more commonly known by the name of German tinder,) is placed into the cavity of the ſtop-cock, which is afterwards turned towards the cylindrical cavity of the ſyringe; this done, the piſton is puſhed in quickly and forcibly, with one ſmart ſtroke, by which means the ſudden condenſation of the air excites a degree of heat ſufficient to ſet fire to the tinder; and in fact if the ſtop-cock be turned outwardly immediately, after having puſhed the piſton in, the tinder will be found burning, and a match may be lighted by it.

From a general conſideration of the effects of compreſſion, it appears that the caloric, or that principle to which the effects of heat are attributed, is contained within the pores of other bodies, ſomewhat like water in the cavities of a ſponge, and that by compreſſing the body, part of that caloric is diſengaged, and becomes ſenſible heat. Thus when a mixture of oxygen and hydrogen gaſes is quickly and forcibly condenſed, that operation forces the gaſes to abandon a quantity of caloric, which becomes ſenſible heat, and as it cannot be diſſipated immediately, raiſes their temperature to a degree ſufficient for their inflammation. This explanation is corroborated by the converſe of the above operation, *viz.* by expanſion; for when gaſes are expanded, they abſorb an additional quantity of heat, which does not raiſe their temperature.

Friction is well known to excite heat, the degree of which differs in proportion to the nature of the bodies concerned, and the force which is employed. This effect of friction is ſo commonly experienced, and ſo generally uſed, as to require but little illuſtration. Rubbing the hands againſt each other, or againſt any part of the body in order to excite heat, is a general practice. Filing, turning, grinding, ſtriking a piece of ſteel againſt a flint, the motion of the axles of wheels in their holes, &c. are common and well-known inſtances of friction, which excite heat. In theſe caſes the conſideration of two remarkable circumſtances forcibly lead us to conclude, that the heat is excited by the compreſſion of the parts of the bodies concerned. One of the circumſtances alluded to is, that compreſſion is the neceſſary conſequence of friction; the other is, that ſuch ſubſtances as are not compreſſible, or the compreſſibility of which is next to nothing, cannot be heated by means of friction.

Thus Dr. Irvine ſays, in his Lectures, "The moſt violent agitation of ſimple fluids, ſuch as water or mercury, will not ſenſibly affect the thermometer. Heat is produced by agitation on thoſe fluids which are compound, and whoſe ſtate of exiſtence is changed by the agitation; ſuch as milk, and the ſolution of certain ſalts in water."

It is aſſerted in Nicholſon's Journal for June 1808, that

Dr. Joſeph Read found that by agitating water in a tin veſſel, or in a glaſs one for a few minutes, the temperature of that fluid was raiſed about eight degrees, as it appeared from a thermometer left in it all that time. We are, however, ſtrongly inclined to ſuſpect that this apparent reſult was owing to ſome fallacy in the mode of conducting the experiment.

It ſeems, therefore, moſt probable, that friction produces a compreſſion, and that the caloric is expelled from the bodies concerned, ſo as to become ſenſible heat, in conſequence of that compreſſion.

The greateſt opponent to this hypotheſis is count Rumford, who inſtituted ſome capital experiments, which are deſcribed at large in the Philoſophical Tranſactions, and in which he ſucceeded to ſet a quantity of water actually a boiling by the friction of metal againſt metal. In ſhort, the metal ſubmitted to friction was encompaſſed by water, and air was carefully excluded from the ſurfaces in motion; yet the water became hot, and was kept boiling a conſiderable time. In this experiment the only obvious ſource of caloric, from without, as the count imagines, was through the borer employed to produce the friction; if it be true, that the water could not at the ſame inſtant be in the act of giving out and receiving heat. Mr. Wm. Henry (Tranſ. of the Mancheſter Society, vol. v. p. 2.) reaſoning upon this experiment of count Rumford, ſays, "I cannot admit that the argument is demonſtrative in proving the evolved caloric not to be derived from external ſubſtances; for no abſurdity is implied in ſuppoſing that a body may be receiving caloric in one ſtate, and giving it out in another." Thus theſe gentlemen ſeem to exclude the action of the compreſſion between the metallic bodies, which is occaſioned by the friction, and upon which the whole effect ſeems moſt probably to depend.

With reſpect to this excitation of heat by means of friction, two uſeful practical conſiderations naturally occur; *viz.* to determine which kinds of friction are capable of producing the greateſt degree of heat, and in what manner the heat which ariſes from the friction of the parts of machinery in general, may be prevented.

The production of heat, and of actual fire, by the friction of wood againſt wood, ſeems to be the firſt that occurs to the human being, ſince the materials neceſſary for it are to be met with every where, and do not require any previous preparation, excepting a trifling adaptation of ſhape. In fact all rude nations that have any notion of fire, light their fires by this means. For this purpoſe, a piece of wood is laid flat nearly in an horizontal ſituation, and another ſlender piece of wood is rubbed with one extremity backward and forward over the ſurface of the former, until it excites heat enough to ſet fire to the duſt that has been abraded from the wood itſelf by the friction. Otherwiſe a blunt pointed piece of wood is held perpendicularly over an horizontal piece, with its point in a little cavity on the ſurface of the latter, and is worked therein, like a drill, by rolling it between the hands of the operator, after the manner of a chocolate mill. Though this operation may at firſt ſight appear to be eaſy and ſimple, and though it be readily performed by the individuals of rude nations; yet certain it is that the practice of it is not eaſily acquired; and in fact there are very few perſons in Europe who are able to ſucceed in it. Profeſſor Bartholdi ſays, that the beſt kinds of wood for this purpoſe are, box-wood rubbed againſt mulberry, or laurel againſt poplar, or againſt ivy. But the uſe of this mode of exciting heat amongſt all civilized nations is ſuperſeded by the incomparably eaſier, and much more effectual method, of ſtriking a piece of ſteel againſt the edge of a ſiliceous ſtone. In this operation ſmall particles of the ſteel are violently compreſſed and ſcraped off in an ignited ſtate, ſo as to fire tinder, gun-powder, &c. The very common and general uſe of this method, for domeſtic conveniency, for gun-locks, &c. renders any farther deſcriptions of it perfectly uſeleſs.

We have ventured to refer the excitation of heat by electricity, to friction, in conſideration that electricity does not excite any heat, unleſs it is actually paſſing through bodies, which in ſome meaſure obſtruct its free paſſage. But we muſt refer the reader for the farther conſideration of this matter to the articles which relate to electricity.

It is a matter of great importance in mechanics to prevent, or, at leaſt, to diminiſh the heat which is excited by the friction of the parts of machinery in general; and for this purpoſe the common practice is to interpoſe ſomething of a lubricating quality between the contiguous parts of machines, *viz.* ſomething which may hinder the too intimate contact of the parts, and whoſe particles are eaſily ſeparated from each other. On various conſiderations olive oil has been found ſuperior to any thing elſe in metallic machinery, and eſpecially in watch or clock-work, when ſteel works in metal or in hard ſtone. Where wood and metals work againſt each other, hog's lard, or mutton-ſuet or ſuch other fat or greaſe, is moſtly uſed; and when wood works againſt wood, then the powder of black lead is found to be the moſt uſeful.

The heat which is excited by the mixture of certain bodies, comes next under conſideration: the inſtances of this kind are very numerous, and different degrees of heat may be excited by this means, as far as actual inflammation. The following are ſelected. If ſpirit of wine be mixed with water, the mixture will inſtantly become hot enough to be perceived not only by means of the thermometer, but likewiſe by the mere application of the human hand. This heat will be gradually diſſipated, ſo that in a few minutes' time that mixture will be found to have acquired the temperature of the ſurrounding bodies. On mixing a quantity of the ſtrongeſt ſulphuric acid with an equal quantity of water, a degree of heat is excited which exceeds that of boiling water. If a mixture of nitric and ſulphuric acids be poured upon an inflammable eſſential oil, ſuch as oil of cloves, oil of turpentine, &c.; the latter is thereby ſo heated as to burſt out in flames. Water mixed with quick-lime excites a conſiderable degree of heat. There is a kind of earth found in Derbyſhire, which is called *black-wad.* If a quantity of this earth, as about half a pound or more of it, be ſprinkled over with linſeed oil, and be then left undiſturbed, and expoſed to the air, about an hour after it will be found in a ſtate of incandeſcence, burning ſomewhat like ſmall coal.

In all the caſes of the excitation of heat by the mixture of fluids, two remarkable circumſtances deſerve particular conſideration. One is that the heat will be excited only when the fluids have a chemical action upon each other, ſuch as between acids and water, ſpirituous liquors and water, &c.; whereas, if oil be mixed with water, or water with quickſilver, no heat will be excited, becauſe no real mixture will take place among theſe bodies. The other circumſtance is, that whenever heat is excited by the mixture of fluids, an incorporation, or a concentration of the ſubſtances is obſerved; for it is always attended with a diminution of bulk. Thus a pint of alcohol and a pint of water, mixed together, will meaſure leſs than two pints. Theſe circumſtances ſeem to indicate, that the affinity, or the mutual attraction of the particles of the bodies concerned, occaſions a kind of compreſſion, in conſequence of which a certain part of the caloric is forced out, and becomes ſenſible heat.

The fourth cauſe of the excitation of heat is decompoſition; and under this head we muſt comprehend the origin of animal heat, fermentation, putrefaction, combuſtion, and all other proceſſes in which the heat is manifeſtly excited in conſequence of the decompoſition of compound bodies. But as theſe proceſſes will be found treated at large under the articles of their peculiar denominations; we ſhall here only add a few remarks on the heat which is produced by decompoſitions in general. In ſhort it ſeems that the caloric, like ſeveral other principles, enters more or leſs into the formation of compound bodies, and that in the decompoſition of theſe bodies, where certain principles are ſet at liberty, and other new combinations enſue, the caloric alſo undergoes its changes; *viz.* it is expelled from certain bodies, and is either ſet entirely at liberty ſo as to become ſenſible heat, or is partially reabſorbed, in which latter caſe but little heat is manifeſted. This liberation of caloric is ſometimes effected ſlowly, as in the proceſs of animal life, in fermentations, &c. or it proceeds ſo quickly and abundantly, as to occaſion actual inflammation. By the concurrence of various favourable circumſtances it happens, not unfrequently, that decompoſitions and ſpontaneous inflammations take place among bodies, which, in general, are not capable of producing ſuch phenomena. Thus, vegetable ſubſtances that have undergone torrefaction, being kept in ſacks of cloth in contact with the ambient air, as coffee, the meal of grain, French beans, &c. have ſometimes been known to take fire. The like effect is alſo produced by the generation of ſulphurated and phoſphorated hydrogen gas. The cauſe of ſubterraneous fires and volcanoes has in great meaſure been attributed to the decompoſition of pyrites, or metallic ſulphurets, buried in the interior of the earth. Theſe maſſes of pyrites are decompoſed by the contact and concurrence of water and air; and the decompoſition is always accompanied by a great extrication of caloric, and a diſengagement of a very inflammable gas, called *ſulphurated hydrogen gas*. This gas is inflamed at an elevated temperature, and communicates the inflammation to other combuſtibles that may be at hand.

With reſpect to the heat which is produced in combuſtions, ſeveral queſtions of economical uſe may be aſked, ſuch as the determination of the cheapeſt and moſt economical mode of employing fuel, the method of preventing the diſſipation of heat, &c. but theſe particulars will be found under the articles FIRE, FUEL, and HEAT.

EXCITEMENT, in Dr. Browne's ſyſten of *Medicine*, nearly ſynonymous with life. See EXCITABILITY.

EXCLAMATION, or ECPHONESIS, in *Rhetoric*, a figure, wherein, by raiſing the voice, and uſing an interjection either expreſsly or underſtood, we teſtify an uncommon ardour, commotion, and paſſion of mind; and expreſs the magnitude of the thing, or the importance of the occaſion.

Such is, "O heavens! O earth!" &c. ſuch alſo is that of Cicero againſt Cataline: "O times! O manners! this the ſenate knows, the conſul ſees—and yet he lives! Lives, ſaid I? nay, and comes into the ſenate!"

In Engliſh the interjections O! or oh! alas! or good God! are generally adjoined in an exclamation. In Latin they uſe O! heu! eheu! ah! vah! pro ſuperi! pro ſuperûm atque hominum fidem!" Sometimes, however, the interjection is underſtood, as, Woe is me! Miſerum me! hoccine ſæculum!

Cicero uſes this figure to expreſs a variety of paſſions. It often denotes reſentment or indignation. Thus, after his return from baniſhment, he exclaims, (*Pro Sext.* c. 12.) "O mournful day to the Senate and all good men; calamitous to the ſtate, afflictive to me and my family; but glorious in the view of poſterity!" At other times it is uſed to expreſs diſdain or contempt. Thus, ſpeaking of Pompey's houſe, which was bought by Mark Antony, he ſays, (Philipp. II. c. 12.) "O conſummate impudence! Dare you go within that houſe! Dare you enter the venerable threſhold, and ſhew your audacious countenance to the tutelar deities which reſide there?" It is no leſs adapted to expreſs grief. Thus, Cicero ſays of Milo, (Pro Milone, ſub fin.) "O that happy country, which ſhall receive this man! ungrateful this, if it baniſh him! miſerable, if it loſe him!" It alſo ſerves to expreſs admiration, as when Cicero, in compliment to Cæſar, ſays, (Pro Ligur. c. 2.) "O admirable clemency! worthy of the greateſt praiſe, the higheſt encomiums, and moſt laſting monuments!" It has its uſe alſo in ridicule and irony. Thus Cicero, in his oration for Balbus, deriding his accuſer, exclaims, "O excellent interpreter of the law! maſter of antiquity! corrector and amender of our conſtitution!" The ſacred writers ſometimes uſe it by way of intreaty or wiſh, Pſ. lv. 6., and at other times in exultation and triumph, ſo St. Paul exclaims, (1 Cor. xv. 25.) "O death, where is thy ſting! O grave, where is thy victory!" It is frequently joined, as in ſome of the preceding inſtances, with the figure "Interrogation." It generally follows the repreſentation of the thing which occaſions it; though it is ſometimes uſed to introduce it, and thus it ſerves to prepare the mind by exciting its attention.

EXCLUSION, the act whereby a perſon or thing is excluded, *i. e.* ſhut out or ſet aſide. A crown imports an excluſion from the papacy: he appointed a ſtranger his heir, in excluſion of his own relations.

Great efforts were made towards the cloſe of the reign of king Charles II. to procure a bill of excluſion, for ſetting aſide the duke of York, the king's brother, on account of his being a papiſt. See CROWN.

EXCLUSIONS, in *Mathematics*. The method of excluſions, is a way of coming at the ſolution of problems (in numerical caſes) by previouſly ejecting, or excluding out of conſideration, ſuch numbers as are of no uſe in ſolving the queſtion; whereby, of conſequence, the proceſs may be regularly and judiciouſly abbreviated.

EXCLUSIVE, is ſometimes uſed adjectively, for the force or power of excluding; as, a patent carries with it an excluſive privilege.

Sometimes it is alſo uſed adverbially; as, he ſent him all the Gazettes, from N° 195, to N° 300 excluſive; *i. e.* all between thoſe two numbers, which themſelves were excepted.

EXCLUSIVE *Propoſitions*, are thoſe wherein the predicate ſo agrees with the ſubject, as to agree with no other. See PROPOSITION. *E. gr.* Virtue alone makes nobility: nothing elſe renders a man truly noble.

EXCŒCARIA, in *Botany*, from *excæco, to deprive of ſight*, becauſe, according to Rumphius, the ſailors who firſt landed on the iſlands of the Eaſt Indies, where this tree grows, were greatly incommoded, and ſometimes even entirely blinded, by the acrid juice which ſpirted forth, as they felled the wood for burning. Linn. Gen. 515. Schreb. 677. Juſſ. 390. Gærtn. t. 108. Claſs and order, *Diœcia Triandria*. Nat. Ord. *Tricoccæ*, Linn. *Euphorbiæ*, Juſſ.

Gen. Ch. Male, *Cal.* Catkin cylindrical, covered with florets. *Cor.* none. *Stam.* Filaments three, thread-ſhaped; anthers roundiſh. Female, *Cal.* Catkin as in the male. *Cor.* none. *Piſt.* Germen ſuperior, roundiſh, ſomewhat triangular;

angular; ſtyles three; ſtigmas ſimple. *Peric.* Capſule three-lobed, ſmooth, of three valves, each marked with a furrow, and three cells. *Seeds* ſolitary, ſmooth.

Eſſ. Ch. Male, Catkin naked. Perianth none. Corolla none. Female as in the male. Styles three. Capſule three-lobed. Seeds ſolitary.

E. *Agallocha.* Linn. Sp. Pl. 1451. (Arbor excœcans; Rumph. Amb. v. 2. 237. t. 79, 80.) Native of rocky, dry, and ſandy places about the coaſt in Amboina and other Eaſt Indian iſlands, flowering in January and February, as well as occaſionally at other ſeaſons. It forms a crooked inelegant tree. The *leaves* are alternate, elliptical, bluntiſh, ſmooth, more or leſs waved or bluntly crenate. *Catkins* cylindrical, lateral. *Capſules* the ſize of a pea. The acrid milk with which the tree abounds, cauſes the inhabitants of the countries where it grows to hold it in abhorrence; but Rumphius ſays it is chiefly dangerous to the eyes. The bark, as well as the milk, are uſed in medicine, being powerfully purgative. There ſeems to be no propriety in applying the Greek name αγαλλοχον, from Dioſcorides, to this tree.

How far the Cammetti, Rheede Hort. Malab. v. 5. 89. t. 45, is a diſtinct ſpecies from the above, we have not materials to decide. Its *leaves* are more pointed and leſs diſtinctly waved. Koenig gathered it by the ſea ſide on the coaſt of Coromandel, in low ground, overflowed during the rainy ſeaſon, which does not agree with what Rumphius relates of the foregoing.

Loureiro deſcribes what is probably another ſpecies, by the name of E. *cochinchinenſis*, in p. 612. of his Flora Cochinch. This, he ſays, has beautiful ſhining *leaves*, red underneath, for the ſake of which it is cultivated as an ornamental ſhrub. Its qualities are aſtringent and glutinous, nor did he ever hear of its being hurtful to the eyes.

EXCOMMUNICATION, an anathema, or eccleſiaſtical cenſure, and puniſhment; whereby a heretic is cut off from the ſociety of the faithful, or an obſtinate ſinner from the communion of the church, and the participation of the ſacraments.

This cenſure of excommunication was originally inſtituted for preſerving the purity of the church; but ambitious eccleſiaſtics converted it by degrees into an engine for promoting their own power, and inflicted it on the moſt frivolous occaſions.

The power of excommunication properly belongs to the biſhop; but he may delegate it to any grave prieſt, with the chancellor.

Every excommunication ſhould be preceded by three public admonitions, two days at leaſt diſtant from each other; but this is to be underſtood of excommunications impoſed by the eccleſiaſtical judge; for thoſe impoſed by the law are incurred to all intents and purpoſes the moment the action is committed.

Theſe latter are called excommunications *by the canon*, or *latæ ſententiæ*; and are ſo very numerous, that it would be difficult even for the beſt canoniſts to give an exact liſt of them; there are fifty in the Clementines; twenty in the bull *Cœna Domini*, &c. Wilkins's Mag. Brit. Conc. vol. iv. p. 664. Rebuffe, on the Concordat, reckons up ſixty penalties accruing upon excommunication.

Excommunication is founded on a natural right which all ſocieties have, of excluding out of their body ſuch as violate the laws thereof.

Excommunication is either *major* or *minor*, i. e. *greater* or *leſs*; the firſt, which is that underſtood when we ſay, ſimply, excommunication ſeparates, or cuts off, the delinquent, not only from the ſacraments, but from all communion and fellowſhip with other Chriſtians. The ſecond, or leſſer, only excludes from the participation of the ſacraments.

The greater excommunication, called alſo *ab homine*, is when a prelate, or his deputy, excommunicates any man perſonally, and interdicts him all ſociety with the faithful, all uſe of ſacraments, &c.

In the ancient church, the ſentences of the greater excommunication were ſolemnly promulged four times in the year, with candles lighted, bells tolling, the croſs, and other ſolemnities.

The leſſer excommunication is incurred *pleno jure*, by having any communication with a perſon excommunicated in the greater excommunication. And this too imports a privation of communion, but not an interdiction from entering the church, or having commerce with the faithful.

Anciently, the excommunicated were obliged to procure abſolution from their biſhop, and make ſatisfaction to the church in forty days' time; otherwiſe they were compelled to it by the ſecular judge, by a ſeizure of their effects, impriſonment of their perſons, &c. (See Excommunicato *Capiendo.*) In France they were allowed a whole year.

By an edict of St. Louis, in the year 1228, vaſſals, tenants, &c. were diſpenſed, or freed from the oath of fidelity, homage, &c. they had taken to their lords, or ſuperiors, when excommunicate, till they had made their ſubmiſſion.

In Spain, to this day, a perſon who is not abſolved from his excommunication in a year's time is deemed a heretic. There was a time, when the people were fully convinced, that the bodies of excommunicated perſons, unleſs they were firſt abſolved, would not rot, but remain entire for ſeveral ages, a horrible ſpectacle to poſterity! as is atteſted by Matthew Paris, and other writers. And the Greeks are ſtill of the opinion, and affirm, they have many proofs thereof, as is ſhewn by Du-Cange, from the teſtimony of a vaſt number of authors.

By the laws, an excommunicated perſon was not to be buried, but the body flung into a pit, or covered with a heap of ſtones; which were called *imblocare corpus*. And by the rubric, in the Book of Common Prayer, the burial office ſhall not be read for any that die excommunicated. See Funeral, &c.

In the ancient church, there were diverſe degrees of excommunication. In effect, excommunication did not always import an interdiction of the ſacraments; but frequently, a ſeparation, or kind of ſchiſm, between the ſeveral churches, or a ſuſpenſion of ſpiritual communication between the biſhops. But afterwards the occaſions of excommunications growing more frequent, they began to uſe it with leſs circumſpection and reſervedneſs.

In the ninth century the eccleſiaſtics were continually making uſe of this ſpiritual weapon, to repel any violences or affronts offered them; and time and familiarity rendering offenders more and more obdurate, they proceeded, by degrees, to rigours unknown to antiquity; as the excommunicating of whole families, or provinces; prohibiting the exerciſe of all religion therein; and even accompanying the excommunications with horrible ceremonies, and direful imprecations.

In the tenth and eleventh centuries, the ſeverity againſt the excommunicated was carried to its higheſt pitch: nobody might come near them, not even their own wives, children, or ſervants; they forfeited all their natural legal rights and privileges, and were excluded from all kinds of offices. Thus was an excommunicated king reduced to the condition of a private man. By thus ſtretching the power of the church to extravagance, they rendered it contemptible.' Gregory VII. tempered it a little; exempting the wives and children of excommunicated perſons from incurring excommunication by holding converſation with their huſbands and parents.

To render the excommunicated ſtill more odious, the prieſt was obliged to ſtop, and break off divine ſervice, if an excommunicated perſon entered the church; nothing of which averſion is any where diſcovered in the practice of the primitive church. At preſent we have but little of the terror or reſpect of our forefathers for excommunication; and it is even judged, and proclaimed, an abuſe, whenever impertinently employed.

The form of excommunication in the Romiſh church, as related by Fevret, is to take lighted torches, throw them on the ground with curſes and anathemas, and trample them out under-foot to the ringing of the bells.

“Auctoritate Dei Patris omnipotentis, et Filii, et Spiritus Sancti, et beatæ Dei genetricis Mariæ, omniumque ſanctorum, excommunicamus, anathematizamus, et a limitibus ſanctæ matris eccleſiæ ſequeſtramus illos malefactores, N. conſentaneos quoque et participes; et niſi reſipuerint, et ad ſatisfactionem venerint, ſic extinguetur lucerna eorum ante viventem in ſæcula ſæculorum. Fiat: Amen: Amen: Amen.” Ex Emendat. Leg. Will. Conquæſt.

We have now none of this folly; the ſentence is gravely read, and the perſon remains excommunicated without farther ceremony. See the form of excommunication of the Engliſh church in Concilia M. Brit. et Hib. vol. iv. p. 663, &c.

Petrus Bleſenſis aſſures us, that in England it was anciently the practice only to excommunicate ſuch as had killed an eccleſiaſtic; whereas they were put to death who had killed a layman. But the reaſon was, they held excommunication a greater puniſhment than death.

The cauſes with us are contempt of the biſhop's court, hereſy, neglect of coming to church, and of receiving the ſacrament, incontinency, adultery, ſimony, &c.

But if the judge of any ſpiritual court excommunicates a man for a cauſe of which he hath not the legal cognizance, the party may have an action againſt him at common law, and he is alſo liable to be indicted at the ſuit of the king. (2 Inſt. 623.) With us by the common law an excommunicated perſon is diſabled to do any act, that is required to be done by one that is “probus et legalis homo.” He cannot ſerve on juries, cannot be a witneſs in any court, and cannot bring an action, either real or perſonal, to recover lands or money due to him. (Litt. § 200.) Beſides, if, within 40 days after the ſentence has been publiſhed in the church, the offender does not ſubmit and abide by the ſentence of the ſpiritual court, the biſhop may certify ſuch contempt to the king in chancery; upon which there iſſues out a writ *De* Excommunicato *capiendo*; which ſee.

We have inſtances of biſhops, who have pronounced formal excommunications againſt caterpillars, and other inſects, after a formal juridical proceſs againſt them, wherein thoſe animals were allowed an advocate, and proctor to defend their cauſe. See Exorcism.

Fevret relates divers inſtances of ſuch excommunications againſt rats, mice, and other animals, for infeſting a country. See the form of theſe excommunications in that author, Traité de l'Albus.

In the ancient church there were two different kinds of excommunications in uſe; the one called *medicinal*, whereby perſons convicted of a crime by their own confeſſion, were removed from communion; the other, called *mortal*, was fulminated againſt rebels, who perſiſted obſtinately in their errors and impieties.

The power of excommunicating was lodged in the whole church in general; that is, the biſhops and prieſts had the adminiſtration thereof by and with the conſent of the people, which was practiſed even in St. Cyprian's time. But afterwards they ceaſed to conſult the people about the matter; the biſhop and clergy arrogated the whole power to themſelves. Recourſe, however, might ſtill be had to the ſynod of the province, to judge of the validity of an excommunication.

Excommunication was alſo practiſed among the Jews, who uſed to expel from their ſynagogue ſuch as had committed any grievous crime. See the Goſpel according to St. John, ix. 22. xii. 42. xvi. 2. And Joſeph. Antiq. Jud. lib. ix. cap. 22. and lib. xvi. cap. 2.

The Eſſeni, when excommunicated, durſt not ſo much as receive food at any perſon's hand, for fear of violating their oath, but contented themſelves to live on herbs; inſomuch that they frequently periſhed and died for want. See Joſeph. de Bell. lib. ii. cap. 12.

Godwyn, in his Moſes and Aaron, diſtinguiſhes three degrees, or kinds, of excommunication among the Jews. The firſt he finds intimated in St. John ix. 22. The ſecond in St. Paul Epiſt. 1 Cor. v. 5. And the third, in the 1ſt Ep. to Corinth. xvi. 22. See Niddui.

The rule of the Benedictines gives the name excommunication to the being excluded from the oratory, and the common table of the houſe in our inns of court called *diſcommoning*. This was the puniſhment of ſuch monks as came too late.

Excommunication, or a being ſecluded, or cut off from a participation in the myſteries of religion, was alſo in uſe under paganiſm.

Such as were thus excommunicated were forbidden to aſſiſt or attend at the ſacrifices, or to enter within the temples; and were afterwards delivered over to the dæmons and furies of hell, with certain imprecations; which was called among the Romans, *diris devovere*. See Execration.

The Druids, among the ancient Britons and Gauls, likewiſe made uſe of excommunication againſt rebels; and interdicted the communion of their myſteries to ſuch as refuſed to acquieſce in their deciſions. See Druids.

That this is the true origin of the extenſive and horrid influence of the European and papal excommunication, will appear evident by the following paſſage of Cæſar, De Bello Gallico, lib. vi. cap. 13. “Si qui aut privatus aut publicus Druidum decreto non ſtetit, ſacrificiis interdicunt. Hæc pœna apud eos eſt graviſſima. Quibus ita eſt interdictum, in numero impiorum et ſceleratorum habentur, ab iis omnes decedunt, aditum eorum ſermonemque defugiunt, ne quid ex contagione incommodi accipiant; neque iis petentibus jus redditur, neque honos ullus communicatur.”

EXCOMMUNICATO Capiendo, ſo called from its effects, or *Significavit*, thus denominated from the biſhops' certificate, a writ directed to the ſheriff, for the apprehenſion of one who ſtands obſtinately excommunicated the ſpace of forty days.

Such a one not ſeeking abſolution, hath, or may have, his contempt certified into the chancery; whence this writ iſſues for taking him up and impriſoning him in the county gaol, without bail or mainprize, until he is reconciled to the church, and ſuch reconciliation is certified by the biſhop.

Excommunicato *Deliberando*, is a writ directed to the under ſheriff, for the delivery of an excommunicated perſon out of priſon; upon certificate of the ordinary of his conformity to the eccleſiaſtical juriſdiction. F. N. B. 62.

Excommunicato *Recipiendo*, is a writ whereby perſons excommunicated, being for their obſtinacy committed to priſon, and unlawfully delivered from thence before they have given ſecurity to obey the authority of the church, are commanded to be ſought for and laid up again.

EXCORIATION, in *Surgery*. A part is ſaid to be excoriated, when it is deprived of its cuticle, by reaſon of inflammation, the action of irritating matter, or of ſtimulating ſubſtances, &c. applied to the ſkin.

Very ſuperficial ulcerations are, alſo, frequently denominated excoriations.

In conſequence of inattention to cleanlineſs, and not occaſionally waſhing away the ſebaceous ſecretion, which is naturally produced under the prepuce, the matter acquires an irritating acrid quality, brings on inflammation all round the corona glandis, followed by extenſive excoriations and ſuppuration. This ſort of caſe is ſeriouſly annoying to the patient, on account of the violent itching, and troubleſome ſoreneſs, which always attend the complaint. The diſorder has ſometimes been named the *falſe gonorrhœa*, and the patient is often rendered very uneaſy in his mind by an apprehenſion of the affection being venereal. Indeed, ignorant and careleſs practitioners have occaſionally miſtaken mere excoriations for chancres, and, quite improperly, have preſcribed a courſe of mercury.

The proper treatment conſiſts in waſhing away all the acrid ſecretion under the prepuce with ſome ſoap-ſuds; injecting under the ſame part, four or five times a day, the ſaturnine lotion; and keeping linen, wet with this application, round the extremity of the penis. The excoriations, if very bad, are to be dreſſed with the ſaturnine ointment. The prepuce, if much ſwelled, and in a ſtate of phymoſis, ſhould have two or three leeches put upon it; but the principal means of cure is attention to keeping the parts clean, and tenderly waſhed with plenty of ſoap once or twice a day. As in all other caſes of inflammation the bowels ought to be kept open.

Excoriation of the nipples is a moſt diſtreſſing complaint. It is more common in the firſt, than the ſubſequent nurſings, and when independent of any diſeaſe in the child's mouth, is owing to the irritation occaſioned by the ſuction.

In many inſtances, a cure may be effected by bathing the parts with a little port wine, or brandy. A more effectual remedy is ſaid to be the tincture of opium.

EXCORTICATION, the act of ſtripping off the cortex or bark from any thing; called alſo decortication.

EXCREMENT, in *Chemiſtry*. See Feces.

Excrement, in *Phyſiology*, is the reſidue of our food, after the nutritious particles have been extracted from it, and it has undergone certain changes by its reſidence in the large inteſtine. See Digestion.

Excrement is alſo attributed, by way of analogy, to plants. Thus gums, diverſe juices, balms &c. iſſuing ſpontaneouſly from their reſpective trees, are ſometimes called excrements.

EXCRESCENCE, in the language of *Surgery*, implies a preternatural protuberance, or any morbid growth, which *projects out of* the ſubſtance or ſurface of a part. When the diſeaſe is involved in the ſurrounding fleſh, though it may be attended with a conſiderable ſwelling, it does not rank as an excreſcence, which word eſſentially ſignifies that the tumour, or whatever the diſeaſe is, *grows out of* the part. Funguſes, polypi, and warts of all kinds, are very often, and with ſtrict propriety, denominated excreſcences.

Excreſcences, of the nature of warts, are particularly apt to grow about the anus. Some of them are generally regarded by ſurgical authors as venereal complaints, becauſe they ſometimes get well under a courſe of mercury. This, however, is a very fallacious criterion of a diſeaſe being ſyphilitic; for mercury is a cure for numerous affections beſides venereal ones. Some ſurgeons have doubted whether there is any ſuch thing as a really venereal excreſcence; and as far as our obſervations extend, all thoſe warty growths which ariſe about the anus and perinæum, and are commonly reputed to be of a ſyphilitic nature, may be cured upon the ſame principles as any other ordinary tumours, not of a ſpecific kind.

Excreſcences in general, not being original parts of the body, are known to be weak in the vital power, and to be incapable of bearing the action of ſuch ſtimulating applications as would not deſtroy a part, which may be ſaid to enter into the natural compoſition of the body. Hence it is, that ſprinkling on warty excreſcences a powder, conſiſting of ſavin and ærugo æris, in equal proportions, generally effects a cure. The ſwellings are partly diminiſhed by abſorption, and partly by ſloughing. We have never ſeen about the anus any excreſcences which could withſtand this application.

But the plan which we particularly recommend to be adopted, when ſuch excreſcences are large and numerous, as they frequently are, is to remove them at once with a knife, or a pair of ſciſſars. When they grow from a narrow neck, their deſtruction might be accompliſhed by tying them with a ligature. The latter method, indeed, is often practiſed by ſurgeons who are fearful of hæmorrhage, or whoſe patients have a remarkable dread of a cutting inſtrument, even in caſes in which the object could be fulfilled much more eaſily, and with leſs pain, by means of exciſion; that is to ſay, in examples in which the baſe of the ſwellings is rather broad. Indeed, where the excreſcences are connected with the ſkin by a wide root, the mode of removing them with a ligature becomes exceedingly troubleſome and painful; for the practitioner is firſt under the neceſſity of introducing, through the centre of their baſe, a needle armed with a double ligature. The needle being cut off, one ligature is then to be firmly tied over one ſide of the root of the tumour, and the other over the oppoſite one. In this manner the ſupply of blood to the excreſcence is ſuppreſſed, and the part ſloughs away. Sometimes when the baſe of the diſeaſe is very broad, and the ligature has not been applied with due tightneſs, it becomes neceſſary to apply another one, the doing of which is attended with as much, if not more, pain than the firſt operation.

Upon the whole, when the excreſcences are ſmall, we prefer ſtimulating them with the powder of ſavin and ærugo æris; when they are large, we recommend extirpating them with a cutting inſtrument.

EXCRETION, from *excerno*, *I throw off*, or *ſeparate*, is the ſeparation of any ſuppoſed noxious matter from the blood in any of the organs of the animal body. The proceſs itſelf is not eſſentially different from that of ſecretion. But the latter term is applied to thoſe ſubſtances which, when formed, are applied to uſeful purpoſes in the animal economy. Thus the mucus of mucous membranes imparts to them a neceſſary moiſture, and defends them from the action of the foreign matter which comes in contact with them; the ſerous exhalation of ſerous membranes preſerves them conſtantly ſmooth and poliſhed, and therefore in a fit ſtate for their oppoſed ſurfaces to move without any obſtacle, &c. The excretions are matters ſuppoſed to be noxious to the body, and to be ſeparated on that account, as the urine, bile, perſpiration, &c. The matters voided from the large inteſtine, conſiſting of the reſidue of our food, are often called the alvine excretions.

EXCRETORY, is applied to certain little ducts or veſſels in the fabric of the glands.

Excretory ducts are the tubes through which the humours ſeparated in the ſeveral glands are emitted or diſcharged out of the gland, into ſome convenient receptacle or emunctory.

A capillary artery, to which a capillary vein is joined, with an excretory duct, convolved or wound together, make up the body of the glands, the organs of ſecretion. The excretory ducts ſpring from the extremities of the arteries and veins, and carry off a liquor ſeparated from the blood. Drake.

The lymphatic glands have either lymphæducts for their excretory ducts, or lacteal veſſels, as in the meſentery. Idem.

EXCURSION, in *Aſtronomy*. See ELONGATION.

EXCURSION, *circles of*. See CIRCLES.

EXCUSABLE HOMICIDE. See HOMICIDE.

EXCUSATI, in *Church Hiſtory*, a term uſed to denote ſlaves, who, flying to any church for ſanctuary, were excuſed and pardoned by their maſters; but theſe were obliged to take an oath to that purpoſe, before they could have them again; and if they broke the oath, they were puniſhed and fined as perſons guilty of perjury.

EXDORF, in *Geography*, a town of Germany, in the county of Henneberg; 7 miles S.E. of Meinungen.

EXE, a river in England, has its origin among the wild eminences of Exmoor, in the weſtern corner of Somerſetſhire, and after uniting with the Barle, enters the confines of Devonſhire, near Exe bridge; thence flowing near Bampton, it ſinks into a rich wooded vale, and paſſing Tiverton, has its current increaſed by the ſtreams of the Loman. Soon after, the Creedy, from Crediton, in the north-weſt, and the Culm, or Columb, from Cullumpton, in the north-eaſt, intermingle their waters with the Exe, and the vale expanding, opens into a beautiful plain, encircled by towering eminences, clothed with wood. Paſſing Exeter, the river proceeds through a fine range of meadows to Topſham, where meeting the tide, and ſuddenly widening to an extent of more than a mile, it becomes navigable for veſſels of ſeveral hundred tons burthen. Hence ſpreading into a grand eſtuary, it rolls onward; but its direct courſe being impeded by a vaſt ſand-bank, called the Warren, it winds to the eaſtward, and flows into the Britiſh channel near Exmouth, its whole courſe being about 60 miles. See CANAL.

EXEA DE LOS CAVALLEROS, an inconſiderable town of Spain in the province of Aragon, ſeated between two rivulets, in the northern part of the province. Its ſurname commemorates the bravery of ſome French and Gaſcogne cavalry, when Alphonſo I. king of Aragon, took it from the Moors. N. lat. 42° 6′. W. long. 1° 9′.

EXEAT, in *Church Diſcipline*, a Latin term uſed for a permiſſion which a biſhop grants a prieſt to go out of his dioceſe; or an abbot to a religious, to go out of his monaſtery.

The word is alſo uſed in ſeveral great ſchools for leave given a ſcholar or ſtudent to go out. His maſter has given him an exeat.

EXECRATION, EXECRATIO, among the *Ancients*, a kind of puniſhment, conſiſting of direful curſes and marks of infamy. Livy relates an inſtance of it, which was uſed againſt Philip king of Macedon, by the Athenians. A general aſſembly of the people being called, they made a decree, that all the ſtatues and images of that king, and of all his anceſtors, both of the male and female ſex, ſhould be demoliſhed, and their very names raſed; that all the feſtivals, ſacred rites, prieſts, and whatever elſe had been inſtituted in honour of him, ſhould be profaned; that the very place where there had been any monument or inſcription to his honour, ſhould be deteſtable, and that nothing ſhould be ſet up, or dedicated in them, which could be done in clean places; and, laſtly, that the public prieſts, as often as they prayed for the Athenian people, allies, armies, and fleets, ſhould as many times deteſt and execrate Philip, his children, kingdom, land, and ſea forces, and the whole race and name of the Macedonians.

Cornelius Nepos, in his life of Alcibiades, calls it *devotion*.

At the taking or demoliſhing of a city, it was frequent to pronounce direful curſes and execrations upon any perſon who ſhould endeavour to rebuild it; which ſome imagine was the reaſon that Troy could never be raiſed out of its aſhes, though ſeveral perſons attempted it, being devoted to eternal and irreparable ruin by Agamemnon. This ſeems to have been a very ancient cuſtom, and derived from the Eaſtern nations; for we find Joſhua, at the deſtruction of Jericho, to have fixed an imprecation upon the perſon who ſhould rebuild it, which was thought to be accompliſhed in Hiel the Bethelite many ages after. Potter, Archæol. tom. ii. p. 97.

EXECREBRONCHOS, in *Surgery*, from εξεχω, *to abound*, and βρογχος, *a throat*, a term which probably ſignified a ſwelling of the thyroid gland, which affection is now almoſt always named bronchocele.

EXECUTANT, Fr. in *Muſic*, a participle uſed ſubſtantively. A muſician or performer who executes his part in a band, in the ſame ſenſe as concertant implies a performer in a concert. See CONCERTANT, EXECUTER, and EXECUTION.

EXECUTED *Contract*, *Eſtate*, *Fine*, and *Remainder*. See the ſubſtantives.

EXECUTER, *Fr.* to execute, play, ſing, or perform a compoſition, or piece of muſic, in all its parts, whether vocal or inſtrumental, and to let every note and paſſage be heard agreeable to the notation in the ſcore.

As muſic is an object for the ear, it can only be judged by its effects in the execution. Many pieces of counterpoint look correct and learned on paper, which no real judge can hear without diſguſt; and others that look thin, ſimple, and common, which in the execution afford the higheſt pleaſure, by unexpected effects. Vulgar compoſers, attentive to ſymmetry and the filling up all the parts, often appear to be great contrapuntiſts, while they are judged merely by the eyes; and ſuch compoſers often have the addreſs to employ ſo many different inſtruments, and ſuch a number of parts in their muſic, that it is with great difficulty a ſufficient band can be collected to do it juſtice in the execution. Rouſſeau.

EXECUTION, the act of executing, *i. e.* of accompliſhing, finiſhing, or atchieving any thing to be done.

We ſay, the execution of a teſtament; of a law; of a treaty; of a building, or the like.

EXECUTION, in *Common Law*, ſignifies the laſt performance of an act; as of a writ, a judgment, or the like.

EXECUTION *of a judgment*, denotes the putting of the law in force, or it is the obtaining the poſſeſſion of any thing recovered by judgment of law.

This is performed in various ways, according to the nature of the action upon which it is founded, and of the judgment which is had or recovered. If the plaintiff recovers in an action real or mixed, whereby the ſeiſin or poſſeſſion of land is awarded to him, the writ of execution ſhall be an *habere facias ſeiſinam*, or writ of ſeiſin, of a freehold; or an *habere facias poſſeſſionem*, or writ of poſſeſſion, of a chattel intereſt. (Finch. L. 470.) Theſe are writs directed to the ſheriff of the county, commanding him to give actual poſſeſſion to the plaintiff, of the land ſo recovered; in the execution of which the ſheriff may take with him the *poſſe comitatus*, or power of the county, and may juſtify breaking open doors, if the poſſeſſion be not quietly delivered. But if it is peaceably yielded up, the delivery of a twig, a turf, or the ring of the door, in the name of ſeiſin, is ſufficient execution of the writ. Upon a preſentation to a benefice recovered in a *quare impedit*, or aſſiſe of *darrein preſentment*, the execution is by a writ *de clerico admittendo;* directed not to the ſheriff, but to the biſhop or archbiſhop, and requiring him to admit and inſtitute the clerk of the plaintiff. In other actions, where the judgment is, that ſomething ſpecial be done or rendered by the defendant, then, in order to compel him ſo to do, and to ſee the judgment executed, a ſpecial writ of execution iſſues to the ſheriff, according to the nature of the caſe. As, upon an aſſiſe of nuſance, or *quod permittat proſternere*, where one part of the judgment is *quod nocumentum amoveatur*, a writ goes to the ſheriff to abate it, at the charge of the party, which likewiſe iſſues even in caſe of an indictment. (Comb. 10.) Upon a replevin, the writ of execution is the writ *de retorno habendo;* and if the diſtreſs be eloigned, the defendant ſhall have a *capias in withernam;* but on the plaintiff's tendering the damages, and ſubmitting to a fine, the proceſs *in withernam* ſhall be ſtayed. (2 Leon. 174.) In detinue, after judgment, the plaintiff ſhall have a *diſtringas*, to compel the defendant to deliver the goods, by repeated diſtreſſes of his chattels, (1 Roll. Abr. 737. Raſt. Entr. 215); or alſo a *ſcire facias* againſt any third perſon in whoſe hands they may happen to be, to ſhew cauſe why they ſhould not be delivered; and if the defendant ſtill continues obſtinate, then (if the judgment hath been by default or on demurrer) the ſheriff ſhall ſummon an inqueſt to aſcertain the value of the goods, and the plaintiff's damages; which (being either ſo aſſeſſed, or by the verdict in caſe of an iſſue, Bro. Abr. tit. *Damages*, 29.) ſhall be levied on the perſon or goods of the defendant.

Executions in actions, where money only is recovered, as a debt or damages, (and not any ſpecific chattel,) are of five ſorts: either againſt the body of the defendant; or againſt his goods and chattels; or againſt his goods and the *profits* of his lands; or againſt his goods and the *poſſeſſion* of his lands; or againſt all three, his body, lands, and goods. The *firſt* of theſe ſpecies of execution is by writ of CAPIAS *ad ſatisfaciendum*, which ſee. This writ is an execution of the higheſt nature, inaſmuch as it deprives a man of his liberty, till he makes the ſatisfaction awarded. When a defendant is once in cuſtody upon this proceſs, he is to be kept in *arcta et ſalva cuſtodia;* and if he be afterwards ſeen at large, it is an *eſcape*, which ſee; and the plaintiff may have an action thereupon againſt the ſheriff for his whole debt. If a *capias ad ſatisfaciendum* be ſued out, and a *non eſt inventus* is returned thereon, the plaintiff may ſue out a proceſs againſt the bail. The *ſecond* ſpecies of execution is againſt the goods and chattels of the defendant, and is called a writ of FIERI *facias*, which ſee. A *third* ſpecies of execution is by writ of LEVARI *facias*, which ſee. This affects a man's goods and the *profits* of his lands. This writ is now little uſed, the remedy by *elegit* being much more effectual. This writ of *elegit* is the *fourth* ſpecies of execution. Moreover, upon ſome proſecutions given by ſtatute, as in the caſe of recognizances or debts acknowledged on ſtatutes merchant, or ſtatutes ſtaple; (purſuant to the ſtatutes 13 Ed. I. *de Mercatoribus*, and 27 Ed. III. c. 9.) upon forfeiture of theſe the body, land, and goods may all be taken at once in execution, to compel the payment of the debt. This proceſs is the *fifth* ſpecies of execution, and is uſually called an *extent*, or *extendi facias*, which ſee. It is to be obſerved, that all theſe writs of execution muſt be ſued out within a year and a day after the judgment is entered, otherwiſe the court concludes *prima facie*, that the judgment is ſatisfied and extinct; yet, however, it will grant a writ of *ſcire facias*, in purſuance of ſtatutes Weſtm. 2. 13 Edw. I. c. 45. for the defendant to ſhew cauſe why the judgment ſhould not be revived, and execution had againſt him; to which the defendant may plead ſuch matter as he has to allege, in order to ſhew why proceſs of execution ſhould not be iſſued: or the plaintiff may ſtill bring an action of debt, founded on this dormant judgment, which was the only method of revival allowed by the common law. (Co. Litt. 290.) Blackſt. Comm. B. III.

Sir Edward Coke, in his Reports, makes two ſorts of executions; one *final*, another with *a quouſque*, as only tending to an end.

EXECUTION *final*, is that which maketh money of the defendant's goods, or extendeth his lands, and delivers them to the plaintiff; which he accepts in ſatisfaction; and this is the end of the ſuit, and all that the king's writ commands to be done.

EXECUTION *with a quouſque*, is that which only tends to an end; as in the caſe of a *capias ad ſatisfaciendum*, &c.

This is not final; but the body of the party is to be taken, to the intent and purpoſe to ſatisfy the plaintiff; and his impriſonment is not abſolute, but till he doth ſatisfy; ſo that the body is but a pledge for the debt. 6 Rep. 87.

EXECUTION, *Tenant by*. See TENANT.

EXECUTION *of criminals*, muſt be according to judgment; and the king cannot alter a judgment from hanging to beheading, becauſe no execution can be warranted, unleſs it be purſuant to the judgment. (3 Inſt. 52. 211. H. P. C. 252.) But there are ancient precedents wherein men condemned to be hanged for felony, have been beheaded by force of a ſpecial warrant from the king. (Bract. 104. Staundf. 13.) And the king may pardon part of the execution in judgment for treaſon, *viz.* all but beheading. It has been ſaid by ſir Edward Coke, and ſir Matthew Hale, that the king cannot change the puniſhment of the law, by altering the hanging or burning into beheading. But others have thought (Foſt. 270. F. N. B. 244.), and as judge Blackſtone ſays, more juſtly, that this prerogative being founded in mercy, and immemorially exerciſed by the crown, is part of the common law. The court may command execution to be done without any writ; (Finch, L. 478.) though ſometimes execution is commanded by writ. (2 Hawk. P. C. 463.) Judgment belongs to the judge; but the execution may be done by the ſheriff, or his deputy; and an execution cannot be lawfully made by any but the proper officer, whoſe warrant for ſo doing was anciently by precept of the judge under his hand and ſeal; as it is ſtill practiſed in the court of the lord high ſteward, upon the execution of a peer; (2 Hal. P. C. 409.) though in the court of peers in parliament, it is done by writ from the king; and if the ſheriff, or other officer alters the execution, or any other executes the offender, or if he is killed without the authority of law, it is felony. (2 Hawk. ib.) The uſage now is for the judge to ſign the calendar, or liſt of all the priſoners' names, with their ſeparate judgments in the margin, which is left with the ſheriff. As for a capital felony, it is written oppoſite to the priſoner's name, "let him be hanged by the neck;

formerly, in the days of Latin and abbreviation, "ſuſ. per coll." for *ſuſpendatur per collum.* And this is the only warrant which the ſheriff has for ſo material an act, as taking away the life of another. (5 Mod. 22.) Upon this judge Blackſtone obſerves, that it may certainly afford matter of ſpeculation, that in civil cauſes there ſhould be ſuch a variety of writs of execution to recover a trifling debt, iſſued in the king's name, and under the ſeal of the court, without which the ſheriff cannot legally ſtir one ſtep; and yet that the execution of a man, the moſt important and terrible taſk of any, ſhould depend upon a marginal note. The ſheriff, upon receipt of his warrant, is to do execution within a convenient time, which in the country is alſo left at large. In London a more ſolemn and becoming exactneſs is uſed, both as to the warrant of execution, and the time of executing thereof; for the recorder, after reporting to the king in perſon the caſes of the ſeveral priſoners, and receiving his royal pleaſure, that the law muſt take its courſe, iſſues his warrant to the ſheriffs, directing them to do execution on the day, and at the place aſſigned; and in the court of king's bench, if the priſoner be tried at the bar, or brought there by *habeas corpus,* a rule is made for his execution, either ſpecifying the time and place, (State Trials, p. 332. Foſt. 43.) or leaving it to the diſcretion of the ſheriff. And, throughout the kingdom, by ſtatute 27 Geo. II. c. 37. it is enacted, that in caſe of murder, the judge ſhall in his ſentence direct execution to be performed on the next day but one after ſentence paſſed. But otherwiſe, the time and place of execution are by law no part of the judgment, as was held by the twelve judges. (Mich. 10 Geo. III.) Beccaria has well obſerved, (On Crimes, &c. ch. 19.) that it is of great importance, that the puniſhment ſhould follow the crime as early as poſſible; that the proſpect of gratification or advantage, which tempts a man to commit the crime, ſhould inſtantly awake the attendant idea of puniſhment. Delay of execution ſerves only to ſeparate thoſe ideas, and then the execution itſelf affects the minds of the ſpectators rather as a terrible ſight, than as the neceſſary conſequence of tranſgreſſion.

In caſe a man condemned to die, come to life after he is hanged, as the judgment is not executed till he is dead, he ought to be hung up again. (2 Hal. P. C. 412. 2 Hawk. P. C. 463.) For the former hanging was no execution of the ſentence; and if a falſe tenderneſs were to be indulged in ſuch caſes, a multitude of colluſions might enſue. The body of a traitor, or felon, is forfeited to the king by the execution. Execution may be avoided by a *reprieve* or a *pardon,* which ſee reſpectively.

Execution *of decrees,* in *Scots Law,* is effected by diligence, either againſt the perſon, or againſt the eſtate of the debtor. The firſt ſtep of perſonal execution is by letters of horning, which paſs by warrant of the court of ſeſſion, on the decrees of magiſtrates of boroughs, ſheriffs, admirals, and commiſſaries. If the debtor does not obey the will of the letters of horning, within the days of the charge, the charger, after denouncing him rebel, and regiſtering the horning, may apply for letters of caption, which contain a command, not only to meſſengers, but to magiſtrates, to apprehend and impriſon the debtor. All meſſengers and magiſtrates who refuſe their aſſiſtance in executing the caption, are liable *ſubſidiarè* for the debt; and ſuch ſubſidiary action is ſupported by the execution of the meſſenger employed by the creditor, expreſſing that they were charged to concur, and would not. Letters of caption contain an expreſs warrant to the meſſenger, in caſe he cannot get acceſs, to break open all doors, and other lock-faſt places. The law ſecures peers, married women, and pupils, againſt perſonal execution of caption upon civil debts. Such commoners alſo as are elected to ſerve in parliament, are ſecured againſt perſonal execution by the privilege of parliament. No caption can be executed againſt a debtor within the precincts of the king's palace of Holyrood-houſe; but this privilege of ſanctuary afforded no ſecurity to criminals, as that did which was by the canon law conferred on churches and religious houſes. When the perſonal preſence of a debtor, under caption, is neceſſary in any of our ſupreme courts, the judges are empowered to grant him a protection, for ſuch time as may be ſufficient for his coming and going, not exceeding a month. Protection from diligence is alſo granted by the court of ſeſſion, under the late bankrupt ſtatute, when it is applied for, with concurrence of the truſtee, or a certain number of the creditors, as the caſe may require.

Execution, *military,* is the pillage or plundering of a country by the enemy's army.

Execution alſo denotes every kind of puniſhment inflicted on an army by ſentence of a court-martial. This is of various kinds; as tying up to three halberts, and receiving a number of laſhes with a whip compoſed of nine cord-laſhes, and each laſh of nine knots, from the drummer; or running the gantlope through the parade at guard-mounting, drawn up in two lines for that purpoſe. On this occaſion the provoſt marches through with twigs or ſwitches, and every ſoldier takes as many as there are criminals to be puniſhed; the criminal then marches through the two lines, and each ſoldier gives him a hard ſtroke, the major riding up and down, to ſee that the men lay on properly. When a ſoldier is to be puniſhed with death, a detachment of about two hundred men from the regiment to which he belongs forms the parade, and a file of grenadiers ſhoots the priſoner to death. Different nations have different modes of puniſhment. The cat with nine tails is deſigned to puniſh foot-ſoldiers; but dragoons and cavalry-men are generally picketed.

Execution, in *Muſical Performance,* the action of conveying to the ear, by the aſſiſtance of the eye, what has been written in the ſcore. As much muſic is compoſed of many parts ſo interwoven and linked together, that both the time and intonation are very difficult to ſeize, and of which the ſpirit depends more on taſte than notation of ſuch pieces, nothing is ſo uncommon as a perfect execution. The reading of the notes exactly is no great merit, the performer muſt enter into all the ideas of the compoſer, and feel, and make the hearer feel, the fire or pathos of the expreſſion; but above all he muſt be poſſeſſed of a nice and acute ear, always attentive to the effect of the whole. In French muſic the leader muſt be particularly careful to preſs and relax the time according to the taſte of the melody, the power of voice, and the geſticulation of the ſinger; the other parts muſt conſequently be extremely attentive in following him. "The totality of the opera at Paris, where muſic had no other meaſure than the geſtures of the ſinger, muſt, in my opinion, require an admirable muſician indeed to keep all the performers together." N. B. This was written by Rouſſeau near 40 years ago, and at that time little diſputed; but the editors of the late edit. of the Encyc. men of taſte and judgment, will, perhaps, ſay with Moliere, "medicin malgre lui," this may have been ſo formerly, "mais, nous avons changés tout ca."

"If the French," ſays St. Evremond, "compoſe in a bolder ſtyle than formerly by their intercourſe with the Italians, the Italians in their turn have gained by their commerce with the French, by learning of them a more agreeable touching, and perfect execution." Letter to the duke of Buckingham.

The reader (ſays the author of the Lettre ſur la Muſ. Fran.) will, I believe, excuſe me if I wave making any remarks on this paſſage, I ſhall only obſerve, that the French think all the world intereſted about their muſic ; but on the contrary, in three fourths of Italy, Italian muſicians are totally ignorant that there exiſts a muſic in France different from their own.

A facility of reading and performing a ſingle part is likewiſe called, if difficult, execution ; particularly when rapid paſſages are played correctly, and without heſitation, at ſight.

Execution of this kind depends in an eſpecial manner on two things ; the firſt in having a powerful hand and quick eye ; and the ſecond in having read much muſic, and being able to phraſe it at a glance : for while we only look at ſingle notes, we ſhall heſitate in pronouncing them : a great facility of execution is only acquired by uniting them into meaning, and putting the thing itſelf in the place of the ſign. In this manner the memory of the reader of a book is no leſs aſſiſted than by his eyes ; and what he would read with great difficulty in a foreign language, though written or printed with the ſame characters as his own.

Execution, in *Painting*, is a technical term ſignifying the ſtyle and manner in which a painter performs his work : in other words, the mechanical part of the art, as far as relates to the handling of the pencil in laying on the colours of a picture.

It is evident from this definition, that without poſſeſſing it in ſome degree, all knowledge of the other branches of the art is totally nugatory ; to what purpoſe would the theory be made perfect, if no practical means of applying it were underſtood ; but beſides that degree of execution abſolutely requiſite to produce any thing in the ſhape of a picture, it well deſerves to be made an object of particular ſtudy, as its various modes are productive of much utility in the progreſs of a picture. A great deal of the character of many objects in painting depends on the manner in which they are wrought, that is, on the peculiarity of the ſtrokes of the pencil ; ſuch, for inſtance, are all ſkins of beaſts ; feathers of birds ; trees ; various kinds of drapery ; armour, &c. in producing the effects of which, execution will alone go very far, in ſpight of bad form and bad colour. There is a charm in it which few perhaps but painters know, and which, unhappily, too many painters feel and value too highly, and deſert for it qualities of a much more valuable kind ; and are content too often to let their works paſs imperfect, even with the knowledge of their imperfections, rather than diſturb the beauty of clearneſs of touch which they may happen to poſſeſs.

It is indeed a taſk of no eaſy nature fully to obtain this quality, as it requires the utmoſt preciſion of judgment ſo to execute a work of art, that ſpirit and vigour ſhould be maintained, accompanied with ſoftneſs and truth. Without which union the diſplay of it is a vice of art inſtead of an excellence, and damns inſtead of exalting the work.

Knowledge of the general character of the object about to be repreſented is the only foundation of a beautiful, decided, and juſt execution : poſſeſſed of that, the artiſt holds in his hands the maſter-key of the expreſſion of its qualities, and renders its effect without difficulty. Wanting it he produces his work with heavineſs, with bungling, and confuſion.

It has been remarked that the countenances of men ſcarcely differ more than do the characters of their hand-writing, and not far, if at all, ſhort of the variety of either of theſe, is that of the manner in which painters have executed their works. Each man in this alſo has his peculiarity ; no two are ſo exactly alike in the execution of their pictures that an able connoiſſeur would not diſtinguiſh between them, and preſently attribute each to its reſpective author.

This diſcrimination of hands conſtitutes almoſt the tout-enſemble of the knowledge of the hoſt of would-be connoiſſeurs ; and unhappily, too many of them have obtained an influence over the opinions of men well able to teach them in better things appertaining to the arts, if common ſenſe were allowed to rule ; and this merely by having pored over the works of painters to endeavour to aſcertain the diſtinguiſhing characteriſtics of each one's workmanſhip : a ſpecies of knowledge agreeable and uſeful to a certain degree, but of eaſy acquirement, and to which thoſe who have a genuine feeling for the really good and valuable qualities pictures may poſſeſs, ſeldom give ſufficient attention to obtain an extended information in it. The works of good artiſts will force themſelves upon our notice, and after ſufficiently admiring the general effects of beauty, of ſublimity, or character they exhibit ; we naturally ſeek to know by what means or in what manner their various parts are executed, and for the purpoſes of connoiſſeurſhip a ſatisfactory acquaintance ſoon takes place on that head. The works of thoſe whoſe power in art is not ſufficient to attract by thoſe better qualities are ſurely not worthy of that cloſe inſpection which is required to become acquainted with their peculiarities of execution. But the trick of the connoiſſeur dealer is, by ſome fancied reſemblance or ſome ſlight reality of reſemblance, to paſs off an inferior work under the ſanction of a great name ; while, as we have obſerved, if common ſenſe were allowed to rule, the name would add no value to the picture, the tinſel would ſtill glare under the gold, and the bauble be ſoon loſt.

This indiſpenſable portion of the art of painting requires early tuition in order to poſſeſs a ready power over the hand, ſo that it ſhall move freely at the command of the will to effect its deſires. The ſame in fact is the caſe with regard to the acquirement of free execution in any other art, ſuch as muſic, writing, &c. For though our muſcles appear to act merely on our willing that their office ſhould be performed, and without any particular direction of the power of the mind over the particular muſcles which produce the motion, yet, in fact, that immediate influence is applied, although from habit and its extreme rapidity, we are inſenſible of the communication. This is plain when we require the uſe of muſcles, in a direction we are not conſtantly in the habit of uſing them in. For inſtance, a man not accuſtomed to ride, or firſt mounting a horſe, finds it neceſſary to exert all his mental influence to cauſe thoſe muſcles to act which are requiſite to maintain his ſeat on the back of the animal, and the communication of that influence is evidently felt ; but when habit has confirmed him in his ſeat on horſe-back, though thoſe ſame muſcles continue to act when he is mounted, he is unconſcious of conſtraining them to do ſo, the dictates of his will are then ſo inſtantaneouſly excited, that the connection between the exertion of its influence, and its effect is completely unobſervabile.

It is therefore requiſite for men deſirous of making conſiderable progreſs in the practical part of an art, early in life to apply themſelves earneſtly to its attainment. The beſt mode of obtaining it in painting is, by copying the works of thoſe moſt ſkilful in their diſplay of it, taking care at the ſame time to lay in a good ſtore of knowledge of the materials requiſite for the art, particularly (if hiſtorical painting be the courſe intended to be purſued) of the human figure, the foldings of draperies, &c. &c., and after ſome time ſpent in making copies of fine works, to paint from nature herſelf, keeping in view the manner in which the great painters, whoſe works they have imitated, ſaw her productions; obſerving how they diſpoſed of thoſe touches allowed to remain viſible, and decided both of light and of dark; alſo how they characterized by their execution of the different parts; for, in a well executed work no touches are allowed to remain that are not neceſſary in ſome meaſure to determine the character of the object; the reſt are all blended or ſoftened together, and ſerve as a baſe to receive thoſe finiſhing touches (as they are called) which are the decided features of the ſtyle of the maſter, (ſee Style, in *Painting*,) the ſpring of energy and vigour in the work, and without which it would appear tame and inſipid.

A picture, wherein the colours and forms are blended all over, is ſure to appear either ſolid like a ſtone, or have the texture of dough, of ſomething ſoft and ſpiritleſs. On the contrary, where no ſoftening takes place, and every touch remains viſible, confuſion inevitably reigns, with the character of tinſel, and a fluttering want of ſolidity.

While the ſtudent is endeavouring to acquire facility of handling his pencil, or of execution, he muſt take care not to be led away by its faſcination, but to remember that it is only the means of preſenting to the world, in an agreeable ſhape, other more dignified, and more valuable qualities in art, which lie deeper than the ſurface; and without which this is worſe than an empty nothing. 'Tis the bane of many an ingenious youth who, happening to poſſeſs it early, and outſhining his companions in years, ſatisfies himſelf that he has made a large advance in his art, when in fact he has obtained only a means of doing ſomething, which more important part, his vanity leads him to forget to make the ſtudies requiſite to enable him to perform, *viz.* to acquaint himſelf thoroughly with the nature of bodies, and the happieſt and beſt modes of combining them in forms and colours: and as he advances in life he is mortified to find himſelf ſurpaſſed by thoſe he had regarded with contempt, but whoſe more ſteady and better directed minds have purſued attentively more valuable objects of ſtudy, and the more uſeful principles of their art, and now ſoar to a height which leaves his weaker talent far beneath.

It muſt, however, be remarked, that a good execution is a highly valuable quality in a picture, which being wrought with judgment, with ſpirit, and eaſe, acquires thereby an additional reliſh to the enjoyments its better properties diſpenſe, and raiſes the artiſt in our eſtimation.

Of all thoſe who have exhibited this talent with ſucceſs, Giacomo Robuſti, called Il Tintoretto, ſtands foremoſt for vigour, as has been noticed under the word Energy, in *Painting*. He has no competitor in the freedom, the boldneſs, and the finiſh of ſtyle in which his beſt works are executed.

Of this his picture of St. Mark deſcending from heaven to reſcue a Chriſtian ſlave condemned to torture among the Turks, originally painted for the Scudo di San Marco at Venice, but now among the ſpoils adorning the Louvre at Paris, is a moſt decided and aſtoniſhing proof. This picture is an immenſe work containing twenty figures or more, thoſe in front larger than life, yet it is wrought all over with the rapidity and eaſe generally characteriſtic of ſmall pictures, or a ſketch within the compaſs of the hand to perform at once; and at the ſame time it has all the effect of rotundity of finiſh the moſt laboured works poſſeſs. In the midſt of the fine pictures which ſurround it, it ſtands quite alone in its vigour of effect and ſplendour of valour; even a work of Rubens, who is extremely ſkilful in this as well as in all other branches of the art; even his, appeared comparatively clumſy in its execution, though one of his fineſt productions, the opening of the Temple of James, or, as it is uſually called, the Peace and War. Titian, from his ſenſe and truth in the St. Peter martyr, beſt withſtands the power of Tintoretto. The compariſon of theſe two works may be ſaid to be ſomewhat ſimilar to that of a man of wit with a man of ſenſe: the former ſhines for a moment by the brilliancy and gaiety of his genius, but when the latter is attentively heard, and his obſervations conſidered, his greater value becomes apparent.

Titian perhaps on the whole is the beſt model to follow for execution: he does not, like Tintoretto, leave his heads without a character in the heat of workmanſhip, though they are not always of the beſt; they are not wrought too minutely: the lights and darks are freely placed, his pencil is full and rich, and each part is made out to its full relievo, and his finiſhing touches are laid on with the niceſt diſcrimination of truth in direction of light and hue of colour; nothing can exceed the delicacy and ſkill his draperies are wrought with as to character; and though not ſo ſtrong as Tintoretto's, they have ſufficient force, and are far more juſtly diſpoſed and characterized. After Titian in imitating him are, Velaſquez and Vandyke for excellence in their execution. Of the former, a Spaniſh painter, there are but few works in this country, but what there are, fully juſtify the remark. The latter in his very fineſt works equals his great predeceſſor in this reſpect, many of whoſe pictures he carefully copied. His touch is exceedingly delicate, and his underſtanding of his ſubject enabled him to place it with the greateſt juſtneſs and propriety. There is rarely ſeen in his works a confuſion in effect or relievo, and his power in his earlier productions ſeems to have encreaſed with his canvas; the large picture at Wilton of the Pembroke family is wrought in a ſtyle ſo broad and maſterly, that it appears to have been as eaſily managed as any of his ſmaller pictures; and he knew how to give with the greateſt eaſe the juſt character of every object he attempted to repreſent. Gout and conſequent weakneſs effected a change in his execution ſo great, that his hand is hardly cognizable in ſome of his latter works by thoſe who have only ſeen his former ones. When he was in Italy, his manner was that of Titian, with ſomewhat of Tintoretto; from this bravura ſtyle, as it may be termed, he fell afterwards to one more tame and ſpiritleſs; ſoftened, and rounded up, with few of thoſe vigorous touches, and with leſs billiancy of effect. Inſtances of both theſe, and alſo intermediate degrees, are at the earl of Egremont's at Petworth. Of the firſt are whole length portraits of ſir Robert and lady Shirley, which he painted when he was very young at Venice; of the others, are portraits of ſeveral branches of the Pony family, who once poſſeſſed that noble manſion. Vandyck certainly ſurpaſſed his maſter Rubens in beauty of execution, but was more than equally ſurpaſſed by him in vigour and variety of imagination; yet the execution of Rubens was extremely powerful, but apt to become ſlovenly, and he is not, generally ſpeaking, a good model to be followed on that head.

For thoſe who are intent upon yielding the ſoft, the delicate, and gentle impreſſions produced by highly laboured works without minuteneſs, Correggio is the exemplar of the whole claſs of that ſtyle of painters. In one particular he, and our own ſir Joſhua, in ſome of their works, ſtand unrivalled in execution. Other painters have given a beautiful ſurface, which, at a proper diſtance, deceives the eye, and preſents the full appearance of fleſh: theſe two have, we may almoſt ſay, made fleſh itſelf; the cloſeſt inſpection merely confirms the deluſion, and the obſerver fancies he could indent his finger in the ſurface, and expect it to ſpring again like nature;

ſuch is the fullneſs of the texture of the colour wrought with the many varying hues of nature. Guido Rheni follows in this claſs of the pleaſing ſtyle. His pictures of the lighter kind are exceedingly grateful to the eye, from the intelligence and eaſe with which his pencil appears to have been conducted through all the various parts. Annibal Carracci, in a more bold manner, is alſo a maſter of great power in the execution part of the art; but he often appears to have laboured to expreſs his thoughts; his works, however, poſſeſs great beauties of this nature.

In works of a different and ſmaller claſs from thoſe produced by the maſters whoſe names we have mentioned, almoſt the whole of the Dutch and Flemiſh ſchools are wonderfully ſkilful in their execution, particularly Rembrandt, Teniers, Janſſen, Metzu, Netſcher, &c. and ſtill more minute Gerard Dow, and Meins. In landſcape, Cuyp, Berghem, Both, Ruyſdael, and Hobbima, are all well worthy of the utmoſt attention in this reſpect; and many others, too numerous to be mentioned here, both of theſe and the Italian ſchool, will greatly aſſiſt the ſtudent who attentively examines their productions to form his judgment, on thoſe points wherein lie the greateſt beauties of this neceſſary branch of the art of painting. But as a good execution conſiſts in a free and ready hand, marking with fullneſs of preciſion and truth the characters of the objects repreſented; nothing but an intimate knowledge of nature will ever enable him to apply his obſervations on works of art to any beneficial purpoſe in completing the productions of his own imagination.

EXECUTIONE *facienda*, in *Law*, a writ commanding execution of a judgment.

Executione *facienda in withernamium*, lies for taking the cattle of one who had formerly conveyed out of the county the cattle of another, ſo that the ſheriff cannot replevy them.

Executione *Judicii*, a writ directed to the judge of an inferior court, to do execution upon a judgment therein, or to return ſome reaſonable cauſe wherefore he delays the execution. F. N. B. 20.

If execution be not done on the firſt writ, an *alias* ſhall iſſue, and a *pluries*, with this clauſe, *vel cauſam nobis ſignifices quare*, &c. And if, upon this writ, execution be not done, or ſome reaſonable cauſe returned why it is delayed, the party ſhall have an attachment againſt him who ought to have done the execution, returnable in B. R. or C. B. New. Nat. Br. 43.

EXECUTIVE Power, *Supreme*, is by the conſtitution of theſe kingdoms lodged in a ſingle perſon, the king or queen for the time being. See Crown and King.

EXECUTOR, a perſon nominated by a teſtator, to take care to ſee his will and teſtament executed or performed, and his effects diſpoſed of according to the tenor of the will.

The teſtaments made in Latin, in the fourteenth century, call executors *proviſores teſtamentarii*.

All perſons are capable of being executors that are capable of making wills, and others beſides, as feme-coverts and infants, and infants unborn; (Weſt. Symb. p. 1. § 635.) but no infant can act as executor till he is ſeventeen years of age. This appointment of an executor, either by expreſs words, or by ſuch as ſtrongly imply the ſame, is eſſential to the making of a will; (Weſt. c. 1. Plowd. 281.) but if the teſtator names no executors, or names incapable perſons, or if the executors that are named refuſe to act, the ordinary muſt grant letters of adminiſtration. See Administrator.

A perſon appointed to be executor is not compellable to execute the will; he may refuſe the charge, before he has adminiſtered as executor, or performed ſuch acts, as paying debts due by the teſtator, or receiving debts due to him, or giving acquittances for the ſame; but if he meddles with the goods of the teſtator, as executor, his ſubſequent refuſal is void, and he ſhall be charged as executor. A perſon to whom a legacy is left may be compelled either to ſtand the executorſhip, or to reſign his legacy. The refuſal of executorſhip muſt be entered and recorded in court. If ſeveral executors are named in a will, and ſome of them refuſe, and others prove the will, they who refuſe may afterwards adminiſter and act; and they muſt be joined in all ſuits, where the co-executors are plaintiffs; but not where they are defendants, becauſe the plaintiff in the action is not bound by law to take notice of any beſides thoſe who have proved the will. Such joint-executors, though they are accounted in law but as one perſon, ſhall not be charged by the acts of their companions, any further than for effects *actually* come to their hands. (Moor. 620. Cro. Eliz. 318. 2 Leon. 209.) But if two or more executors join in a receipt (in writing) and one of them only actually receives the money, each is liable for the whole, as to creditors at law, but not as to legatees or next of kin. (1 Salk. 318.) If joint-executors, by agreement among themſelves, agree that each ſhall intermeddle with a certain part of the teſtator's eſtate, yet each ſhall be chargeable for the whole (to creditors) by agreeing to the other's receipts. Hard. 314.

The intereſt, veſted in the executor by the will of the deceaſed, may be continued and kept alive by the will of the ſame executor, ſo that the executor of A.'s executor is to all intents and purpoſes the executor and repreſentative of A. himſelf. (Stat. 25 Edw. III. ſt. 5. c. 5. 1 Leon. 275.) But the executor of A.'s adminiſtrator, or the adminiſtrator of A.'s executor, is not the repreſentative of A. For the power of an executor is founded upon the ſpecial confidence and actual appointment of the deceaſed; and ſuch executor is therefore allowed to tranſmit that power to another, in whom he has equal confidence; but the adminiſtrator of A. is merely the officer of the ordinary, preſcribed to him by act of parliament, in whom the deceaſed has repoſed no truſt at all; and therefore, on the death of that officer, it reſults back to the ordinary to appoint another.

As to the office or duty of an executor, it is to be obſerved that he may do many things before he proves the will, which an adminiſtrator cannot do; becauſe the former derives his power from the will, and not from the probate or appointment of the ordinary, as the latter does. (Comyns. 151. Wentw. ch. 3.) He may maintain actions of treſpaſs, replevin, or detinue; releaſe an action, aſſent to a legacy, be ſued, alien, or otherwiſe intermeddle with the goods of the teſtator: by adminiſtering, the executor is entitled to receive all debts due to the teſtator, and all payments made to him are good, though he ſhould die, and never prove the will; but he cannot maintain a ſuit or action of debt, or the like, before he has proved the will. The ordinary, &c. may cite the executor, either to prove the will, or refuſe the office; and he may ſequeſter the goods of the deceaſed, till the executor has proved it; and if he does not appear on the proceſs, the ordinary may excommunicate him. On the other hand, the ordinary is compellable by mandamus to proceed to probate, when the will is not controverted. The executor muſt bury the deceaſed in a manner ſuitable to the eſtate he leaves behind him; neceſſary funeral expences are allowed, previous to all other debts and charges; but if he be extravagant, he is chargeable with devaſtation, or waſte of the ſubſtance of the deceaſed, which ſhall be only prejudicial to himſelf, and not to the creditors or legatees of the deceaſed. (Salk. 196. Godolph. p. 2. c. 26. § 2.) He is then to make an inventory of all the goods and chattels, whether in poſſeſſion or action of the deceaſed, which he is to deliver in to the ordinary upon oath, if lawfully required. He is then to collect all the goods and chattels ſo inventoried; for which purpoſe the law confers on him ample powers, as the repreſentative of the deceaſed; (Co. Litt. 209.) and having the ſame property in his goods as the principal had when living, and the ſame remedies to recover them; and if there be two or more executors, a ſale or releaſe by one of them ſhall be good againſt all the reſt. (Dyer. 23.) The executor muſt in the next place pay the debts of the deceaſed, in the order of their priority. See Debt, and Debtee *Executor*.

Among debts of equal degree, the executor (and alſo the adminiſtrator) is allowed to pay himſelf firſt, by retaining in his hands ſo much as his debt amounts to. (10 Mod. 496.) If a creditor conſtitutes his debtor his executor, this is a releaſe or diſcharge of the debt, whether the executor acts or not, (Plowd. 184. Salk. 299.) provided there be aſſets ſufficient to pay the teſtator's debts.

If no ſuit has commenced againſt him, the executor may pay any one creditor in equal degree his whole debt, though he has nothing left for the reſt; for, without a ſuit commenced, the executor has no legal notice of the debt. After the debts, the executor is to pay the legacies, which he is to pay as far as his aſſets will extend; but he may not give himſelf the preference herein, as in the caſe of debts. In caſe of a deficiency of aſſets, all the *general* legacies muſt abate proportionably, in order to pay the debts; but a *ſpecific* legacy, as of a piece of plate, horſe, &c. is not to abate at all, unleſs there be not ſufficient without it. (2 Vern. 111.) If the legatees have been paid their legacies, and debts come in more than enough to exhauſt the reſiduum, they are afterwards bound to refund a rateable part. (Ibid. 205.) See Legacy, and Donation *Cauſa Mortis*.

When all the debts and legacies are diſcharged, the ſurplus or reſiduum muſt be paid to the reſiduary legatee, if any be appointed by the will; if there be none, it was formerly underſtood to belong to the executor; (Perkins, 525.) but it ſeems to be now the general opinion, that, if there be an expreſs legacy given to an executor, and no deviſe of the ſurplus, ſuch ſurplus ſhall not go to the executor; but be diſpoſed to the next of kin, according to the ſtatute of diſtributions; the executor ſtanding on the ſame footing as an adminiſtrator. (Prec. Chanc. 323. 1 P. Wms. 7. 544. 2 P. Wms. 338. 3 P. Wms. 43. 194. Stra. 559.) See Inteſtate.

Where no expreſs legacy is given to the executor, the ſurplus ſhall go to the executor, and not otherwiſe diſpoſed of by will. When there are ſeveral executors, and ſome of them are dead, the legatary muſt ſue the ſurviving executors, and not the executors or adminiſtrators of thoſe that are dead. And if all the executors are dead, he muſt ſue the executors or adminiſtrators of thoſe that died laſt, and not thoſe of the reſt.

By the French law, an executor ſhould be ſeiſed of all the moveables of the deceaſed during one year; at the end whereof he is to account for them. To the validity of a teſtament, it is not neceſſary there be an executor nominated therein.

Executor *de ſon tort*, or of his own wrong, is he who takes on him the office of an executor by intruſion, not being conſtituted thereto by the teſtator or deceaſed, nor authorized by the ordinary to adminiſter.

If an executor in his own wrong takes upon himſelf the office of an executor, without lawful authority, he is chargeable to the rightful executor, and to all the creditors of the teſtator, and likewiſe to the legatees, ſo far as the goods amounted to, which he wrongfully poſſeſſed; and ſuch an executor is made by any act of acquiſition, transferring, or poſſeſſing himſelf of any of the eſtate or goods of the deceaſed; but not by acts of neceſſity, piety, or charity. (2 Nelſon Abr. 793.) Such an executor cannot bring an action in right of the deceaſed; but actions may be brought againſt him; neither can he retain for his own debt or legacy. In caſe of his death, his executors or adminiſtrators are liable to the ſuit of the lawful executor, creditors, and legatees, by 30 Car. II. cap 7.

Executor, *Debtee*. See Debtee.

EXECUTORY, that which has, or carries with it a ſufficient authority for being executed.

Executory *contract*. See Contract.

Executory *deviſe of lands*, is ſuch a diſpoſition of them by will that thereby no eſtate veſts at the death of the deviſor, but only on ſome future contingency.

It differs from a *remainder* (which ſee) in three very material points; 1. That it needs not any particular eſtate to ſupport it. 2. That by it a fee-ſimple, or other leſs eſtate, may be limited after a fee-ſimple. 3. That by this means a remainder may be limited of a chattel intereſt, after a particular eſtate for life created in the ſame. The *firſt* caſe happens, when a man deviſes a future eſtate to ariſe upon a contingency; and, till that contingency happens, does not diſpoſe of the fee ſimple, but leaves it to deſcend to his heir at law. As if one deviſes land to a feme-ſole and her heirs upon her day of marriage; here is in effect a contingent remainder without any particular eſtate to ſupport it; a freehold commencing *in futuro*. This limitation, though it would be void in a deed, yet is good in a will, by way of executory deviſe. (1 Sid. 153.) For, ſince by a deviſe a freehold may paſs without corporal tradition or livery of ſeiſin, it may therefore commence *in futuro*; becauſe the principal reaſon why it cannot commence *in futuro* in other caſes is the neceſſity of actual ſeiſin, which always operates *in præſenti*. And ſince it may thus commence *in futuro*, there is no need of a particular eſtate to ſupport it; the only uſe of which is to make the remainder, by its unity with the particular eſtate, a preſent intereſt. And hence it follows, that ſuch an executory deviſe, not being a preſent intereſt, cannot be barred by a recovery, ſuffered before it commences. (Cro. Jac. 593.) The *ſecond* caſe happens where a deviſor deviſes his whole eſtate in fee, but limits a remainder thereon to commence on a future contingency. As if a man deviſes land to A. and his heirs; but if he die before the age of 21, then to B. and his heirs; this remainder, though void in a deed, is good by way of executory deviſe. (2 Mod. 289.) But in both theſe ſpecies of executory deviſes, the contingencies ought to be ſuch as may happen within a reaſonable time; as within one or more life or lives in being, or within a moderate term of years; for courts of juſtice will not indulge even wills, ſo as to create a perpetuity, which the law abhors. (12 Mod. 287. 1 Vern. 164.) *Thirdly*, by executory deviſe a term of years may be given to one man for his life, and afterwards limited over in remainder to another, which could not be done by deed; for by law the firſt grant of it, to a man for life, was a total diſpoſition of the whole term; a life eſtate being eſteemed of a higher and larger nature than any term of years. (8 Rep. 95.) On this ſubject, ſee Blackſt. Comm. vol. ii. p. 176, 8vo.

Executory *eſtate*. See Estate.

Executory *fine*. See Fine.

EXEDENS Herpes. See Herpes.

EXEDRÆ, Εξεδραι, among the *Ancients*, were places wherein the philoſophers, ſophiſts, rhetors, &c. uſed to hold their conferences and diſputes.

M. Perrault is of opinion, the exedræ were a ſort of little academies, where the men of learning met together. See Academy.

Budæus rather thinks, that what the ancients called exedræ, might anſwer to what we call chapters in the cloiſters of monks, or collegiate churches.

EXEGESIS, Εξηγησις, a term ſometimes uſed by the learned, to ſignify *explication*.

Several interpreters of the Bible are of opinion, that in the paſſages of Scripture, where we meet with Abba Pater, two words, the firſt Syriac, and the ſecond Greek or Latin, but both ſignifying the ſame thing; the ſecond is only an exegeſis, or explanation of the firſt.

Exegesis is alſo uſed for an entire diſcourſe by way of explication or comment on any thing.

Exegesis *numeroſa*, or *linealis*, ſignifies the numeral, or lineal ſolution, or extraction of roots, out of adfected equations, firſt invented by Vieta. Ozanam calls it *la rhetique*. See Extraction *of roots*.

EXEGETES, formed of εξηγεομαι, *I explain*, among the Athenians, perſons learned in the laws, whom the judges uſed to conſult in capital cauſes.

EXEGETICA, in *Algebra*, the art of finding, either in numbers or lines, the roots of the equation of a problem, according as the problem is either numerical or geometrical. See Root and Equation.

EXELCOSIS, from ελκος, *an ulcer*, in *Surgery*, an incipient ulceration, or an excoriation, which is juſt beginning to ſuppurate.

EXEMPLAR, a model or original to be imitated or copied.

Exemplar alſo denotes the idea or image conceived or formed in the mind of the artiſt, whereby he conducts his work. Such is the idea of Cæſar, which a painter has in his mind when he goes to make a picture of Cæſar. The exemplar is ordinarily numbered among the cauſes. See Cause.

EXEMPLIFICATION *of Letters Patent*, denotes an exemplar, or copy of letters patent, made from the inrolment thereof, and ſealed with the great ſeal of England.

Such exemplifications are as effectual to be ſhewed, or pleaded, as the letters patent themſelves.

EXEMPLIFICATIONE, in *Law*, is a writ granted for exemplification of an original record. Reg. Orig. 290.

EXEMPTION, a privilege, or diſpenſation, whereby a perſon is excepted out of ſome general rule.

Exemption is particularly applied to churches, chapels, and monaſteries, which have a privilege given them by the popes, or princes, whereby they are exempted from the juriſdiction of the biſhop or ordinary.

The council of Conſtance revoked all exemptions, to reſtore to the general law, weakened and diminiſhed by a relaxation of ſeveral ages, its ancient force and vigour, and make it every where obtain in all its latitude.

The council of Trent prohibited, and declared them null for the future; confirming only ſuch as were well founded on legal conceſſions from the holy ſee.

Exemption, in *Law*, denotes a privilege to be free from ſervice or appearance; thus, knights, clergymen, &c. are exempted from appearing at the county courts by ſtatute, and peers from ſerving on inqueſts. (6 Rep. 23.) Perſons ſeventy years of age, apothecaries, &c. are alſo exempted by law from ſerving on juries, and juſtices of peace, attornies, &c. from pariſh offices. 2 Inſt. 247.

EXERCISE, a repetition of any operation, for the ſtrengthening or retaining of a habit.

Exercise, or bodily motion, conſtitutes, in the language of the older phyſicians, one of the ſix *non-naturals*, and has been juſtly conſidered, from the earlieſt times, as an important meaſure in the preſervation of health, as well as in the cure of ſeveral diſeaſes.

The value of corporeal exercifes in the eſtimation of the ancient phyſicians, from Hippocrates downwards, is manifeſt from their writings, in which the various kinds of exerciſe, as well as the degrees and times in which they are uſeful, are particularly diſcuſſed. Eſculapius himſelf is ſaid by Galen to have recommended riding on horſeback, and other exerciſes, as the means of benefiting invalids. But Herodicus, a Thracian, ſeems to have been the firſt who paid ſerious attention to exerciſe, as a remedy for diſeaſes. He was maſter of one of the academies, called *Gymnaſia*, in which the military and athletic exerciſes were taught; and having remarked that his pupils uſually enjoyed high health, he turned his attention to the regulation of the gymnaſtic exerciſes, with a view to attain or preſerve good health; thus adding the *medical gymnaſtic* art, to the two others juſt mentioned. (See Gymnastic, and Herodicus.) This maſter of the gymnaſium, however, went to work empirically, and is accuſed by Hippocrates of doing conſiderable miſchief, in attempting to cure febrile diſeaſes by his exerciſes. (De Morb. Epidem. lib. vi.) Hippocrates and his commentator, Galen, have left many obſervations relative to the different exerciſes, and their particular effects in the alleviation of particular diſeaſes. Friction, eſpecially by means of the *ſtrigil*, or fleſh bruſh, is much inculcated; on which ſubject Galen has compoſed his ſecond book, "De Sanitate Tuenda." The various modes of wreſtling, the exerciſes of the *corycus*, or hanging ball, &c. are commented on by Hippocrates in lib. ii. De Diæta: and Galen wrote a little treatiſe *de parva pila*, (the little ball,) which he recommends as an exerciſe that influences both the body and the mind at the ſame time. In his diſcourſe to Thraſibulus he diſcuſſes the queſtion, whether the preſervation of the health properly belongs to medicine, or to the gymnaſtic art: he inveighs againſt the athletic and other violent practices of the gymnaſium, but approves of the more moderate exerciſes, which he conſiders as ſubſervient to the purpoſes, and conſequently a part of the art of the phyſician. Antyllus, and other Greek writers, have treated of the various exerciſes in the ſame light, as is evinced by the collections of Oribaſius. (See Collect. Med. lib. vi.) The Romans even exceeded the Greeks in their attention to the medical gymnaſtics. Aſclepiades, in the time of Pompey, as Pliny informs us, conſidered the different modes of exerciſe, *viz.* friction, walking, and geſtation, as the chief auxiliaries of the phyſician, eſpecially when combined with the proper regulation of diet; and by the employment of theſe exerciſes, the inſtitution of baths, the invention of hanging beds, *lecti penſiles*, and other means of making phyſic agreeable, he is ſaid to have acquired the general applauſe of all mankind: "univerſum prope humanum genus circumegit in, &c." (Plin. Nat. Hiſt. lib. xxvi. cap. 3.) Many eminent examples of the benefits of exerciſe among the Romans are on record. Suetonius ſtates that Germanicus was cured of a ſort of atrophy of the lower extremities, (crurum gracilitas) by riding. And Cicero himſelf, when reduced to a ſtate of infirmity, which rendered it neceſſary for him to deſiſt from pleading, recovered his health by travelling, and by exceſſive diligence in the uſe of friction. (Plutarch.) Friction was an exerciſe, indeed, reduced to a regular ſyſtem among the ordinary habits of the Romans, and was preſcribed to a great extent by their phyſicians. See Friction.

That exerciſe, eſpecially in the open air, is highly beneficial to the conſtitution, is a truth which univerſal experience has eſtabliſhed. It is ſcarcely neceſſary, therefore, to appeal to the arguments of phyſiology to corroborate the propoſition. It may be ſufficient to ſtate, that the immediate reſult of bodily exertion is an acceleration of the circulation of the blood; a quicker and ſtronger contraction of the heart, by which the blood is puſhed more effectually to every part of the ſyſtem, and eſpecially through the ſmall and extreme branches of the veſſels. Hence a glow is produced on the ſurface, and the complexion aſſumes a redder hue, from the diſtention of the capillary veſſels with blood; and the exhalent arteries begin to pour out the thinner portions of the fluids in perſpiration. In the ſame manner, the extreme arteries of all the other parts of the body are diſtended, and excited to greater action; whence all the organs of ſecretion, which are principally made up of convolutions of the extreme arteries, are neceſſarily ſtimulated to an active performance of their ſeveral functions. The veſſels of the ſtomach pour out the gaſtric liquors more abundantly, and the work of digeſtion is more perfectly and actively completed; the appetite for a new ſupply of aliment quickly returns, and the ſtomach is prepared for repeating the digeſtive proceſs, by the increaſed ſupply of the digeſtive liquor. The liver and the pancreas, in like manner, elaborate their reſpective fluids, the bile and pancreatic juice, more copiouſly, and thus contribute an increaſed aid to the operations of the alimentary canal. The lungs, in the mean time, being called upon for an augmented ſupply of the vivifying principle derived from the oxygen of the atmoſphere, by the increaſed circulation of the blood through them, reſpiration is increaſed in proportion to the quantity of venous blood which they receive. Thus, notwithſtanding the greater rapidity with which the blood is carried to the ſecreting organs, it is rendered adequate to the ſecretion of the healthy fluids peculiar to each, by the increaſed operation of the lungs; as well as to the ſupport of the greater muſcular action, in which the exerciſe conſiſts.

It muſt be obvious, then, that this general activity of the whole ſyſtem, this free circulation through the moſt minute ramifications of the veſſels, and through the glands and organs which they compoſe, and this prompt ſeparation of the excrementitious and other parts of the blood, by the ſecretions, cannot but contribute to the general health of the body. It is not leſs obvious that it contributes to the evolution and growth of the different parts of the body; whether we conſider the great influx of the blood, from which all growth is derived; or obſerve the fact, that thoſe muſcles and limbs, which are moſt actively exerciſed, invariably acquire ſuperior bulk, as well as ſuperior ſtrength. The muſcles of the arms in blackſmiths, and thoſe of the loins in porters, and all others employed in raiſing or carrying great weights, invariably acquire a diſproportionate ſize; and, on the contrary, thoſe muſcles which are little employed are apt to ſhrink, and to be comparatively enfeebled, as in the legs of tailors. The effect of exerciſe in giving ſtrength and rigidity of fibre to the muſcular or fleſhy part of animals is well known, and daily exemplified in the difference of texture in the wings and legs of birds which we uſe as food. In the common fowls, which ſeldom uſe the wing, and conſtantly employ the legs in walking, the hardneſs of the fleſh of the latter, and tenderneſs of that of the former, are notorious. From this influence of exerciſe in contributing to the growth and ſtrength of the animal body, we may obviouſly trace the final cauſe of that inſtinctive diſpoſition to activity and motion, which the young of all animals poſſeſs.

Regular exerciſe, not too violent in degree, nor continued too long, ſo as to induce exceſſive fatigue, is therefore to be conſidered as the moſt important preventive of diſeaſes. It is not eaſy to lay down rules by which it ſhould be regulated; ſince the conſtitution, age, ſtrength and habits muſt modify its effects in different individuals. A ſudden tranſition from a ſtate of reſt to violent exertion is injurious to the invalid, eſpecially after a full meal, or if continued until a profuſe perſpiration, or great laſſitude takes place; for this over-exertion neceſſarily leads to a languor and imperfect performance of all the vital actions, every organ partaking of the general fatigue. The various kinds of exerciſe may be conſidered under two claſſes, the active and the paſſive; the former being the reſult of our own muſcular activity, ſuch as walking, dancing, running, ſwimming, fencing, the military exerciſe, and different athletic games; the latter the reſult of communicated motion, as riding in a carriage, ſailing, ſwinging, friction, &c.; riding on horſeback, or driving a carriage, partakes in ſome meaſure of both the active and paſſive exerciſes.

Walking, which ſeems to be the moſt natural exerciſe, is capable of producing all the effects above detailed, if adapted in degree and duration to the various circumſtances. Hence the moſt obſtinate caſes of hypochondriacal diſorders, of indigeſtion, and other ſtomach complaints, have been frequently removed by perſeverance in walking, eſpecially in the open air of the country. But when the exerciſe of walking is adopted with a view to baniſh the complaints juſt mentioned, which a ſedentary life is apt to induce, it is moſt effectual when regularly and ſtrenuouſly purſued. That degree of walking, which, when reſorted to occaſionally, or with conſiderable intermiſſions, produces great fatigue and languor, and therefore is rather prejudicial than advantageous, would, if daily continued, ſoon ceaſe to fatigue, and would then contribute greatly to reſtore the healthy ſtate of the functions. It muſt be recollected that the animal vigour is conſumed, or, to uſe the language of Brown, the excitability is exhauſted, by the mental functions as well as by muſcular exertion; therefore, to carry with us, in our walks in ſearch of health, the brooding anxieties and cares of our profeſſions,—to attempt to combine ſtudy with ſuch exerciſe by reading, or by ſerious reaſoning in converſation, is to thwart the good effects of the plan. We may obſerve that, ſo incompatible is deep thought with muſcular exertion, that moſt people ſtop in the midſt of their activity, when their arguments require great reflection. Serenity of mind, and a relaxation from the ſerious occupations of life, are therefore neceſſary, when walking is reſorted to as a remedy.

Of the more violent ſpecies of active exerciſe, which can only be reſorted to as a preſervative from diſeaſe, by thoſe who are in a ſtate of good health, it is unneceſſary to ſpeak.

The modes of exerciſe which are particularly uſeful in the cure of diſeaſes, or in the reſtoration of the health of convaleſcents, are the different ſpecies of geſtation, eſpecially riding in carriages, or on horſeback, and ſailing.

The motion of a ſhip produces the moſt gentle exerciſe, and is therefore adapted even to the relief of very infirm conditions of the body, and it has been employed from early times in the cure of conſumption. The Romans, in the time of Pliny, uſed to ſend their conſumptive patients to Egypt; not, as that author takes care to inform us, on account of any peculiarity of that country, but in conſequence of the length of the voyage. Annæus Gallio, who had been conſul, was cured of a conſumption by ſuch a voyage. (Nat. Hiſt. lib. xxxi. cap. 6.) Celſus ſeems to have conſidered ſailing, when reſorted to early, as the principal remedy for conſumption: "opus eſt, ſi vires patiuntur, longa navigatione," he ſays; and where the ſtrength is not equal to it, he recommends ſhort voyages, or the uſe of a litter, or other means of gentle geſtation. (De Medicina, lib. iii. cap. 22.) The advantages of a ſea voyage, eſpecially to a warmer climate, are well known to modern phyſicians; and inſtances of the ſucceſs of ſuch a voyage to Madeira, Liſbon, &c. when undertaken in the incipient ſtage of conſumption, as Celſus recommends it, are very numerous. This, however, like all other remedies for conſumption, is too often reſorted to when the diſeaſe has already advanced too far to admit of any effectual relief. See CONSUMPTION.

The exerciſe of geſtation by means of a carriage, and the more active exerciſe of riding on horſeback, being more eaſily obtained, are of more importance in our conſideration of the ſubject. Horſeback exerciſe was not much adopted by the ancients, with a view to the cure of diſeaſes; partly becauſe that valuable animal was leſs uſed by the Greeks and Romans, and partly becauſe their mode of riding, without ſtirrups, was incompatible with the weakneſs of invalids. (See Fuller, Medicina Gymnaſtica, p. 231.) Hence we may underſtand the obſervation of Antyllus, that "riding is of little uſe to thoſe who are ſickly, becauſe a ſlow pace is productive only of laſſitude, eſpecially in the loins;" he admits, however, that "a quick pace of the horſe, although it occaſions a troubleſome ſhaking of the whole body, is nevertheleſs ſomewhat beneficial, and ſtrengthens the ſyſtem, eſpecially the ſtomach and the organs of ſenſe, more than all other exerciſes." (Oribaſius, loc. cit. lib. vi. cap. 24. de Equitatione.) The great advantages of riding in the prevention and cure of many diſeaſes are inſiſted upon in the ſtrongeſt terms by Sydenham, who, indeed, appears, in ſeveral parts of his writings, to have conſidered it as a remedy of ineſtimable value, provided it be perſevered in with conſtancy, in the manner which we have inculcated in reſpect to *walking*. Speaking of the mode of cure in chronic diſeaſes, that ſagacious phyſician obſerves, "nothing, among all the expedients which have hitherto come to my knowledge, ſo effectually ſupports the ſpirits and ſtrength, as long and conſtant riding on horſeback." (Diſſ. Epiſtolaris.) Again in his Treatiſe on the Gout, and particularly reſpecting the prevention of the paroxyſms by exerciſe, he ſays, "riding on horſeback is far preferable to all other exerciſes for this purpoſe; in truth I have frequently conſidered, that if any perſon were acquainted with a medicine, which he choſe to keep ſecret, of equal efficacy in this, and in the greater number of chronic diſeaſes, with a conſtant and perſevering exerciſe on horſeback, he would ſpeedily accumulate the moſt ample wealth." And to expreſs his full conviction of the value of this exerciſe in conſumptive complaints, he uſes theſe ſtrong terms: "in ſhort, however fatal conſumption is deemed to be, and actually is, ſince it deſtroys two thirds of thoſe who die of chronic diſeaſes, yet I ſolemnly affirm, that neither is mercury a more effectual remedy for the lues venerea, nor Peruvian bark for agues, than is the exerciſe juſt commended for conſumption, provided that the patient be always careful to ſleep in dry linen, and that his journey be ſufficiently long." The truth of this great encomium is indeed queſtioned by modern practitioners in general, however weighty the authority of Sydenham may be. But there are many caſes on record, which ſeem to juſtify this obſervation. Witneſs the caſe of the late Dr. Currie, of Liverpool, as related by himſelf, in the Zoonomia of Darwin. (Vol. ii. claſs ii. Ord. i. 6.) In this caſe, the patient had an hereditary prediſpoſition to conſumption, and was reſtored by travelling from a ſtate of debility, in which the erect poſture could ſcarcely be borne without fainting, to good health; having begun with the exerciſe of a carriage, and afterwards ridden on horſeback, as his ſtrength augmented. Sydenham has related ſeveral examples of the value of this exerciſe, and others may be found detailed by Fuller, &c. We cannot therefore doubt, that in many inſtances, in which it has ſeemed to be deſtitute of the efficacy aſcribed to it by Sydenham, the failure muſt be attributed to the imperfect or too late uſe of the remedy. "I muſt here repeat," ſays Fuller, quaintly, "that when I ſpeak of riding, I underſtand the *habit of riding*, the want of which diſtinction has made it ineffectual to many a man. He that in this diſtemper (conſumption) above all others rides for his health, muſt be like a Tartar, in a manner always on horſeback; and then from a weak condition he may come to the ſtrength of a Tartar." (Medicin. Gymnaſt. p. 106.) We have dilated upon this topic, from a conviction that many chronic diſeaſes, which are included under the epithets of bilious and nervous, as well as many morbid conditions of the viſcera, for which drugs, and even the waters of Briſtol, Bath, and Cheltenham, are ineffectually ſwallowed, might be removed by a ſteady and unremitting exerciſe, in a carriage, or ſtill more certainly on horſeback.

It is unneceſſary to enter into a particular enumeration and diſcuſſion of every poſſible form of exerciſe, the principle being the ſame with reſpect to all. A late intelligent writer has laid down ſome uſeful practical precepts on theſe topics, mixed with a good deal of trifling obſervation, and abſurd hypotheſis. (See Willich's Lectures on Diet and Regimen, chap. 7.) The following remarks on the injuries occaſioned by want of exerciſe are from that popular writer.

"We are now to conſider the conſequences ariſing from *want of exerciſe*. This, indeed, is ſtill more debilitating than too violent motion. The ſolid parts of the human frame are relaxed by it; the circulation of the fluids is retarded; they gradually ſtagnate in the ſmaller capillary veſſels; the ſecretions are diminiſhed; and abundance of moiſture or fat is generated, which renders the body, as well as the mind, more indolent and lethargic, relaxation of the muſcles, obſtructions of the inteſtines, hemorrhoids, apoplectic fits, various ſpecies of dropſy, and at length a premature death, are the ſad conſequences. Men of letters are the moſt unhealthy of all human beings, becauſe their bodies have ſcarcely any other exerciſe but the imperceptible motion of the arms. Want of appetite, flatulency, anxiety, at one time obſtructions, at another diarrhœa, and the moſt diverſified nervous ſymptoms are their attendants. Sleep is beyond their reach; a thouſand tormenting inconveniences, hypocondriaſis, and at length a complete ſtate of melancholy, is too frequently their lot. Temperance alone will not remedy all theſe evils; for, ſince we cannot remain vigorous and healthy for two days together, with the ſame maſs of blood, a new acceſs of the neweſt and moſt ſubtle parts of our fluids muſt daily ſupport the nervous ſyſtem, in order to preſerve its regular functions. If this be not continually reſtored, weakneſs and relaxation of body and mind are the inevitable conſequences; with this difference only, that in a ſtate of debility from too much bodily exerciſe, the thick and coarſe particles of the fluids are carried into circulation with the others, and the next meal or the firſt ſleep after it, ſoon ſupplies the deficiency in mental labour; on the contrary, digeſtion is interrupted, the crude and viſcid parts of food remain unaſſimilated, and the body is prevented from receiving proper nouriſhment. In like manner ſedentary mechanics and artificers are affected, particularly ſhoe makers, tailors, and weavers. They experience maladies ſimilar to thoſe to which men of letters are ſubject; and it has been frequently obſerved, that they are very liable to diſeaſes of the mind, and eſpecially to religious fanaticiſm."

Exercise, *Field*, in *Military Affairs*, relates to the evolutions performed by companies, regiments, or greater bodies of troops, when learning, or practiſing, thoſe movements neceſſary to be correctly underſtood by perſons of all ranks in the military profeſſion. See Evolutions and Tactics.

Exercise, *Gun*, relates to the ſeveral arrangements, and motions, made for ſerving either heavy or light artillery, under every circumſtance common to military operations. See Gun-*Exerciſe*.

Exercise, *Manual*, teaches the ſeveral motions of the firelock, whereby all act as it were in uniſon, and perform their duties when drawn up for diſplay, or for ſervice, in an uniform and appropriate manner. See Manual-*Exerciſe*.

Exercise, *Sword*, refers to the ſeveral poſitions of the ſword, adapted either for attack, defence, or compliment. See Sword-*Exerciſe*.

Exercise, in a *Naval Senſe*, is the preparatory practice of managing the artillery and ſmall arms, in order to make the ſhips' crew perfectly ſkilled therein, ſo as to direct its execution ſucceſsfully in time of battle. The words of command introduced, during the late war, for the exerciſe of the great guns, are the following: "Silence: caſt looſe your guns; level your guns; take out your tompions; run out your guns; prime; point your guns; fire; ſpunge your guns; load with cartridge; ſhot your guns; put in your tompions; houſe your guns; and ſecure your guns. Falconer's Marine Dict. art. *Exerciſe*.

Exerciſe may alſo denote the execution of the movements, which the different orders and diſpoſitions of fleets occaſionally require, and which the ſeveral ſhips are required to perform, by means of ſignals.

Exercises, in the plural, are particularly underſtood of what is taught young gentlemen in the academies, or riding-ſchools, &c. As riding the great horſe, dancing, fencing, vaulting, drawing fortifications, &c.

EXERGASIA, Εξεργασια, *Expoſition*, in *Rhetoric*, a figure conſiſting of ſeveral equivalent expreſſions, or ſuch as are nearly ſo, in order to repreſent the ſame thing in a ſtronger manner. The warmth and vehemence of the ſpeaker often urge him to recur to this figure, when he is affected with his ſubject, and there are no words, no expreſſions, ſufficiently forcible to expreſs his ſentiments; and he therefore repeats one after another, as his fancy ſuggeſts them. This flow of expreſſion, under the conduct of a good judgment, is often attended with advantage; as it warms the hearers, and impreſſes their minds, excites their paſſions, and enables them to ſee things in a ſtronger light.

EXERGUM, Exergue, or *Exerge*, often denominated by Evelyn *exurge*, among *Medaliſts*, is the bottom of a coin, commonly ſeparated from the field by a line, upon which the figures of the reverſe ſtand. It is ſo called from being εξ εργου, *out of the* work of the medal. When the letters or words of a medal run round the margin, are on either ſide of the figure, or upon the exergue, they are denominated a *legend*; but when they occupy the field, they are called an inſcription. See Legend and Inscription.

EXETER, in *Geography*, a city in Devonſhire, England is of great antiquity, and, as Riſdon emphatically ſtyles it "may be called the emporium and principal ornament of the weſt." Its Roman name, as it appears in Ptolemy, is *Iſca*; and it is conjectured that the ſecond legion of Auguſta was ſtationed here for ſome time: this was commanded by Veſpaſian, who was the conqueror of Britannia Prima, in which province this place was included. In the Itinerary of Antoninus, Exeter is called Iſca-Danmoniorum, and is the moſt weſterly ſtation he has noticed: though, from the Iters of Ptolemy and Richard; from the remains of Roman roads over, and around Haldon; and from the veſtiges of ancient ways through Drew-Teignton to Oakhampton, and perhaps of a road hence over Dartmoor, by Hollow-ſtreet in the pariſh of Chagford; it is apparent that various principal roads ran weſtward from this city; and, therefore, it is probable that the Romans had other ſtations weſt of this. How long Exeter retained the name of Iſca-Danmoniorum is uncertain; though it ſeems probable that it fell into diſuſe very ſoon after the Romans quitted the iſland, about which time it appears to have been re-occupied by the Britons who had preſerved their independence by retiring to the wilds of Cornwall. They did not, however, continue in the poſſeſſion of it many years; for Cerdic, the founder of the kingdom of Weſſex, having greatly extended his territories, either by conqueſt or intrigue, included the moſt conſiderable portion of Devonſhire within his dominions: and at length Exeter became ſubjugated to the power of the Saxons. Under their government its name was changed to Evan-Ceſtre, Ex-Ceſtre, &c., and thence, through various ſimilar appellations, ſoftened to Exeter.

This city has been ſeveral times beſieged; but the greateſt calamities it experienced were inflicted by the Danes, who, in the reign of Alfred, in violation of a ſolemn treaty, ſurpriſed and routed the king's horſemen, and mounting their ſteeds, rode to Exeter, and remained there for the winter. Alfred collected all his forces and inveſted the city by land, while his fleet blocked up the harbour: the Danes capitulated, and agreed to evacuate all the territories of the Weſt Saxons. Between the period of the death of Alfred and the reign of Athelſtan, the Corniſh Britons had recovered poſſeſſion of Exeter; but Athelſtan having defeated and driven them to the weſt of the Tamar, they were never afterwards able to oppoſe the Saxon arms. To ſecure his conqueſts he ſurrounded Exeter with a wall of hewn ſtones defended by towers: and under his auſpices, ſays Malmſbury, "it became ſuch a place of trade, that it abounded with opulence." He adds that many other remarkable works of Athelſtan were to be ſeen in the city and its neighbourhood. In the year 1003 Exeter was the firſt ſacrifice to the fury of Swein king of Denmark, when he came to revenge the inhuman maſſacre of his countrymen: being delivered up by the treachery of its governor, after a ſiege of two months, many of the inhabitants were put to the ſword, and moſt of the buildings deſtroyed by fire. Before it was well recovered from this calamity, it was again beſieged and taken by William the Conqueror. In the reign of Stephen, this city was alternately garriſoned by the forces of the king and the empreſs. It again became the ſcene of hoſtility during the conteſt between Henry VI. and Edward IV. In the reign of Henry VII. it was cloſely, though ineffectually, beſieged by three thouſand men under Perkin Warbeck. The laſt ſiege Exeter experienced was in Edward VI.'s reign, when religious innovations occaſioned an alarming inſurrection in the weſt of England: the inhabitants, though reduced nearly to famine, ſo bravely defended the city for thirty-five days, that the inſurgents abandoned their deſign.

The ground incloſed within the walls of the city is nearly in the form of a parallelogram, of four furlongs in length, and three in breadth: this ſpace is interſected by the four principal ſtreets which meet near the centre, and diverging at right angles, connect the city with the ſuburbs. The whole extent occupied by buildings is about one mile and three quarters in length, and one mile in breadth. In the year 1769 the ſurrounding walls were entire; but many parts have been ſince deſtroyed. Stukeley ſpeaks of them as being, in his time, in pretty good repair, and having many turrets and towers, various parts of which are ſtill remaining. Leland, ſpeaking of this city, obſerves, that it is "a good mile and more in cumpace, and is right ſtrongly waullid and maintainid. Ther be diverſe fair towers in the toune waul bytwixt the ſouth and the weſt gate. Ther be four gates in the toune, by the names of eſt, weſt, north, and ſouth. The eſt and the weſt gates be now the faireſt, and of one faſcion of building: the ſouth gate hath beene the ſtrongeſt." In the year 1769 the north gate was taken down, to make a more convenient entrance into the city; and in 1784 the eaſt gate was removed for the ſame purpoſe. The ſouth gate, the interior arch of which Dr. Stukeley remarks to be of Roman workmanſhip, is intended to experience the ſame fate.

The ſituation of Exeter is commanding and pleaſant: it ſtands on the acclivity of an eminence on the eaſtern banks of the river Exe, which flows in a ſemi-circular direction round the ſouth-weſt ſide of the city. "What adds to its wholeſomeneſs and cleanlineſs," ſays Stukeley, "is, that the ground is higher on a ridge along the middle of its length declining on both ſides. Further, on the ſouth-weſt and north-weſt ſides it is precipitous; ſo that with the river, the walls, the declivity of ground, and ditch without ſide, 'twas a place of very great ſtrength, and well choſe for a frontier." In the higheſt part of the city, on the north ſide, ſtand the remains of Rougemont caſtle, which was formerly the ſeat of the Weſt Saxon kings, and afterwards of the dukes of Exeter. This building has little to recommend it but its antiquity and pleaſant ſituation. The ruins of the exterior walls are nearly all that remain; theſe incloſe a conſiderable ſpace, of a pentagonal form, and were defended by four towers; two on the weſt, and two on the eaſt ſide. The ramparts of the caſtle command a moſt delightful view over the adjacent country. When the caſtle was erected is unknown; though Grafton's tale, that it was built by Julius Cæſar, is unqueſtionably falſe. William the Conqueror either rebuilt, or much repaired, the whole edifice, and beſtowed it on Baldwin de Briono, huſband of Albreda his niece, whoſe deſcendants, by the female line, enjoyed it, together with the office of ſheriff of Devon, which ſeems to have been annexed to it, till the fourteenth year of Henry III.'s reign, when that prince, reſuming into his own hands ſundry caſtles and forts in this realm, diſpoſſeſſed Robert de Courtney, in whoſe family it had been for three deſcents. In the civil war of the ſeventeenth century the caſtle was completely ruined, when the city withſtood a blockade of two months againſt Fairfax, one of whoſe forts, Mr. Gough ſays, ſtill remains in a field to the north. Within the area incloſed by the walls, a ſmall chapel was erected by lady Elizabeth de Fortibus, counteſs of Devon, who endowed it with lands, called the prebends of Hays and Catton, for the payment of certain weekly ſervices therein to be performed. A ſeſſions-houſe, of Portland-ſtone, has been recently built within the area on the north-weſt ſide.

Within the walls of the city are fifteen pariſh churches, and in the ſuburbs four; but moſt of them being ſmall, they preſent nothing worthy of particular deſcription.

The cathedral is a large intereſting edifice, and, according to Hooker and ſome other writers, was five hundred years in building; it conſiſts of a nave with two aiſles, a choir with aiſles, a north and ſouth tranſept, which are terminated by lofty towers. On the ſouth ſide was a large cloiſter, which is moſtly deſtroyed. To the eaſt of this is the biſhop's palace, which, with its gardens, are incloſed within a lofty wall. For a particular hiſtory and deſcription with ſeveral architectural points, ſee a large folio work publiſhed by the Society of Antiquaries.

The epiſcopal ſee of Devon was ſeated at Crediton previous to its eſtabliſhment at Exeter; but Leofric, who was biſhop of that ſee, and lord chancellor of England, prevailed on Edward the Confeſſor to remove it to the latter town in the year 1049. That monarch, in perſon, with Eadyga, his queen, attended the inſtallation, and placed the biſhop in his new ſee; which at the ſame time he endowed with the lands and emoluments appertaining to that of Crediton. The ſee being thus eſtabliſhed, it appears probable that a ſuitable cathedral was ſoon afterwards erected: but whether it was conſtructed by the enlargement and alteration of ſome exiſting edifice, or whether a ſeparate and entire building was now raiſed, is uncertain. "It ſeems not unlikely," obſerves ſir Henry Englefield, "that the firſt cathedral was not more than about ſixty feet in length, and occupied the ſite of the preſent chapel of St. Mary." That the chapel, in its preſent ſtate, was not the Saxon church, is ſatisfactorily proved by an examination of its architecture. No particular alteration appears to have been made in the cathedral before the time of William Warlewaſt, the third biſhop, who was a Norman, and had been chaplain to the Conqueror, and his two ſons, William and Henry; the latter of whom inducted him to this ſee in 1107. This prelate was a liberal benefactor to his cathedral; and it appears that he conſiderably enlarged it, and laid the foundation of the preſent choir: to him the towers yet remaining are probably to be aſcribed; they are perfectly ſimilar in ſtyle to the buildings of Gundulphus his cotemporary, and bear much more reſemblance to the magnificence of the Norman architects, than to the ſimplicity of the Engliſh Saxons.

Exeter has been from time immemorial, and ſtill is, inveſted with great privileges. At the period of the Norman ſurvey it enjoyed the ſame exemption from taxes as London, York, and Wincheſter. Since that time it has obtained many charters, and grants of immunities, from ſeveral monarchs. In the reign of Henry I. the fee-farm rents were granted to Matilda his queen; and in king John's time, Iſabel, his conſort, held Exeter in dower, with a fair thereunto belonging. In the third year of John's reign, the burgeſſes paid a fine of 110 marks for a confirmation of their charters; and about this period the city, which had been previouſly governed by port-reves and bailiffs, was incorporated, and had a mayor for its chief officer. We find in the Notitia Parliamentaria, that "in the reign of Edward I. the burgeſſes and citizens pleaded that their city was an ancient demeſne, and that they held it in fee-farm of the crown, paying 39*l.* 15*s.* 3*d.* To ſupport this claim, they referred to Henry III.'s charter, made to his brother Richard, king of the Romans; whereby they further challenged return of writs, a gallows, pillory, &c. and a fair of four days, beſides three weekly markets; which liberties they certified they enjoyed ſince the time of the conqueſt; upon which they were allowed." Henry VIII.

conſtituted Exeter a county of itſelf; thus rendering it independent of Devon, and inveſting it with correſponding privileges.

The corporation now conſiſts of a mayor, twenty-four aldermen, a recorder, chamberlain, town-clerk, ſheriff, four ſtewards, and ſeveral inferior officers. The corporate bodies within the city are thirteen, each of which is governed by officers annually choſen from among themſelves. Exeter was one of the firſt cities that returned members to parliament: the right of election is veſted in the magiſtrates and freemen, who are ſuppoſed to amount to about one thouſand perſons. The trade of Exeter is extenſive; yet would probably have been much more ſo, but for a contention between the inhabitants and Hugh Courtenay, earl of Devon, which deprived the city of the uſe of its river for navigable purpoſes during ſeveral centuries. The diſpute is reported by Izacke to have ariſen about ſome pots of fiſh; which, being expoſed for ſale in the market place, were ſeen nearly at the ſame time by the cators of the earl, and of the biſhop of Exeter, both of whom wanted the whole. The mayor, to whom the difference was referred, adjudged one part to the earl, another to the biſhop, and the third he directed to be kept for the uſe of the market. This deciſion, and a ſubſequent determination of the mayor and council, that no freeman of Exeter ſhould wear any foreigner's livery, badge, or cognizance without the mayor's licence, offended the earl, who immediately impeded the navigation of the river, "ſtopping, filling, and quirting the ſame," ſays Hooker, "with great trees, timber, and ſtones, in ſuch ſort, that no veſſel, or veſſels, could paſſe or repaſſe." Previouſly to this occurrence the tides flowed beyond the city; but now they only reach Topſham, a town between three or four miles nearer the ſea, the advantage of which was probably the chief object of the earl's meaſures, as that place was part of his eſtate, and became exceedingly flouriſhing in conſequence. The river was ſo completely choaked up, that though many attempts were made to reſtore the navigation, ſcarcely any thing was accompliſhed till the year 1675, when a canal was cut from Topſham to the city; and about twenty years afterwards the preſent haven was conſtructed: and by means of ſluices and flood-gates, veſſels of 150 tons burthen are now admitted to a good quay, formed near the city walls.

Exeter is ſituated 170 miles W. from London. The number of inhabitants, as returned under the late act, was 17,388; of houſes 2836. The principal employ of the labouring claſſes of people ariſes from the woollen trade; and the city has derived immenſe profits from the exportation of ſerge, kerſeys, and other articles, the value of which together has been computed at the average ſum of 600,000*l. per annum*: the chief markets were, during peace, Spain, Portugal, Germany, and Italy. About 300 perſons are alſo employed in manufacturing cotton, at a large factory eſtabliſhed on the banks of the river. Exeter had anciently a mint, which was granted by king Athelſtan; and money has been coined here ſo late as the reign of William III., the place of coinage being denoted by the letter E under the buſt.

This city has been the birth place of ſeveral very eminent and learned men. Among the moſt diſtinguiſhed are, Joſephus Iſcanus, whoſe writings adorned the commencement of the thirteenth century: John Hooker, ſir William Petre, and ſir Thomas Bodley, who all flouriſhed in the ſixteenth century; and ſir Peter, afterwards lord King, who held the high office of lord chancellor from 1725 to 1733.

In the vicinity of Exeter are ſeveral handſome, and reſpectable ſeats, belonging to the nobility and gentry. The principal of theſe are, Powderham-caſtle, belonging to viſcount Courtney; Mamhead, the ſeat of lord Liſburne; Haldon-houſe, the ſeat of ſir Lawrence Palk, &c.; Mount-Radford, the ſeat of John Baring, eſq.; Peamore, the ſeat of Samuel Kekewich, eſq.; Cleve, the ſeat of Thomas Northmore, eſq.; Cowicke, the ſeat of James White, eſq.; Oxton-houſe, the ſeat of the Rev. John Swete. Polwhele's Hiſtory of Devonſhire, 8vo. Jenkins's Hiſtory and Antiquities of Exeter, 12mo. 1806.

Exeter, a poſt-town of America, in the county of Rockingham and ſtate of New Hampſhire, and, Portſmouth excepted, the moſt conſiderable ſea-port town in the ſtate. It is ſituated on the head of the navigation on Swamſcot, or Exeter river, a branch of the Piſcataqua, 15 miles S.W. of Portſmouth. The tide riſes here eleven feet. This town is well ſituated for manufactures, and has already ſix ſaw mills, a fulling mill, ſlitting mill, paper mill, ſnuff mill, two chocolate and ten griſt mills, iron-works, and two printing offices. The ſadlery buſineſs is very conſiderable. Some few veſſels of different burden are built here, and the river is capable of floating thoſe of 500 tons. The ſituation of Exeter is adapted for an extenſive population. The public edifices are, two congregational churches, an elegant building appropriated to the academy, a handſome and capacious court-houſe, and a gaol. The public offices of the ſtate are at preſent kept in this place. It contains 1727 inhabitants. The townſhip is of an irregular figure, and about four miles ſquare. It was incorporated in 1638, before which period it was called Swamſcot falls; it lies 50 miles N. of Boſton. N. lat. 42° 59′. W. long. 71°. The academy was founded and endowed by the Hon. John Phillips, L.L.D. of Exeter, and incorporated by act of aſſembly in 1781. It is ſaid to be a reſpectable inſtitution, under the inſpection of a board of truſtees, and the immediate government and inſtruction of a preceptor and an aſſiſtant. Its annual income is 480*l.* and the number of ſtudents is commonly between 60 and 80. In 1794 a building was erected, which, in point of convenience, and perhaps of elegance, is exceeded by few buildings of the kind in the United States. Morſe.

Exeter, the north-weſternmoſt townſhip in Waſhington county, and ſtate of Rhode iſland, in which the ſeveral branches of Wood river unite; containing 2476 inhabitants, of whom 24 are ſlaves.—Alſo, a townſhip in Luzern county, Pennſylvania, including 737 inhabitants.—Alſo, a town in New Hanover county, in Wilmington diſtrict, North Carolina; ſituated on the N.E. branch of Cape Fear, about 36 miles from Wilmington.

EXFOLIATION. This term, in *Surgery*, denotes the proceſs by which the dead part of a bone ſeparates from the living portion. It is alſo not uncommon for ſurgeons to ſignify, by the word *exfoliation*, the piece of bone itſelf that has periſhed, though this is certainly an abuſe of language.

Exfoliation, or the ſeparation of a dead portion of bone from the living, is effected much in the ſame way as a ſlough is thrown off from the ſoft parts. The piece of bone which has periſhed is not detached by becoming rotten; for, in fact, it poſſeſſes conſiderable firmneſs, and at firſt coheres as intimately as ever to the living bone immediately contiguous to it. As Mr. Hunter has accurately obſerved, if the proceſs of exfoliation were not to take place, the dead piece of bone would remain undetached for years, inaſmuch as putrefaction is concerned in producing the ſeparation.

The more the pathologiſt conſiders the diſeaſes of the bones, the more he will find them reſemble thoſe of the ſoft parts. This fact, indeed, anatomy would lead one to infer, ſince the texture of the bones is the more ſimilar to the ſtructure of the reſt of the body, than an uninformed perſon would ſuppoſe. The chief difference is, that the bones contain lime, which the ſoft parts do not.

Mr. Hunter deſcribes the proceſs of exfoliation as follows; a dead bone (he ſays) acts on the ſyſtem in the ſame manner as any other extraneous body. It ſtimulates the adjacent living parts, in conſequence of which ſuch a proceſs is begun, as muſt end in the dead piece being thrown off. The effects of this ſtimulus are; firſt, that the living adjacent bone becomes more vaſcular, a circumſtance which always takes place, when a part has more to do than is juſt ſufficient for the ſupport of life. Secondly, that the earth of the living part, when it is in contact with the dead bone, is abſorbed. Hence the bone becomes ſofter, and is now only adherent by the animal matter in its texture. Thirdly, that the living animal part is at laſt abſorbed along the ſurfaces of contact. This part of the proceſs begins long before the laſt is finiſhed. Both of them begin firſt at the ſurface, though, in their courſe, they do not every where take place, in an equal degree, at the ſame time. Fourthly, that, in proportion to the waſte made by the laſt part of the proceſs, a fungus ariſes from the living ſurface, and fills up the intermediate ſpace, ſo as to prevent a vacuum. Mr. Hunter obſerves, that theſe different ſtages, taken together, conſtitute ulceration. He remarks, that when any part of a bone is once looſe, it will be puſhed towards the ſurface of the body, as moſt other inanimate ſubſtances are. This part of the proceſs is partly mechanical, and partly a continuation of ulceration. The ſame diſtinguiſhed ſurgical writer alſo notices, that a proof of the third ſtage above mentioned, may be derived from certain caſes, in which people die while exfoliation is going on. A ſmall groove, or worm-eaten canal, may then be diſcovered, which becomes gradually deeper, and follows the irregularities of the dead and living ſurfaces. After the application of the trepan, a circular piece of bone is frequently thrown off, which is always leſs than the ſpace from which it came. This, ſays Mr. Hunter, could never be the caſe, if there were not a loſs of ſubſtance.

Thus we find that exfoliation, and the proceſs by which a ſlough of the ſoft parts is detached, are nearly alike. In both inſtances, the matter which forms the bond of connection between the dead and living ſubſtances, is abſorbed, the dead part is looſened, and is next puſhed off by the riſing of the granulations.

The bones, on which exfoliations moſt frequently occur, are ſuch as are of a firm, ſolid ſtructure; thoſe which are of a ſpongy cellular texture, are more ſubject to the affection called caries.

All the old ſurgical practitioners and writers uſed to promulgate the doctrine, that whenever the ſurface of a bone was laid bare, and deprived of its perioſteum, an exfoliation muſt inevitably follow. The practice, which was reſorted to in conſequence of this notion, did really, for the moſt part, occaſion a deſtruction of a part of the bone, and the progreſs of the caſe ſeemed a confirmation of the erroneous opinion, reſting on experience itſelf for its foundation. For it followed almoſt as a matter of courſe with the ancient ſurgeons that ſince they conſidered the occurrence of exfoliation unavoidable in the circumſtance which we have mentioned, their grand aim was to promote and accelerate the proceſs, ſo as to ſhorten, as they conceived, the duration of the caſe. With this view, they uſed to put on the uncovered part of the bone ſtimulating, drying, ſpirituous applications, and, very often, the actual and potential cautery. Alſo, fancying that the wound could never heal till the dead piece of bone had come away, they uſed to avoid laying down the fleſh, ſo as not to leave the ſurface of the bone a long while expoſed, a cauſe, of itſelf, quite adequate to the production of an exfoliation.

However, the fact is, that a mere temporary expoſure of part of a bone, ſuch a tranſient denudation, as need only be permitted in caſes of wounds, is not neceſſarily, or even commonly followed by an exfoliation, when a proper method of treatment is purſued.

We have already remarked that the diſeaſes of the bones are more like thoſe of the ſoft parts, than many would imagine. The expoſed ſurface of a bone will not die, if it be otherwiſe free from injury, and the ſurgeon, immediately he is called, take care to lay down the detached fleſh in the ſituation which it previouſly occupied. Even when the denuded bone, on account of loſs of ſubſtance, cannot be directly covered again, it will not always exfoliate, provided the ſurgeon, inſtead of uſing the cautery, cauſtics, ſpirituous, or any other irritating applications, applies only ſome plain ſoft lint, or a pledget of any mild ſimple ointment.

When the ſoft parts are merely divided, the expoſed ſurface will not ſlough; but when the wound is complicated, with a violent degree of contuſion, laceration, &c. the caſe is different, and the fibres, veſſels, &c. moſt injured, will die and be thrown off. Theſe parts may either be killed at once by the violence, or the miſchief which they have ſuſtained may give riſe to inflammation, which may terminate in ſloughing. Things are nearly the ſame with reſpect to the bones. We will bring to our conſideration a few circumſtances relating to the ſubject of wounds of the head, which are, perhaps, more frequently than any other kind of wounds followed by exfoliations. In theſe inſtances, if the ſoft parts be ſimply cut, ſo as to occaſion an expoſure of the cranium, without the bone itſelf being violently contuſed, the wound may be healed by the firſt intention, and no part of the ſkull will exfoliate. The ſame occurrences may happen, together with a detachment of the pericranium, and yet the ſame conſequences will follow.

However, when the external violence has affected the bone, as well as the ſoft parts, the injured part of the ſkull will frequently die and exfoliate, notwithſtanding the moſt judicious treatment.

The proceſs by which an exfoliating piece of bone is thrown off, depends almoſt entirely upon nature, and the ſurgeon can interfere very little, with any real utility. The milder and leſs irritating his dreſſings are, the better. Sometimes, when the dead part of the bone is looſe, but is ſo covered with fleſh that it cannot come away, the practitioner may greatly expedite the cure, by making a proper opening for the removal of the piece of bone that has exfoliated. Sometimes, when the proceſs of exfoliation is long and tedious, he may render eſſential aid by occaſionally introducing a pair of ſmall forceps into ſome ſinus leading down to the affected bone, and moving the exfoliating portion a little every now and then, ſo as to accelerate its ſeparation. This latter proceeding, it is obvious, is only admiſſible when the opening in the ſoft parts is large enough, and when the dead piece of bone either projects, or is of ſuch a ſhape as will allow of its being taken hold of with a pair of forceps. Sometimes, when the dead piece of bone is prevented from exfoliating, by being overlapped by new oſſeous matter at its circumference, the ſurgeon may properly make ſome attempt to cut away the portion which is ſo wedged, that its ſpontaneous detachment would require an unreaſonable length of time. Endeavours of this kind, however, on the part of the ſurgeon, ſhould be made with great circumſpection and prudence; and, indeed, they can only be juſtifiable when the affected bone is ſufficiently ſuperficial.

EXFOLIATIVUM, from *exfolio, to ſhed the leaf*, an inſtrument for ſcraping or exfoliating bones.

EXFREDIARE, in our *Old Writers*, denotes the breaking of the peace, or committing open violence. Leg. Hen. I. cap. 31.

The word is formed from the Saxon, *frede*, *peace*.

EX GRAVI QUERELA, in *Law*, a writ that lies for him to whom any lands or tenements in fee are deviſed by will (within any city, town, or borough, wherein lands are deviſeable by cuſtom), and the heir of the deviſor enters, and detains them from him. (Reg. Orig. 244. Old Nat. Br. 87.) And if a man deviſes ſuch lands or tenements unto another in tail, with remainder over in fee, if the tenant in tail enter, and is ſeiſed by force of the intail, and afterwards dieth without iſſue, he in the remainder ſhall have the writ, ex gravi querela, to execute that deviſe. (New Nat. Br. 441.) Alſo where a tenant in tail dies without iſſue of his body, the heir of the donor, or he who hath the reverſion of the land, ſhall have this writ in the nature of a *formedon in the reverter*. Ibid.

If a deviſor's heir be ouſted by the deviſee, by entry on the lands, he may not afterwards have this writ, but is to have his remedy by the ordinary courſe of the common law. (Co. Litt. 111.) If the claimant's title accrues within 20 years, the moſt eligible method of proceeding, is now by *ejectment*; which ſee.

EXHÆREDATIO. See Exheredation.

EXHALATION, a fume or ſteam exhaling or iſſuing from a body, and diffuſing itſelf in the atmoſphere.

The terms exhalation and vapour are ordinarily uſed indifferently, but the more accurate writers diſtinguiſh them; appropriating the term vapour to the moiſt fumes raiſed from water and other liquid bodies; and exhalation to the dry ones emitted from ſolid bodies, as earth, fire, minerals, ſulphurs, ſalts, &c. In this ſenſe, exhalations are dry ſubtile corpuſcules, or effluvia, looſened from hard terreſtrial bodies, either by the heat of the ſun, or the agitation of the air, or ſome other cauſe, and emitted upwards to a certain height of the atmoſphere, where, mixing with the vapours, they help to conſtitute clouds, and return back again into dews, miſts, rains, &c.

Sir Iſaac Newton takes true and permanent air to be formed from the exhalations raiſed from the hardeſt and moſt compact bodies. See Air, Damp, Evaporation, and Vapour.

EXHAUSTED Receiver, a glaſs, or other veſſel, applied on the plate of an air-pump, and having the air extracted out of it by the working of the engine. (See Air-*pump*.) Things placed in an exhauſted receiver, are ſaid to be *in vacuo*. See Vacuum.

EXHAUSTIONS, in *Mathematics*. Method of exhauſtions is a way of proving the equality of two magnitudes, by a *reductio ad abſurdum*; ſhewing, that if one be ſuppoſed either greater or leſs than the other, there will ariſe a contradiction. The method of exhauſtions was of frequent uſe among the ancient mathematicians, as Euclid, Archimedes, &c. It is founded on what Euclid ſays in his tenth book, *viz.* that thoſe quantities whoſe difference is leſs than any aſſignable quantity, are equal; for if they were unequal, be the difference ever ſo ſmall, yet it may be ſo multiplied, as to become greater than either of them; if not ſo, then it is really nothing.

This he aſſumes in the proof of prop. 1. book x. which imports, that if, from the greater of two quantities you take more than its half, and from the remainder more than its half, and ſo continually, there will, at length, remain a quantity leſs than either of thoſe propoſed.

On this foundation it is demonſtrated, that if a regular polygon of infinite ſides be inſcribed in or circumſcribed about a circle, the ſpace, which is the difference between the circle and the polygon, will by degrees be quite exhauſted and the circle become equal to the polygon.

EXHEBENUM, in *Natural Hiſtory*, the name of a white and ſmooth ſtone, uſed by the ancient artificers in poliſhing gold. It ſeems to be the ſame with the lapis Samius, a ſmall ſmooth ſtone which they often found in the Samian earth.

EXHEREDATION, Exhæredatio, in the *Civil Law*, with us ordinarily called diſinheriting, is the father's excluding his ſon from inheriting his eſtate.

There are fourteen cauſes of exheredation expreſſed in Juſtinian's Novel; without ſome one of which cauſes, he decrees the exheredation null, and the teſtament inofficious, as the civilians call it.

Indeed, by the ancient Roman law, the father might pronounce exheredation without any cauſe; but the rigour of this law was reſtrained and moderated by Juſtinian.

EXHIBIT, in *Law*. When a deed, acquittance, or other writing is, in a chancery ſuit, exhibited, to be proved by witneſs, and the examiner writes on the back, that it was ſhewed to the witneſs at the time of his examination; this is called an exhibit.

EXHIBITION, a producing or ſhewing of titles, authorities, and other proofs of a matter in conteſt.

Anciently, they uſed the phraſe, exhibition of a tragedy, comedy, or the like; but now we ſay repreſentation in lieu thereof.

Exhibition, *Exhibitio*, in our *Old Writers*, is uſed for an allowance of meat and drink, ſuch as was cuſtomary among the religious appropriators of churches, who uſually made it to the depending vicar. The benefactions ſettled for the maintaining of ſcholars in the univerſities, not depending on the foundation, are alſo called exhibitions.

EXHORTATION, Hortatio, in *Rhetoric*, differs only from *ſuaſion*, in that the latter principally endeavours to convince the underſtanding, and the former to work on the affections.

EXHUMATION, of *ex*, *out of*, and *humus*, *ground*, the act of digging up a body interred in holy ground, by the authority of the judge.

In France, the exhumation of a dead body is ordered, upon proof that he was killed in a duel. By the French laws, a parſon has a right to demand the exhumation of the body of one of his pariſhioners, when interred out of the pariſh without his conſent.

EXIDEUIL, in *Geography*, a town of France, in the department of Dordogne, and chief place of a canton, in the diſtrict of Perigueux; 18 miles N. E. of Perigueux. The place contains 870, and the canton 8378 inhabitants, in 15 communes, and on a territorial extent of 190 kiliometres.

EXIGENCE, or Exigency, that which a thing requires, or which is expedient and ſuitable thereto.

EXIGENT, or Exigi Facias, in *Law*, a writ which lies where the defendant, in a perſonal action, cannot be found, nor any thing of his within the county, whereby to be attached, or diſtrained. It is directed to the ſheriff, ordering him to proclaim and call the party five county-court days ſucceſſively, and charge him to appear, under pain of outlawry.

The ſame writ alſo lies in an indictment of felony, where the party indicted cannot be found.

It is called an exigent, becauſe it exigit, *i. e.* exacts, or requires the party to appear, or, by forthcoming, to anſwer the law. If he appear not at the laſt day's proclamation, he is ſaid to be *quinquies*, or *quinto exactus*, and then is outlawed. See OUTLAWRY.

EXIGENTERS, four officers of the court of common pleas, who make all exigents and proclamations, in all actions where the proceſs of outlawry lies.

Anciently, the making writs of *ſuperſedeas* upon ſuch exigents as paſſed in their offices, did likewiſe belong to them; but this branch of buſineſs was taken from them under king James I. and committed to a particular officer in the court of common pleas, created by patent. See SUPERSEDEAS.

EXILE, BANISHMENT. See BANISHMENT.

Among the Romans, the word exile, *exilium*, properly ſignified an interdiction or excluſion from water and fire; the neceſſary conſequence of which was, that the interdicted perſon muſt betake himſelf into ſome other country, ſince there was no living without fire and water. Thus Cicero ad Herenn. obſerves, that the form of the ſentence did not expreſs exile, but only *aquæ & ignis interdictio*. See INTERDICTION.

The ſame author remarks, that exile was not properly a puniſhment, but a voluntary flying, or avoiding the puniſhment decreed: "Exilium non eſſe ſupplicium, ſed perfugium, portuſque ſupplicii." Pro Cæcina.

He adds, that there was no crime among the Romans, as among other nations, puniſhed with exile; but exile was a recourſe people flew voluntarily to, in order to avoid chains, ignominy, ſtarving, &c.

The Athenians frequently ſent their generals, and great men into exile, out of envy of their merits, or diſtruſt of their too great authority.

EXILE is ſometimes alſo uſed for the relegating a perſon into a place, whence he is obliged not to ſtir without leave.

The word is derived from the Latin *exilium*, or from *exul*, a baniſhed perſon; and that, probably, from *extra ſolum*, out of his native ſoil.

Figuratively, we uſe the phraſe, *honourable exile*, for an office, or employment, which obliges a man to reſide in ſome remote or diſagreeable place.

Under the reign of Tiberius, remote employments were a kind of myſterious exiles. A biſhopric, or even a lord-lieutenancy, in Ireland, has been ſometimes deemed a kind of exile. A reſidence, or embaſſy, in ſome barbarous country, is alſo a ſort of exile. Accordingly, it is ſaid, that the king cannot even conſtitute a man deputy, or lord-lieutenant of Ireland, nor make one a foreign ambaſſador againſt his will, ſince theſe in reality might be no more than honourable exiles. 2 Inſt. 46.

EXILES, in *Geography*, a town of France, in the department of the Po, on the river Doria; 5 miles W. S. W. of Suſa. This town was fortified, and guarded one of the paſſes into Piedmont; but by the treaty of peace between the French republic and the king of Sardinia, in 1796, the fortifications were to be razed.

EXILIUM, in *Law*, ſignifies a ſpoiling; and, by the ſtatute of Marlbridge, it ſeems to extend to the injury done to tenants, by altering their tenure, ejecting them, &c. And this is the ſenſe that Fleta determines; who diſtinguiſhes between vaſtum, deſtructio, and exilium. For he tells us, that vaſtum and deſtructio are almoſt the ſame, and are properly applied to houſes, gardens, or woods; but exilium is when ſervants are enfranchiſed, and afterwards unlawfully turned out of their tenements. Flet. lib. i. cap. 11. Stat. Marlb. cap. 25.

EXIMA, in *Geography*, a tribe or kabyle in the province of Suſa, in the ſouthern diviſion of Morocco; amounting to about 11,000 perſons.

EXIMENO, ANTONIO, in *Biography*, a Spaniſh Ex-Jeſuit, who had reſided at Rome many years, and publiſhed in that city, in 4to. 1744, a work, intitled "Dell' Origene e della Regole della Muſica," in which, too confident of his own powers, he imagined himſelf capable, with four years ſtudy only, intuitively to frame a better ſyſtem of counterpoint than that upon which ſo many great muſicians had been formed. Poſſeſſed of eloquence, fire, and a lively imagination, his book has been called in Italy, "a whimſical romance upon the art of muſic, in which is diſcovered a rage for pulling down, without the power of rebuilding." The author has certainly, with ſhrewdneſs and accuracy, ſtarted ſeveral difficulties, and pointed out imperfections in the theory and practice of muſic, as well as in the particular ſyſtems of Tartini and Rameau; but his own reſources and experience are totally inſufficient to the taſk of correcting the errors of the old ſyſtem, or forming a new one that is more perfect. He has more eloquence of language than ſcience in muſic. His reaſoning is ingenious and ſpecious, even when his data are falſe; but his examples of compoſition are below contempt; and yet, they are courageouſly given as models for ſtudents, ſuperior to thoſe of the old great maſters of harmony.

When Sig. Eximeno calls fugues and canons Gothic compoſitions, he does not diſgrace their ſtructure any more than he would our cathedrals, by calling them Gothic buildings. Let fugues be baniſhed from the theatres and private concerts, if he pleaſes, and let them remain in the church as a diſtinct ſpecies of compoſition, where they were firſt generated, and where they can never become vulgar or obſolete. The ſtyle being naturally grave, requires muſical learning, and will, by the ſolemnity of the words and place of performance, continue to be reverenced and reſpected. It is allowed that variety is more wanted in muſic than in any other art, and by totally excommunicating canons and fugues from the church, the art will loſe one capital ſource of variety, as well as ingenuity; and intelligent hearers will be deprived of a ſolemn ſtyle of muſic, to be heard no where elſe.

EXINANITION, the ſame as evacuation.

EXISTENCE, that whereby a thing has an actual eſſence, or is ſaid *to be*, *eſſe*.

The notion of exiſtence is applicable not only to a created but an uncreated ſubſtance: but it muſt be added, that the exiſtence of created ſubſtances, and eſpecially corporeal ones, implies a reſpect to place, time, and even an efficient cauſe; whence the ſchoolmen generally define it, that whereby a thing is formally and extrinſically without [*extra*] its cauſes, and that here, and now.

Exiſtence and eſſence come very near the nature of each other; in effect, they only differ in that we have different manners of conceiving the ſame thing.

For, 1. Eſſence is uſually explained either by the firſt, nobleſt, and radical attribute of the thing, *e. gr.* that of body, by extenſion; that of mind by thinking, &c. or by ſpecifying all the intrinſic attributes; and exiſtence, either by ſpecifying all place and all time, as in that of God; or by ſpecifying ſome definite place, and time, together with the cauſe, as in the creatures.

2. The foundation and occaſion of this diſtinction is

this: that eſſence belongs to the queſtion, *What is it? Quid eſt?* but exiſtence to the queſtion, *Is it? An eſt?*

3. Exiſtence, neceſſarily pre-ſuppoſes eſſence, and cannot be conceived without it; but eſſence may be conceived without exiſtence; in that eſſence belongs equally to things that are in *potentia*, and *in actu*; but exiſtence only to thoſe *in actu*. Note, however, that this does not obtain in God, about whoſe nature and eſſence the mind cannot think without conceiving his exiſtence.

We have divers ways of arriving at the knowledge of the exiſtence of things. Our own exiſtence we know by intuition; the exiſtence of a God, by demonſtration; and that of other things, by ſenſation.

As for our own exiſtence, we perceive it ſo plainly, that it neither needs, nor is it capable of any proof. In every act of ſenſation, reaſoning, or thinking, we are conſcious to ourſelves of our own being, and in this matter come not ſhort of the higheſt degree of certainty.

As to our knowledge of the exiſtence of a God, though he has given us no innate ideas of himſelf, yet, having furniſhed us with faculties of ſenſe, perception, and reaſon, we can never want a clear proof thereof. See GOD.

The knowledge of the exiſtence of other things, *i. e.* of external objects, bodies, a world, &c. we only have by ſenſation; for there being no neceſſary connection of real exiſtence with any idea a man hath in his memory, nor of any other exiſtence but that of God, with the exiſtence of any particular man; no particular man can know the exiſtence of any other being, but only when, by actually operating upon him, it makes itſelf be perceived by him. The having the idea of any thing in our mind, no more proves the exiſtence of that thing than the picture of a man evidences his being in the world, or the viſions of a dream make a true ſtory. It is, therefore, the actual receiving of ideas from without that gives us notice of the exiſtence of other things, and makes us know that ſomething doth exiſt at that time without us, which cauſes that idea in us, though we neither know nor conſider how it doth it.

This notice which we have by our ſenſes, of the exiſtence of things without us, though it be not altogether ſo certain as intuition and demonſtration, yet deſerves the name of knowledge, if we perſuade ourſelves that our faculties act and inform us right concerning the exiſtence of thoſe objects that affect them.

Now, beſides the aſſurance of our ſenſes themſelves, that they do not err in the information they give us of the exiſtence of things without us, we have other concurrent reaſons, as, 1. It is plain thoſe perceptions are produced in us by exterior cauſes affecting our ſenſes; becauſe thoſe that want the organs of any ſenſe never have the ideas belonging to that ſenſe produced in their minds. 2. Becauſe we find we cannot avoid having thoſe ideas, produced in our minds. When our eyes are ſhut, we can at pleaſure recal to our mind the ideas of light or the ſun, which former ſenſations had lodged in our memories; but if we turn our eyes towards the ſun, we cannot avoid the idea which the light or the ſun then produces in us, which ſhews a manifeſt difference between thoſe ideas laid up in the memory, and ſuch as force themſelves upon us, and we cannot avoid having; beſides, there is no one who doth not perceive the difference in himſelf between actually looking upon the ſun, and contemplating the idea he has of it in his memory; and therefore he hath certain knowledge, that they are not both memory or fancy. 3. Add to this, that many ideas are produced in us with pain, which we afterwards remember without the leaſt offence; thus, the pain of heat or cold, when the idea of it is received in our mind, gives us no diſturbance, which, when felt, was very troubleſome; and we remember the pain of hunger, thirſt, head ach, &c. without any pain at all, which would either never diſturb us, or elſe conſtantly do it, as often as we thought of it, were there nothing more but ideas floating in our minds, and appearances entertaining our fancies, without the real exiſtence of things affecting us from abroad. 4. Our ſenſes, in many caſes, bear witneſs to the truth of each other's report concerning the exiſtence of ſenſible things without us: he that doubts, when he ſees a fire, whether it be real, may feel it too if he pleaſes; and, by the exquiſite pain, may be convinced, that it is not a bare idea or phantom. Such is Mr. Locke's demonſtration of the exiſtence of external bodies.

The ingenious Dr. Berkeley has a different ſyſtem: external bodies, he contends, have no exiſtence, but in a mind perceiving them; that is, they only exiſt, *quatenus*, they are perceived; and of this he has given us what he and ſeveral others account a demonſtration.

In reality, "that neither our thoughts, paſſions, nor ideas formed by the imagination, exiſt without the mind, he obſerves, is allowed; and that the various ſenſations impreſſed on the mind, whatever objects they compoſe, cannot exiſt otherwiſe than in a mind perceiving them, is not leſs evident. This appears from the meaning of the term exiſt, when applied to ſenſible things. Thus, the table I write on, exiſts, *i. e.* I ſee and feel it; and were I out of my ſtudy, I ſhould ſay it exiſted; *i. e.* that were I in my ſtudy I ſhould ſee and feel it as before. There was an odour; *i. e.* I ſmelt it, &c. but the exiſtence of unthinking beings, without any relation to their being perceived, is unintelligible, their *eſſe* is *percipi*." The notion of bodies, he endeavours to ſhew, is founded on the doctrine of abſtract ideas: "What are light and colours, heat and cold, extenſion and figure; in a word, the things we ſee and feel, but ſo many ſenſations, notions, ideas, or impreſſions on the ſenſe? And is it poſſible to ſeparate, even in thought, any of theſe from perception? The ſeveral bodies, then, that compoſe the frame of the world, have not any ſubſiſtence without a mind: their *eſſe* is to be perceived or known; and as long as they are not perceived by me, nor any other thinking being, they have no ſhadow of exiſtence at all. The things we perceive are colour, figure, motion, &c. that is, the idea of thoſe things; but has an idea any exiſtence out of the mind? To have an idea is the ſame thing as to perceive; that, therefore, wherein colour, figure, &c. exiſt, muſt perceive them. It is evident, therefore, there can be no unthinking ſubſtance or ſubſtratum of thoſe ideas: but you may argue, if the ideas themſelves do not exiſt without the mind, there may be things like them, whereof they are copies or reſemblances, which exiſt without the mind; it is anſwered, an idea can be like nothing but an idea; a colour or figure can be like nothing elſe but another figure or colour. It may be farther aſked, whether thoſe ſuppoſed originals, or external things, whereof our ideas are the pictures, be themſelves perceivable or not? If they be, they are ideas; if they be not, I appeal to any one, whether it be ſenſe to ſay, a colour is like ſomewhat which is inviſible; hard or ſoft, like ſomewhat intangible, &c. Some diſtinguiſh between primary and ſecondary qualities; the former, *viz.* extenſion, ſolidity, figure, motion, reſt, and number, they maintain have a real exiſtence out of the mind; as for the latter, under which come all other ſenſible qualities, as colours, ſounds, taſtes, &c. they allow the ideas we have of them are not reſemblances of any things exiſting without the mind, or unperceived, but depend on the ſize, texture, motion, &c. of the minute particles of matter. Now, it is certain, that thoſe primary qualities are inſeparably united with the other ſecondary ones, and cannot even in thought be abſtracted from them, and therefore muſt only exiſt in the mind. Can any man conceive the extenſion and motion of a body without its other ſenſible qualities? For my part, I find it impoſſible to frame an idea of a body extended and moving, without giving it ſome colour, &c. In effect, extenſion, figure, and motion, abſtracted from all other qualities, are inconceivable; where the others, therefore, are, there theſe too muſt be, *i. e.* in the mind, and no where elſe. Again, great and ſmall, ſwift and ſlow, are allowed to exiſt no where without the mind, being merely relative and changing, as the frame or poſition of the organ changes: the extenſion, therefore, that exiſts without the mind, is neither great nor ſmall, the motion neither ſwift nor ſlow; *i. e.* they are nothing. That number is a creature of the mind, is plain (even though the other qualities were allowed to exiſt) from this; that the ſame thing bears a different denomination of number, as the mind views it with different aſpects; thus, the ſame extenſion is 1, or 3, or 36, as the mind conſiders it, with reference to a yard, a foot, or an inch. Nay, many of the modern geometricians hold, that a finite line may be divided into an infinite number of parts, and each of theſe infiniteſimals, into an infinity of others; and ſo on, *in infinitum*; ſo that the ſame thing is either unity or infinity, either no number or all number. In effect, after the ſame manner as the modern philoſophers prove colours, taſtes, &c. to have no exiſtence in matter, or without the mind; the ſame thing may be proved of all ſenſible qualities whatſoever: thus, they ſay, heat and cold are only the affections of the mind, not at all patterns of real beings exiſting in corporeal ſubſtances; becauſe the ſame body which ſeems cold to one hand, ſeems warm to another. Now, why may we not as well argue, that figure and extenſion are not patterns or reſemblances of qualities exiſting in matter; becauſe to the ſame eye, at different ſtations, or to eyes of different ſtructure, at the ſame ſtation, they appear various? Again, ſweetneſs, it is proved, does not exiſt in the thing ſapid, becauſe the thing remaining unaltered, the ſweetneſs is changed to bitterneſs, as in a fever, or by an otherwiſe vitiated palate. Is it not as reaſonable to ſay, that motion does not exiſt out of the mind? ſince, if the ſucceſſion of ideas in the mind become ſwifter, the motion, it is acknowledged, will appear ſlower, without any external alteration. Again, were it poſſible for ſolid figured bodies to exiſt out of the mind, yet it were impoſſible for us ever to know it: our ſenſes, indeed, give us ſenſation of ideas, but do not tell us that any things exiſt without the mind, or unperceived, like thoſe which are perceived: this the materialiſts allow. No other way therefore remains, but that we know them by reaſon's inferring their exiſtence from what is immediately perceived by ſenſe. But how ſhould reaſon do this, when it is confeſſed, there is not any neceſſary connection between our ſenſations and theſe bodies? It is evident, from the phenomena of dreams, phrenſies, &c. that we may be affected with the ideas we have now, though there were no bodies exiſting without them; nor does the ſuppoſition of external bodies at all forward us, in conceiving how our ideas ſhould come to be produced. The materialiſts own themſelves unable to conceive in what manner body can act on ſpirit, or how it ſhould imprint any idea on the mind. To ſuppoſe, therefore, bodies exiſting without the mind; is little elſe than to ſuppoſe God has created innumerable beings entirely uſeleſs, and ſerving to no purpoſe at all. On the whole it appears, that the exiſtence of bodies out of a mind perceiving them, is not only impoſſible, and a contradiction in terms; but, were it poſſible, nay real, it were impoſſible we ſhould ever know it. And again, that ſuppoſing that there are no ſuch things, yet we ſhould have the very ſame reaſon to ſuppoſe there were that we now have. Suppoſe, *e. gr.* an intelligence affected with the ſame train of ſenſations, impreſſed in the ſame order, and with the ſame vividneſs, would it not have all the reaſon to believe the exiſtence of bodies repreſented by his ideas that we have? All our ideas and ſenſations are viſibly inactive; nay, the very being of an idea implies paſſiveneſs and inertneſs; ſo that it is impoſſible for an idea to do any thing, or, in ſtrictneſs, be the cauſe of any thing; it cannot, therefore, be the reſemblance or pattern of any active being, unleſs oppoſites can be ſaid to reſemble one another. Now, we find a continual ſucceſſion of ideas of the mind; but theſe, it has been proved, do not depend on any external body as their cauſe; it remains, therefore, that their cauſe is an incorporeal active ſubſtance or ſpirit: for that I am not the cauſe of my own ideas, is plain from this, that when I open my eyes in broad day-light, I cannot help ſeeing various objects. Now, the fixed rules or methods wherein the mind we depend on excites in us the ideas of ſenſe, are called *laws of nature*; theſe we learn by experience, which teaches us, that ſuch and ſuch ideas are attended with ſuch and ſuch other ideas in the ordinary courſe of things. Ideas are not any how, and at random, produced; there is a certain order and connection eſtabliſhed among them like that of cauſe and effect; and there are ſeveral combinations of them made in a very regular artful manner, which we call *bodies*; and the ſyſtem of thoſe, *the world*. In ſtrictneſs, however, the connection of ideas does not imply the relation of cauſe and effect, but only of a mark or ſign of the thing ſignified: the fire I ſee is not the cauſe of the pain I feel, but the mark that forewarns me of it; the noiſe I hear is not the effect of this or that motion or colliſion of natural bodies, but the ſign thereof. The Carteſians own ſomewhat like this: the action of bodies on our organs, ſay they, is not the efficient cauſe of our ideas and perceptions, but only the occaſional cauſe, which determines God to act on the mind, according to the laws of the union of the ſoul and body." (See CAUSE.) Dr. Berkeley, indeed, taking away bodies, takes away what theſe philoſophers account the occaſions of their ideas: "by an occaſion, he ſays, muſt either be meant the agent that produces an effect, or ſomething obſerved to accompany or go before it in the ordinary courſe of things; but matter is allowed to be paſſive and inert, and cannot therefore be an agent or efficient cauſe; and this matter primitively, and in itſelf, is allowed imperceivable, and devoid of all particular ſenſible qualities; *i. e.* it has not this or that particular colour, this or that particular figure, &c. but has colour in the general, figure in the abſtract, &c. but an abſtract is no object of ſenſe; matter, therefore, cannot be the occaſion of our ideas in the latter ſenſe." See Berkel. Princip. of Human Knowl. See ABSTRACTION.

How far the great argument of the maintainers of a material world from the impoſſibility of God's deceiving us, and from the evidence that he does ſo, if there be no ſuch thing, will go againſt this reaſoning, we leave to the reader. See Stanl. Hiſt. Philoſoph. part xii. p. 816. where the objections of the ancient Pyrrhoniſt to the exiſtence of bodies are recited.

As to the exiſtence of ſpirits, Mr. Locke allows, that our having ideas of them does not make us know that any ſuch things do exiſt without us; or that there are any finite ſpirits, or any other ſpiritual beings, but God. We have ground from revelation, and ſeveral other reaſons, to believe with aſſurance, that there are ſuch creatures; but our ſenſes, being not able to diſcover them, we want the means of knowing their particular exiſtence; for we can no more know that there are infinite ſpirits really exiſting by the idea we have of ſuch beings, than by the ideas any one has of fairies or centaurs, he can come to know that things anſwering to thoſe ideas do really exiſt.

EXIT, properly expreſſes the departure of a player from off the ſtage, when he has acted his part.

The word is alſo uſed in a figurative ſenſe, to expreſs an kind of departure, even death.

EXITERIA, Eξιτηρια, in *Antiquity*, oblations or prayers to any of the gods for a proſperous expedition or journey. There were alſo feaſts under this denomination, which were celebrated by the Greeks, with ſacrifices and prayers, when their generals undertook expeditions againſt any enemy.

EXITURA, from *exeo*, *to come from*, in *Surgery*, an abſceſs which diſcharges matter.

EXITUS, Issues, in *Law*, the yearly rents or profits of lands or tenements. See Issue, &c.

EXLEGALITUS, the ſame with an outlawed perſon. See Outlaw.

EXLUNZA, in *Geography*, a town of Spain, in the province of Leon; 5 miles S.E. of Leon.

EX MERO MOTU, in *Law*, formal words uſed in the king's charters and letters patent, ſignifying that he does what is contained therein of his own will and motion, without petition or ſuggeſtion of any other.

The effect of theſe words is to bar all exceptions that might be taken to the inſtrument, by alleging that the prince in paſſing ſuch charter was abuſed by falſe ſuggeſtions.

EXMES, in *Geography*, a town of France, in the department of the Orne, and chief place of a canton in the diſtrict of Argentan; 9 miles E. of Argentan. The place contains 618, and the canton 7358 inhabitants, in 31 communes, and on a territorial extent of 147½ kiliometres.

EXMOUTH, though a watering place of conſiderable ſize and repute, is only a hamlet belonging to the pariſh of Littleham, in the county of Devon, England. As its name imports, it ſtands near the mouth of the river Exe. The buildings in general are low, but here are ſome good houſes inhabited by genteel families. The vicinity is highly pictureſque: from an eminence, called Chapel-hill, a line of coaſt preſents itſelf, which extends from Exeter to Berry-head, a diſtance of about twenty miles. This line is broken by ſeveral hills, behind which ſpring up ſome bold towering head-lands.

The plantations of Mamhead and Powderham-caſtle heighten the beauty of the proſpect; which is additionally embelliſhed by the noble buildings connected with thoſe eſtates. Holinſhed mentions a caſtle erected here to defend the entrance of the haven; and ſome ſlight veſtiges of embraſures are ſtill apparent. Exmouth is ſituated 168 miles W. from London; and contains, including the pariſh of Littleham, 432 houſes, and 1909 inhabitants, of whom 570 are returned as employed in trade or manufacture. Polwhele's Devonſhire, vol. ii.

EXOACANTHA, in *Botany*, from εξακανθουμαι, *to be armed with ſpines*; Mart. Mill. Dict. v. 2. Billard. Pl. Syr. faſc. 1. 10. Willd. Sp. Pl. v. 1. 1378. Claſs and order, *Pentandria Digynia*. Nat. Ord. *Umbellatæ*.

Gen. Ch. *General Umbel* of many ſpreading rays; the inner ones gradually ſhorter; the innermoſt extremely ſhort; *partial* of many rays. *General involucrum* moſtly of 12 channelled leaves, with ſpinous points; *partial* halved, its intermediate leaf very long, exactly like thoſe of the general involucrum. *Perianth* ſcarcely perceptible. *Cor.* uniform, of five equal, inflexed, heart-ſhaped petals. *Stam.* Filaments five, longer than the corolla; anthers roundiſh. *Piſt.* Germen inferior, ovate; ſtyles two, ſhort, ſtraight; ſtigmas ſimple. *Fruit* ſomewhat ovate, ſtriated, ſeparable into two parts. *Seeds* two, ovate, convex and ſtriated on the outſide, flat on the inner.

1. E. *heterophylla*. Billard. Syr. faſc. 1. t. 2. Gathered by M. La Billardiere near Nazareth. *Root* biennial, tap-ſhaped. *Stem* two feet, or more in height, ſlightly zig-zag, branched, round, ſtriated, leafy, ſmooth. *Leaves* pinnate, ſmooth; leaflets one or two pair with an odd one; thoſe of the radical leaves ovate, ſharply ſerrated, often cut; thoſe of the ſtem-leaves lanceolate, acute, narrow, entire, the odd ones very long. *Umbels* terminal, ſolitary, of about 40 rays; the partial ones of about as many, which are equal and crowded. The *involucral* leaves are very long, prominent, curved downwards, each ending in a ſharp ſpine. *Petals* white. *Anthers* yellowiſh. This plant is a-kin to the *Echinophora*, (ſee that article,) but differs generically in the want of a perianth, and in having all the flowers perfect and regular, with naked fruit, not imbedded in the involucrum.

EXOCARPUS, from εξ, *out of*, and καρπος, *a fruit*, becauſe the ſeed ſtands naked at the top of a fleſhy baſis or receptacle reſembling a pulpy fruit. Billard. Voy. Engl. ed. v 1. 167. t. 14. Claſs and order, *Polygamia Monoecia*, or rather, perhaps, *Pentandria Monogynia*. Nat. Ord. *Terebintaceæ*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, in five deep roundiſh, equal ſegments. *Cor.* none. *Stam.* Filaments five, inſerted into the calyx between its ſegments: anthers ſmall, roundiſh. *Piſt.* Germen ſuperior, globular; ſtyle, ſhort, ſolitary; ſtigma peltate, orbicular. *Peric.* none. *Seed* a roundiſh nut, of one cell, ſtanding on the top of an elliptical, hollow, fleſhy *receptacle*, about thrice its own ſize. Some flowers have an abortive germen, others have no ſtamens, all on the ſame plant.

Eſſ. Ch. Calyx inferior, in five deep ſegments. Corolla none. Stamens five. Piſtil one. Stigma peltate. Nut of one cell, ſtanding on a hollow fleſhy receptacle.

E. *cupreſſiformis*, the only known ſpecies, is an evergreen tree, found in New Holland by M. La Billardiere, as well as by Dr. White. It bears innumerable, compound, pendulous, angular, leafleſs *branches*, at whoſe extremities are ſituated the minute greeniſh *flowers*, produced in the month of May. The *fruit* is red, not unlike that of the yew in ſize, form, and colour, but the ſeed is perfectly expoſed to view. This plant has been raiſed from ſeed in England, but whether it ſtill remains in the gardens we know not. Its ſingularity entitles it to notice, and, we believe, it is by no means very tender, if not hardy enough to bear our winters in the open air.

EXOCATACŒLUS, in *Antiquity*, a general denomination, under which were included ſeveral grand officers of the church at Conſtantinople; as, the grand œconomus, grand ſacellarius, grand maſter of the chapel, grand ſcevophylax, or keeper of the veſſels, grand chartophylax, the maſter of the little chapel, and the protecdicus, or firſt advocate of the church.

There are many opinions with reſpect to the etymology of this term. F. Goar apprehends, that all the inferior prieſts were called Καταχοιλοι, *catacœli q. d.* people of a low condition, and that their ſuperiors were called exocatacœli, *q. d.* people out of the number of catacœli, or above them. Upon the whole, however, he adheres to the ſentiment of G. Coreſius, who ſays, that the patriarchal palace, and the apartments of the ſyncellus, and of the monks in the patriarch's ſervice, were in a very low part of the city which, with regard to the reſt, ſeemed a valley or pit; and that the officers above mentioned had their ſeveral houſes or palaces εξω, out of the valley; whence the name exocatacœli. M. Du-Cange derives the appellation from their being above the level or rank of the other clerks, and ſeated at church, &c. in more honourable places erected for that purpoſe on either ſide of the patriarch's throne.

The exocatacœli were of great authority: in public aſſemblies they had the precedence of biſhops; and in the patriarchate of Conſtantinople did the office of deacons, as the cardinals originally did in the church of Rome. Accordingly, in the letter of John IX. to the emperor Baſilius Leo, they are called cardinales.

At firſt they were prieſts; but ſome patriarchs of Conſtantinople, whom Codin does not mention, would have them for the future to be no more than deacons. The reaſon was, that being prieſts, each of them had their ſeveral churches, wherein they were to officiate on all the grand feſtival days; ſo that it unhappily fell out, the patriarch, on the moſt ſolemn days, was deſerted by all his chief miniſters.

EXO'CHAS, or Exóche, from εξω, *without*, and εχω, *to have*, in *Surgery*, a kind of excreſcence on the outſide of the anus.

EXOCIONITÆ, Exocionites, in *Church Antiquity*. The Arians were firſt called Exocionites, becauſe, when expelled the city by Theodoſius the Great, they retired into a place called Exocionium, and there held their aſſemblies. Juſtinian gave the orthodox all the churches of the heretics, excepting that of the Exocionites.

The word is derived from Εξακιονιον, or Εξωκιονιον, the name of the place above mentioned. Codin, in his Origines, ſays, that the Exocionium was a place encompaſſed with a wall, built and adorned by Conſtantine; and that without the circumference of the wall there was a column, with a ſtatue of that emperor, whence the place took its name, *viz.* from εξω, *without*, and κιων, *column*.

EXOCŒTUS, in *Ichthyology*, a genus of the abdominal kind of fiſhes; the head is ſcaly; mouth without teeth; jaws connected at each ſide; in the gill-membrane ten rays; body whitiſh; abdomen angulated; pectoral fins large, and formed for flying; anterior part of the rays carinated. Theſe are the flying fiſhes of Engliſh authors.

Species.

Volitans. Abdomen carinated each ſide. Linn. Amœn. Acad. *Exocœtus*, Gronov. *Winged flying fiſh*, Donov. Brit. Fiſhes.

This is an inhabitant of the American and Red ſeas, and alſo thoſe of the warmer parts of Europe: in one or more inſtances it has been known to appear as far north as Britain. The vaſtly diſproportionate magnitude of the pectoral fins in this genus of fiſhes affords them extraordinary advantage in effecting their eſcape when cloſely purſued by their voracious enemies in the water; but this facility of eſcape expoſes them oftentimes to the attacks of other adverſaries, and they not unfrequently elude the purſuit of the bonito, or the porpeſſe, in their native element, to become the prey of gulls, corvorants, and other aquatic birds that hover over the water to ſeize on them in their aerial flight. They remain only for a ſhort time ſuſpended in the air before they again dive into the water, and after a pauſe of a few moments emerge again at ſome diſtance. They often quit the water in ſhoals, and ſometimes alight on board ſhips in great numbers. The fleſh is occaſionally eaten.

The colour is ſilvery, with the back rather blueiſh; the pectoral fins blueiſh, edged with yellow; ventral fins and extremity of the tail ſometimes reddiſh.

Exiliens. Ventral fin reaching to the tail. Gmel. Bloch. *Swallow fiſh.*

A native of the Mediterranean and Red ſeas. The colour is ſilvery, blue on the back, with the fins yellowiſh at the baſe, with the extremity blueiſh. The fleſh is in eſteem.

Mesogaster. Ventral fins in the middle of the abdomen. Bloch. *Atlantic flying-fiſh.*

Native of the Atlantic ſeas, and was obſerved by Plumier about the coaſts of the Antilles. The fiſh is bright ſilvery, with the back and fins blueiſh. The ſpecies is ſufficiently diſtinguiſhed by the ſituation of the ventral fins.

Commersonii. Dorſal fin marked with a dark blue ſpot.

Cepede. *Commerſonian flying-fiſh.* Shaw Gen. Zool.

Deſcribed by Commerſon as reſembling the firſt ſpecies, except in having a dark blue ſpot on that part of the dorſal fin neareſt the tail, and the ventral fins placed beyond the middle of the abdomen, their tips reaching to about the middle of the anal fin.

The laſt mentioned ſpecies, we are inclined to believe, may not differ ſpecifically from the fiſh deſcribed by Bloch under the name of meſogaſter: the evolans and volitans of Linnæus, according to ſome writers, conſtitute but one ſpecies; and we ſhould alſo ſpeak with diffidence of the fiſh denominated exocœtus non volitans by Forſkal; is it a variety of volitans β, as Gmelin conſiders, or rather an error ariſing from ſome accidental circumſtance?

EXOCY'STE, or Exocy'stis, from εξω, *without*, and κυστις, *the bladder*. Writers define this term of ſurgery a prolapſus of the lining of the bladder. We are probably to underſtand by the word, a protruſion of the lining outward, between the faſciculi of the muſcular coat of this organ, an occurrence which we know does really ſometimes take place. Stones have been found protruded in this manner, carrying along with them a part of the lining of the bladder.

EXODIARY, Exodiarius, in the *Ancient Roman Tragedy*, was a droll, or mime, who appeared on the ſtage when the tragedy was ended, and performed what they called the exodium, or concluſion of the ſhew, to divert the company.

EXODIUM, Εξοδιον, in the *Ancient Greek Drama*, was one of the four parts or diviſions of a tragedy.

The word is formed from the Greek, εξοδος, *going out*, *digreſſion*, of εξ and οδος, *way*, *road*. Feſtus, lib. v. calls it *exitus*.

The exodium, according to Ariſtotle, was ſo much as was rehearſed after the chorus had ceaſed to ſing for the laſt time; ſo that exodium with them was far from being what the epilogue is with us, as ſeveral people have imagined it was.

The exodium was ſo much of the piece as included the cataſtrophe and unravelling of the plot; which cataſtrophe, &c. in pieces regularly compoſed, always began after the laſt ſinging of the chorus, anſwering nearly to our fourth and fifth acts. M. Dacier's Comment. on Ariſtotle's Poetics, chap. 12. See Catastrophe and Chorus.

Among the Romans the exodium was a different thing; it was pretty nearly what farces are with us. After the tragedy was over, came a pantomime on the ſtage, called the exodiarius, who, by his grimace, jeſting, and buffoonery, diverted the people, compoſed their minds, and wiped away the tears which the tragic ſpectacle had occaſioned to be ſhed.

Viginere on T. Livy ſays, the exodium conſiſted of certain

tain humorous drolling verſes, rehearſed by the youth at the end of the fabulæ atellanæ, and anſwering to our farces. In another place, the ſame author ſays, that the exodia were a kind of interludes in the intervals between the acts, partly fable and pleaſantry, partly muſic, &c. to give time both for the ſpectators and actors to recover breath. The paſſage in Livy, whence he takes the notion, is lib. vii. dec. 1. "Ridicula intexta verſibus, quæ juventus inter ſe more antiquo jactare cœpit, eaque conferta ſunt fabulis potiſſimum atellanis." See alſo Juvenal.

> "Urbicus exodio riſum movet Attellanæ
> Geſtibus Autonoes."

Exodium, in the *Septuagint*, ſignifies the end or concluſion of a feaſt.

The Hebrew text calls the day עערת, which the Seventy render Εξοδιον.

In particular, exodion is uſed for the eighth day of the feaſt of tabernacles, which, it is ſaid, had a ſpecial view to the commemoration of the Exodus, or departure out of Egypt, though there is nothing of it expreſſed in Scripture.

Exodium, was alſo the name of a ſong ſung at the concluſion of a meal or feaſt.

EXODUS, the ſecond of the five books of Moſes.

The word in its original Greek, Εξοδος, literally imports a *going out*, or *journey*; and was applied to this book, becauſe the hiſtory of the Iſraelites' paſſage out of Egypt is related therein. Beſides this, it contains the ſtory of what was tranſacted in Egypt from the death of Joſeph to the delivery of the Jews; as well as what paſſed in the wilderneſs, and particularly at mount Sinai, to the building of the tabernacle.

The Hebrews call it *veelle ſemoth*, q. d. *hæc nomina*, theſe are the initial words of the book; for the ſame reaſon they call Geneſis, *bereſith*, q. d. *in principio*, *in the beginning*.

EX OFFICIO, in *Law*, denotes a power which a perſon has in virtue of his office, to do certain things without being applied to; as a juſtice of peace may not only grant ſurety of the peace, at the complaint or requeſt of any perſon, but he may demand and take it, ex officio, at diſcretion, &c. Dalt. 270.

By a branch of ſtatute 1 Eliz. the queen, by her letters patent, might authorize any perſons exerciſing eccleſiaſtical juriſdiction to adminiſter an oath, ex officio, whereby ſuppoſed offenders were forced to confeſs, accuſe, or clear themſelves of any criminal matter, &c. but this branch relating to this oath is repealed by 17 Car. I. cap. 11.

Ex officio *Informations*. See Information.

EXOLICETUS, in *Natural Hiſtory*, a name uſed among the writers of the middle ages to expreſs a ſmall ſtone which had ſuch a variety of colours that it dazzled, as they ſay, people's eyes in looking at them. It is ſaid to have been found in Libya. The name is probably only a corruption of the hexacontalithos of Pliny and the older writers; and this ſeems to have been no other than a name for the opal.

EXOMIS, of εξ, *out of*, and ωμος, *ſhoulder*, in *Antiquity*, a ſtraight narrow garment through which the ſhoulders appeared. It had ſomething in common with the tunic, and ſomething with the pallium. It was worn by ſlaves, ſervants, and the lower claſſes of people among the Romans.

EXOMOLOGESIS, Εξομολογησις, formed of Εξομολογεω, *I confeſs*, a term little uſed but in ſpeaking of the ancient ceremonies of repentance, whereof the exomologeſis, by us called *confeſſion*, was a part.

Some of the ancients, and particularly Tertullian, De Pœnit. cap. 9. uſe the word in a greater latitude, as comprehending the whole of repentance.

A public exomologeſis was never commanded by the church for ſecret ſins, as may be ſeen in the capitulars of Charlemagne, and the canons of divers councils.

EXOMPHALOS, from εξ, *out*, and ομφαλος, *the navel*, in *Surgery*, an umbilical hernia, or a diſeaſe which conſiſts of a protruſion of ſome of the abdominal viſcera at the navel. The ſubject will be particularly conſidered in the article Hernia.

EXONCHOMA, from εξ, *out*, and ογχος, *a tumour*, any large prominent ſwelling.

EXONEIROSIS, from εξ, *out*, and ονειρος, *dream*, a nocturnal pollution or emiſſion of the ſemen in dreams. This, if it happens but rarely, is uſually a ſign only of redundant vigour; but if it happens frequently, is a ſign of weakneſs of the ſeminal veſſels, which is moſt frequently the caſe.

EXONERATIONE Sectæ, in *Law*, a writ that lay for the king's ward, to be freed from all ſuit to the county-court, hundred-court, leet, &c. during the wardſhip. F. N. B. 158.

EXONYCHOS, of εξω, *without*, and ονυξ, *a nail*, in *Botany*, a name given by ſome of the ancient writers, among whom are Dioſcorides and Pliny, to the gromwell or lithoſpermum. See Ægonychus.

EXOPHTHALMIA, from εξ, *out*, and οφθαλμος, *the eye*, in *Surgery*, a diſeaſe conſiſting of a protruſion, or a preternatural projection of the globe of the eye from the orbit, ſo that the part cannot be duly covered by the eye-lids. The diſorder may proceed either from a morbid enlargement of the eye-ball, or what, perhaps, is a ſtill more common cauſe, ſome tumour which occupies or diminiſhes the cavity of the orbit, and conſequently diſplaces the eye.

The affection has ſeveral other names beſides exophthalmia; as, for inſtance, buphthalmus, ophthalmoptoſis, prolapſus oculi, ecpieſmos, melon, &c.

From the few words already delivered on the ſubject, it is eaſy to perceive that exophthalmia may ariſe from a variety of cauſes, and muſt of courſe require very different modes of treatment in different caſes.

One cauſe of the diſorder noticed by writers, is a diſeaſe of the fat and cellular ſubſtances ſituated in the orbit, and ſerving as a ſupport to the eye-ball. In this caſe the ſurface of the eye appears more moiſtened with tears than uſual, and the fat and cellular ſubſtance becoming thickened and indurated, forces the eye-ball forward out of its ſocket. As the eye cannot now be properly covered and ſheltered by the eye-lids, it inflames, and ulcerates on its ſurface, and the patient becomes afflicted with very ſevere and deep-ſeated pain. This ſort of cauſe is as difficult of removal, when the diſeaſe has advanced to a certain extent, as it is difficult of detection at an early period of the caſe. The famous oculiſt, Saint Yves, pretends, however, to have ſometimes diſperſed ſuch thickenings of the cellular ſubſtance in the orbit by perſevering in the exhibition of calomel and purgative medicines. The ſame author aſſures us, that he ſucceſsfully exhibited the æthiops mineralis to a ſcrofulous patient for three months, whoſe eye-ball protruded to the extent of three lines, by reaſon of a morbid thickening of the cellular ſubſtance, and an enlargement of the lachrymal gland.

When the diſeaſe does not yield to any remedies, the ſymptoms may become ſo urgent as to render the extirpation of the eye indiſpenſably neceſſary, as is proved by the following caſe related by Saint Yves. A woman's eye-ball protruded out of its natural ſituation, in conſequence of a morbid thickening of the fat at the bottom of the orbit.

The diſeaſe was attended with inſupportable pain, and great reſtleſſneſs. The ſymptoms were appeaſed by the employment of general means, and the progreſs of the affection was for a time retarded. Three years afterwards, the eye having been left in a projecting condition, Saint Yves was requeſted to viſit the patient. She was now labouring under a violent fever, accompanied with ſevere head-ach. The globe of the eye was of a leaden colour, and exceedingly prominent, its coats being ſwollen, and appearing likely to become gangrenous. The medical practitioners who were in the habit of attending the woman were of opinion that the eye ought to be extirpated. The neceſſity for performing the operation, indeed, ſeemed to them ſo urgent, that the proceeding was immediately adopted. The febrile and all untoward ſymptoms ſubſided on the fourth or fifth day, and, in about three weeks, the cure was complete.

Exophthalmia may alſo be occaſioned by ſome tumour of the ſurrounding parts, either of thoſe within, or of others on the outſide of, the orbit. The celebrated French ſurgeon, M. Louis, met with a man, 40 years of age, in whom a carcinomatous fungus, ſituated in the antrum, had deſtroyed the bony plate which conſtitutes the bottom of the orbit, and puſhed the eye-ball almoſt entirely on the cheek, ſo as to produce a great deformity of the countenance. The upper jaw bone was carious, both towards the palate and noſe, and the patient periſhed of the afflicting complaints, brought on by the carcinomatous ulceration of all the diſeaſed parts. The exophthalmia was the effect of the prodigious ſize of the tumour, the growth of which could not be effectually reſiſted by the bones. The protruſion of the eye, ſays M. Louis, might have been prevented by attacking the firſt diſeaſe at a proper period, on the ſide towards the mouth. The growth of the cancerous fungus is repreſented by this diſtinguiſhed writer as the effect of a diſeaſe of the bone, which latter affection he deſcribes as the conſequence of ſyphilis, which had not been ſkilfully treated.

Raw makes mention of a child whoſe left eye was completely protruded from the orbit, and as large as one's two fiſts. The diſeaſe, which had only begun a few months before, proved fatal. On opening the cranium, a fungous ſwelling was diſcovered, the baſe of which was connected with the dura mater above the orbit, without any diſeaſe of the cerebrum.

Exophthalmia, however, originates ſtill more frequently from the enlargement of an exoſtoſis, which ariſes within the orbit, and forces the eye-ball out, in proportion as it increaſes in magnitude. When the bony ſwelling is ſituated near the edge of the orbit, the tumour may be attacked with beneficial effects, without meddling with the eye itſelf. The truth of what has juſt now been obſerved is illuſtrated by the following caſe. A woman, 30 years of age, had a fiſtula lachrymalis, for which ſhe had undergone an operation to no purpoſe. The bones became enlarged, and, fifteen years afterwards, an exoſtoſis of the os planum and internal angular proceſs of the os frontis had attained the ſize of an egg. The globe of the eye, being laterally compreſſed, was forced out of the orbit, and, in ſome meaſure, hung over that part of the cheek which was near the leſſer angle. M. Braſſant applied a cauſtic to the exoſtoſis; ſuppuration enſued, and in the courſe of three or four months an exfoliation of a conſiderable portion of the bony ſwelling took place, the eye reſumed its natural poſition, and the cure was completed a ſhort time afterwards.

Exophthalmia is ſometimes produced by the formation of a ſteatomatous, or ſchirrous tumour, at the bottom, or ſides of the orbit. Trincavelli, Bonnetus, and Saint-Yves, furniſh us with ſeveral examples of this ſort. Here an operation is requiſite; but a great deal of patience and dexterity are eſſential in its performance. As the recital of facts tends to the elucidation both of precept and practice, we ſhall offer an abridged account of a caſe, related by Dr. Hope, in the Philoſophical Tranſactions, where every thing reſpecting the method of treatment is very perſpicuouſly explained. A young woman, eighteen years of age, was affected, when twelve years old, with a diſtortion of her left eye, towards the temple. This circumſtance aroſe gradually, in conſequence of the growth of a tumour between the eye and the orbit. In a few years, the ſwelling protruded externally, in the form of a hard tumour, which extended from the greater angle nearly to the leſſer one, beneath the lower eyelid, and which reached nearly half an inch over the cheek. This tumour had puſhed almoſt the whole eye-ball out of the orbit, ſo that the pupil was removed more than three inches from its proper place. The eye was alſo much more prominent than the other, puſhed over the temple, and quite motionleſs, which circumſtances, together with the tumour, preſented a frightful appearance. The ſight, however, was not loſt. Dr Hope, though diſſuaded by Monro, undertook the cure of the patient in the year 1744. Having placed her in a convenient poſture, and made the integuments tenſe, he made an inciſion about an inch long, from the greater to the leſſer angle, following the direction of the fibres of the orbicularis palpebrarum muſcle. The lips of the wound being ſeparated, he next paſſed a crooked needle, armed with ſome ſilk, through the middle of the tumour, and, regularly as he cut all the adheſions with a biſtoury, he drew outward the whole maſs of the diſeaſe. Sciſſars were employed for dividing ſuch connections, as were the moſt deeply ſituated. The part which was thus cut out appeared to be furniſhed with a thick membranous ſubſtance, excluſively of the body of the tumour, which was of a regular, ſpherical, ſmooth form, and about as large as a ſmall pigeon's egg; the interior was of a fleſhy ſtructure. In detaching the ſwelling from its adheſions, ſeveral callous indurations were met with, attached to the globe of the eye. The tumour being extirpated, Dr. Hope introduced his finger to the bottom of the orbit, where he felt ſeveral hardneſſes and calloſities ſtill remaining; he kept his finger there, and having by this means paſſed in a needle and ligature, he drew them through the baſe of the calloſities. Now having directed an aſſiſtant to hold up the ligature, he paſſed in the point of a pair of ſciſſars, on the end of his finger, and made two or three ſtrokes with them, in the place where he felt the roots of the callous hardneſſes. Thus he ſucceeded in cutting away the whole of the indurated parts, ſo as to leave the bottom of the orbit, as far as he could aſcertain, perfectly ſmooth and free from calloſity. All the time that the operation laſted, no hæmorrage of any conſequence took place: only a large quantity of dark-coloured grumous blood was poured out from the varicous veſſels. The wound was dreſſed with ſome dry lint, which was not removed till the third day. The eyelids and tunica conjunctiva were affected with a flabby kind of ſwelling, attended with a ſlight inflammation and pain in the anterior part of the head. The dreſſings conſiſted of ſimple digeſtive and reſolvent applications. The pain in the head, and the tumefaction continued three days, without any formation of matter. Dr. Hope then touched the bottom of the wound with the lapis infernalis, and, a few hours afterwards, a large quantity of black blood was diſcharged. From this period the pain in the head, and the ſwelling ſubſided; there was alſo emitted, during the two ſucceeding days, a bloody ſanies, which occurrence induced Dr. Hope to make uſe of ſome injections of warm water, mixed with a little ſpirit of wine, and honey of roſes. After the adoption of this plan of treatment, the pus aſſumed a more favourable appearance. Such ſoft, fungous excreſcences as aroſe in the courſe of the cure, were deſtroyed with the lapis infernalis, and it was not long before the wound was entirely healed. The eye, however, remained unalterably immoveable; for the abductor muſcles had been ſo long contracted, while the adductors had been for ſo conſiderable a time ſtretched and tenſe, that they had completely loſt all power of action.

Finding, that by making rather forcible preſſure on the eye-ball, the part could be made to return, in a great degree, into the orbit, though it became protruded again as ſoon as ſuch preſſure was diſcontinued; Dr. Hope conceived, that a bandage which would conſtantly keep up a graduated compreſſion, might be attended with ſome benefit, and determine the muſcles more ſpeedily to reſume their proper tone, by maintaining the eye in its natural ſituation. Conformably to this idea, this gentleman cauſed a ſteel bandage to be conſtructed, with a concave plate proportioned to the convexity of the globe of the eye. This apparatus made preſſure on the ſide of the eye-ball next the temple, by means of a ſcrew. The machine was put on, after gently puſhing back the eye into its natural ſituation with the hand; and then laying a ſoft compreſs between the eye and the plate of copper, Dr. Hope uſed to make the preſſure act on the part by means of the ſcrew, in ſuch a way, that it was impoſſible for the eye to become diſplaced outward again, as it uſually was before. With the aid of this bandage, which the patient wore conſtantly, night and day, and which was gradually tightened more and more, the eye regained its natural poſition in the ſpace of about twenty days, and did not deviate from it again. At the time when the caſe was publiſhed, the eye was capable of motion in every direction, and the patient could ſee quite as well with it as the other. The wound got completely well in about a month, and only ſeven weeks elapſed before the cure was, in every reſpect, perfect.

Reſpecting the foregoing caſe, M. Louis obſerves, that it certainly does honour to the ſkill and intelligence of the gentleman who undertook the treatment.

Le Dran was equally ſucceſsful in the treatment of a ſimilar diſeaſe, though certainly it was not ſo conſiderable as the preceding. The means made uſe of, were the actual cautery and alternative medicines. The ſubject was a young lady, aged eighteen, who, from her infancy, had been ſubject to inflammations about her lips, eyes, and ears. She had had a fiſtula lachrymalis, and, ſome time after the uſual operation for this complaint, there originated, at the leſſer angle of the eye, a fungous excreſcence, which protruded from the orbit, and had been ſucceſſively removed with the knife, and touched with the lapis infernalis; but in vain, as the tumour always made its appearance again. This plan of treatment was not attended with any greater ſucceſs under the hands of Le Dran, and, conſequently, he ſoon made up his mind to attack the excreſcence, by introducing the actual cautery into its centre. For this purpoſe, he took a long, large, ſewing needle, and had it firmly fixed on a handle. The inſtrument, having been made red-hot in the flame of a wax-candle, was puſhed to the depth of about half an inch into the middle of the ſwelling. By repeating the application of the cautery three or four times, at intervals of a few days, Le Dran ſucceeded in deſtroying the tumour as deeply as its root, the action of the fire having extended beyond the parts actually touched with the heated needle. The conſequence was, that the ſwelling never grew again. To render this cure more certain, Le Dran, for a long while, kept the cauteriſed part open, and the patient was ordered to take alterative medicines, the chief of which were calomel and æthiops mineralis.

The two foregoing examples prove what ſurgery can accompliſh, when the diſeaſe is taken in time. However, when the proper kind of treatment has been deferred too long, the affection of the eye becomes of ſuch a deſcription, as to be irremediable. Nothing now remains to be done except extirpating, not only the tumour, but alſo the whole of the eye-ball. Even this formidable operation is often impracticable, particularly when the parietes of the orbit are diſeaſed. For the bones, in conſequence of the preſſure made upon them by the ſwelling, are rendered carious, and very foul ill-conditioned ulcers are produced. In this ſtate there can be but little hope of a recovery, whatever mode of treatment is adopted.

One ſpecies of exophthalmia, which is indeed uncommon, but not the leſs worthy of being known, is that which is occaſioned by an encyſted tumour. In the fourth volume of the Medical Obſervations and Inquiries, there is an inſtance recorded by Dr. Brocleſby. A labouring man of the pariſh of Haſelmere, in Surry, had been for ſeveral years afflicted with a pain and an obſcurity of ſight in one of his eyes. The affection continued, without much attention being paid to it, until, about two or three years afterwards, the man became quite blind on that ſide. At this period, the globe of the eye was protruded outward in ſuch a manner, that almoſt the whole of the inner ſurface of the lower eye-lid was turned out, and hung down over the cheek, ſo as to form a true ectropium.

Several ſurgeons who were conſulted adviſed the patient not to expoſe himſelf to the riſk of an operation, fearful that the diſeaſe might be converted into one of a cancerous nature. Notwithſtanding this counſel, the man did not ceaſe going about to have the advice of all ſuch perſons as ſeemed likely to afford him any aſſiſtance. At length, he applied to Mr. Dale Ingram, who, having carefully examined the diſeaſe, thought, that on compreſſing different places, he felt a decided fluctuation below the globe of the eye. He immediately ſuſpected, that the fluid was contained in a cyſt, and, conſequently, that the patient might receive relief from an operation. However, the above gentleman would not undertake any thing without conſulting Mr. Bromfield.

The latter ſurgeon, after a careful examination, was not againſt the probability of ſucceſs, and he did the operation in the following manner. After having covered the ſound eye, by tying a handkerchief round the head, and put the eye-lids of the affected eye as near together as poſſible, and directed them to be held in this poſition, Mr. Bromfield made an inciſion through the lower eye-lid to the conjunctiva, and thus made a ſufficient opening for the introduction of his finger behind the globe of the eye. In this way he was enabled to put in a very narrow ſharp-pointed knife, for the purpoſe of puncturing the ſubſtance, which was taken to be the cyſt. Mr. Bromfield was not deceived in his expectation; for, as ſoon as the opening was made, nearly a glaſsful of a thin tranſparent fluid was diſcharged. He now waited a little, both in order to give the patient an opportunity of waſhing out of his mouth ſome blood, which had got into it, and for the ſake of conſidering what ſteps could be taken to extirpate the cyſt, which had contained the fluid. At laſt, he determined to proceed as follows: he paſſed into the wound a double kind of tenaculum, with which he took hold of the cyſt, and then diſſected it entirely away. The wound was filled with ſoft lint, and the dreſſings were kept on with a ſuitable bandage.

In leſs than four and twenty hours there appeared on the ſame ſide of the face a conſiderable degree of ſwelling, which ſoon ſubſided, however, on a dilatation of the firſt wound being made, lighter dreſſings being put on, and the bowels opened. In leſs than a month the man got quite well, and returned to his home with infinite ſatiſfaction. Dr. Brocleſby obſerves, that Mr. Ingram was perſuaded, before the operation, that the muſcles would draw back the eye-ball into the orbit, and that even ſome degree of viſion might return. The doctor could hardly ſuppoſe all this poſſible; but, having an opportunity of ſeeing the man, about five months afterwards, he could ſcarcely recognize him. The eye-lids had recovered their original ſtate, and moved as well as thoſe of the oppoſite eye. The man alſo informed Dr. Brocleſby, that, for about the laſt month, he had begun to diſtinguiſh with the affected eye light from darkneſs, and that his power of ſeeing was becoming greater every day. Dr. Brocleſby remarks, that he could not find any caſe of this kind related by authors, except one very analogous inſtance, recorded by Saint Yves in his treatiſe on the diſeaſes of the eyes.

The laſt kind of exophthalmia which we have to notice, is that which Sauvages has termed *traumatic*. In this ſort of caſe, the eye is ſo much protruded from the orbit, that ſurgeons have frequently been induced to remove the diſplaced part altogether, and this ſometimes has been done too inconſiderately for the unfortunate patient. Covillard informs us, in his Chirurgical Obſervations, that he was called to ſee a man, againſt whoſe eye a racket-ball had been ſtruck with ſuch violence, that all the circumference of the globe of the eye was ſeparated from the orbit. A relation of the perſon who was hurt was ſtanding by with a pair of ſciſſars in his hand, ready to cut the reſt of the parts which connected the eye with the head. Covillard entered the room in time, and very fortunately, to reſiſt this proceeding, as a complete cure enſued without having recourſe to it. Indeed, ſuch was the ſucceſs, that the patient's power of ſeeing ſuffered no kind of diminution or impairment. A ſimilar inſtance, though ariſing from a very different cauſe, occurred to Mr. Benjamin Bell. The eye was almoſt knocked out of the orbit by the violence with which a pointed piece of iron had entered betwixt the ſocket and the eye-ball. The iron had paſſed through a portion of the orbit, and remained firmly fixed there for about a quarter of an hour. During the whole of this time, the patient ſuffered inſupportable pain. He had completely loſt the faculty of ſeeing, and the eye-ball protruded in ſuch a manner, that there was every reaſon to fear that the optic nerve was ruptured, and, conſequently, great doubt concerning the propriety of replacing the part, or not. However, as a little delay did not ſeem likely to be dangerous, it was determined to wait a little. On the firſt removal of the dreſſings, and after taking away the iron, which cou'd only be done with difficulty, ſo deeply had it ſtuck, it was with pleaſure and aſtoniſhment that the ſight was found to return immediately, even before the eye had been replaced. The inflammation which followed was ſoon appeaſed by proper remedies, and viſion was re-eſtabliſhed in its original perfection.

Mr. White makes mention of an analogous example in his book of ſurgical caſes, with this difference, however, that the eye was protruded in a ſtill greater degree.

Theſe two inſtances confirm the one recorded by Covillard, and weigh againſt what Maitre Jean has ſtated, namely, that Covillard's caſe is not authentic.

In order to conceive the truth of the foregoing obſervations, we have only to recollect the way in which the [illegible] is retained in, and connected with the orbit. The ſurface of the boundaries of each orbit (ſays M. Louis, in defending Covillard's caſe,) is oblique, and inclines behind more towards the temple than the noſe. The eye-ball is fixed on the ſide towards the noſe, and juts out in front beyond the cavity of the orbit. Hence, it is manifeſt from the ſlighteſt examination, that the globe of the eye, in the natural ſtate, is partly ſituated on the outſide of the orbit. When it is alſo conſidered that the optic nerve is very looſe, in order to be adapted for readily following, without being at all ſtretched, all the rotatory motions of the eye-ball, produced by the action of the different muſcles belonging to this organ, we can then have no difficulty in imagining how the eye may make an immenſe protruſion outward, in conſequence of an inconſiderable ſwelling, and how it may ſeem to be quite diſplaced from its ſocket, without either the optic nerve or the muſcles being torn or lacerated.

EXORCISM, Εξορκισμος, prayers or conjurations wherewith to exorciſe, *i. e.* to drive out devils or dæmons from perſons apprehended to be poſſeſſed, or to preſerve from danger.

The word is derived from the Greek, εξορκιζειν, *adjurare*, *conjurare*, *to adjure*, or *conjure*. In moſt dictionaries, exorciſm and conjuration are uſed as ſynonymous; but in reality, conjuration is only a part of the exorciſm; and the exorciſm the ceremony entire. The conjuration is properly the formula, where the devil is commanded to come forth, &c.

Exorciſms are of great uſe in the Romiſh church; their prelates, &c. are frequently exorciſing dæmoniacal perſons. The prieſts make holy water by exorciſing common water a certain number of times. In reality, the exorciſm is a part in moſt of their conſecrations.

Exorciſms had anciently another and farther purpoſe; being applied by way of trial or purgation to extort the truth from the accuſed.

The exorciſm, in this ſenſe, was a ſort of bread conjured and exorciſed for the purpoſe; and the opinion was, that if the perſon was criminal he could not ſwallow the bread.

This, it ſeems, was a frequent practice in the time of our Edward III. and the bread thus exorciſed was ſaid to be corſned.

Linderbroeck gives inſtances of exorciſms with barley-bread, and others with cheeſe; and hence, probably, might ariſe that popular imprecation, "May this bread choak me, if I tell a lye." See Ordeal and Judicium *Dei*.

EXORCIST, in the *Romiſh Church*, a prieſt, or tonſured clerk, who has received the four leſſer orders, one of which is that of exorciſt.

The term is likewiſe applied to a prelate, or to a prieſt delegated by a prelate, who actually exorciſes a perſon poſſeſſed.

It is a diſpute among divines whether ever the Greeks had any ſuch order as that of exorciſt. Fa. Goar, in his Notes on the Greek Euchologion, has made it probable they had, from ſeveral concurring paſſages in St. Dionyſius and St. Ignatius Martyr.

The ordination of exorciſts is performed in the time of maſs, their principal office being to expel devils. The fourth council of Carthage, can. 7. appoints, that in the ordination of exorciſts, the biſhop, putting the book of exorciſms

orciſms in their hands, ſhall ſay theſe words: "Receive it, and keep it in remembrance, and have power to lay hands on energumeni, whether baptiſed or catechumens; which form ſtill obtains."

M. Fleury mentions certain people among the Jews who travelled round the country, making profeſſion of driving out devils by invocations, which, they pretended, had been taught them by Solomon; theſe were alſo called exorciſts. See Joſeph. Antiq. Jud. lib. viii. cap. Origen. Tract. xxxv. in Matt. 35. 63.

EXORDIUM, in *Oratory*, the preamble or beginning of a diſcourſe or ſpeech, ſerving to prepare the audience and introduce the matter in hand.

The word is formed from the Latin *ordiri, to begin*, by a metaphor taken from the weavers, who are ſaid, *ordiri telam, to begin*, or *warp* a web, by diſpoſing and ordering the threads in a certain manner for the future work. See Warp.

The exordium, on other occaſions, is called the *prologue*, *prælude*, and *proem*.

Cicero defines exordium a part of an oration, whereby the minds of the audience are duly prepared for what remains to be ſaid. The exordium is a part of principal importance, and is to be laboured with extraordinary care; whence Tully calls it "difficillima pars orationis."

Cicero and Quinctilian mention three ends, to one or other of which it ſhould be ſubſervient; *viz.* "reddere auditores benevolos, attentos, dociles." The firſt end, or that of conciliating the good will of the hearers, may be effected by a ſelection of topics, in cauſes at the bar, from the particular ſituation of the ſpeaker himſelf, or of his client, or from the character and behaviour of his antagoniſt contraſted with his own; on other occaſions, from the nature of the ſubject, as cloſely connected with the intereſt of the hearers; and, in general, from the modeſty and good intention with which the ſpeaker enters upon his ſubject. The ſecond end, or that of exciting and engaging the attention of the hearers, may be accompliſhed by giving them ſome hints of the importance, dignity, or novelty of the ſubject; or ſome favourable view of the clearneſs and preciſion with which it is to be treated, and of the brevity with which it is to be diſcuſſed. In order to effect the third end, or to render the hearers docile, or open to perſuaſion, the ſpeaker muſt begin with ſtudying to remove any particular prepoſſeſſions they may have contracted againſt the cauſe, or ſide of the argument which he eſpouſes.

The ancient critics diſtinguiſh two kinds of introduction, which they call "Principium," in which the orator plainly and directly profeſſes his aim in ſpeaking: and "Inſinuatio," where, preſuming the diſpoſition of the audience to be much againſt the orator, he muſt gradually reconcile them to hearing him, before he plainly diſcovers the point which he has in view. Of this latter ſort of introduction we have an admirable ſpecimen in Cicero's ſecond oration againſt Rullus.

Exordiums are of two kinds; either juſt and formal, or vehement and abrupt. In the firſt, the audience is prepared and conducted by due and eaſy ſteps; in the ſecond, the orator, as if ſeized with ſome ſudden paſſion, breaks out upon his audience at once. Such is that exordium of Iſaiah; "Hear, Oh heavens! and give ear, Oh earth!" Or that of Cicero againſt Catiline; "Quouſque tandem abutere patientia noſtra, Catilina?" Abrupt exordiums are moſt ſuitable on occaſions of extraordinary joy, indignation, or the like; though we have inſtances of panegyrics of the greateſt orators, begun abruptly, without any ſuch occaſions. Such is that of Gorgias, who began his eloge of the city and people of Elis with Ηλις, πολις ευδαιμων, *Elis, beata civitas.* Abrupt, haſty, exordiums, were more to the taſte and manner of the Greeks than of the Latins.

Agreeably to the objects which the orator ſhould have in view in this part of his diſcourſe, as we have already ſtated them, the requiſites in an exordium are, 1. *Propriety*, whereby the exordium appears eaſy and natural, becomes of a piece with the whole diſcourſe, and matches it as a part does the whole; ſo that it could not be accommodated to any other, or, perhaps, a contrary occaſion. The ancient orators were very defective in this point; their exordiums had frequently nothing in common with the ſubject.

In order to render introductions natural and eaſy, Dr. Blair ſuggeſts that they ſhould not be planned, till the ſubſtance of the diſcourſe has been thoroughly digeſted in the mind. This mode of forming an introduction is conformable to the rule given by Cicero, though not always to his practice. "Omnibus rebus conſideratis," ſays he, "tum denique id quod primum eſt dicendum, poſtremum ſoleo cogitare, quo utor exordio. Nam ſi quando id primum invenire volui nullum mihi occurrit, niſi aut exile, aut nugatorium, aut vulgare;" *i. e.* "when I have planned and digeſted all the materials of my diſcourſe, it is my cuſtom to think, in the laſt place, of the introduction with which I am to begin. For if at any time I have endeavoured to invent an introduction firſt, nothing has ever occurred to me for that purpoſe, but what was trifling, nugatory, and vulgar."

2. *Modeſty*, or an ingenuous baſhfulneſs, which recommends the orator exceedingly to the favour of his audience. This is what Cicero extols ſo much in L. Craſſus, "Fuit enim in L. Craſſo pudor quidnam, qui non modo non obeſſet ejus orationi, ſed etiam probitatis commendatione prodeſſet." The ſame Tully owns of himſelf, that at the beginning of his oration every limb trembled, and his whole mind was in a flutter. The vain-glory of that author ſhould be carefully avoided, of whom Horace ſpeaks, and who began his poem "Fortunam Priami cantabo et nobile bellum."

The modeſty of the orator ſhould diſcover itſelf not only in his expreſſions at the beginning, but in his whole manner; in his looks, in his geſtures, and in the tone of his voice. However, the modeſty of an introduction ſhould never betray any thing mean or abject. The orator, whilſt he exhibits to his hearers modeſty and diffidence, real and not affected, ſhould manifeſt a becoming ſenſe of dignity, ariſing from a perſuaſion of the juſtice or importance of the ſubject of which he is to ſpeak. The modeſty of an introduction requires that it ſhould not promiſe too much. "Non fumum ex fulgore, ſed ex fumo dare lucem." Horace.

"He does not laviſh at a blaze his fire.
Sudden to glare, and then in ſmoke expire;
But riſes from a cloud of ſmoke to light,
And pours his ſpecious miracles to ſight."—Francis.

Although, in general, the orator ſhould not put forth his whole ſtrength in the beginning, but gradually riſe as his diſcourſe advances; yet there are caſes in which he may be allowed to ſet out in a high and bold tone; *e. g.* when he riſes to defend ſome cauſe which has been much decried by the public. In ſubjects too of a declamatory nature, and in ſermons, where the ſubject is ſtriking, a magnificent introduction has ſometimes a good effect, if it be properly ſupported in the ſequel. Boſſuet, Flechier, and the other celebrated French preachers, very often begin their diſcourſes with laboured and ſublime introductions; theſe raiſe attention, and throw a luſtre on the ſubject; but every ſpeaker ſhould be on his guard againſt ſtriking a higher note at the beginning than he is able to keep up in his progreſs, and thus diſappointing the expectations which he has excited. Among Engliſh preachers, attempts of this kind are not always ſo ſucceſsful. Variety ſhould be ſtudied in introductions as much as poſſible. Explanatory introductions from the context are the moſt ſimple of any, and frequently the beſt that can be uſed ; but they ſhould never be long. An hiſtorical introduction has generally a happy effect in rouſing attention ; when one can lay hold upon ſome noted fact that is connected with the text or diſcourſe, and by a proper illuſtration of it, open the way to the ſubject that is to be treated of.

3. *Brevity*, not amplified or ſwelled with a detail of circumſtances, or a long circuit of words ; and in this reſpect it ſhould be accommodated to the length of the diſcourſe ; nor ſhould the introduction anticipate any material part of the ſubject.

4. The *ſtyle* of the exordium ſhould be juſt, eaſy, and pleaſant. Quinctilian facetiouſly compares a faulty exordium to a ſcarred face, which is preſently diſcerned, and very diſagreeable. Thus, Cicero, " Veſtibula, adituſque ad cauſam facias illuſtres."

Correctneſs of expreſſion is peculiarly requiſite on account of the ſituation of the hearers, who are then more diſpoſed to criticize than in any other ſtage of the oration or diſcourſe; becauſe they are as yet unoccupied with the ſubject or the arguments, and their attention is chiefly, if not wholly, directed to the ſpeaker's ſtyle and manner. A correct plainneſs, an elegant ſimplicity, is the proper character of an introduction, ; " ut videamur," ſays Quinctilian, " accuraté non callidé dicere."

5. *Calmneſs* of manner is peculiarly ſuitable to the exordium. This is ſeldom the place for vehemence and paſſion. Emotions muſt riſe as the diſcourſe advances. The minds of the hearers muſt be prepared, before the ſpeaker can venture on ſtrong and paſſionate ſentiments. To this rule there are ſome exceptions, as, for inſtance, when the ſubject is ſuch that the mere mention of it naturally awakens ſome paſſionate emotion, or when the unexpected preſence of ſome perſon or object, in a popular aſſembly, inflames the ſpeaker, and makes him break forth with unuſual warmth. Either of theſe will juſtify what is called the exordium *ab abrupto*. An inſtance of this kind we have already referred to in Cicero's firſt oration againſt Catilinè. However, introductions of this kind ſhould rarely occur. In the introduction the ſpeaker ſhould prepare the way for thoſe warm emotions, which he deſigns to raiſe in the ſubſequent parts of his diſcourſe.

The exordium appears an eſſential part of an oration ; though anciently in the Areopagus, Julius Pollux tells us they ſpoke without any exordium, and paſſions, and any peroration or epilogue. The like is ſaid to have been done by Xenophon, who began thus : " Darius et Pariſatis duos habuere filios."

EXORMISTOS, in *Ichthyology*, a name given by ſome of the old writers to that ſpecies of the petromyzon which other authors call the lampetra fluviatilis, and we in Engliſh the lampern. This is diſtinguiſhed by Artedi by the name of the petromyzon, with only one ſeries of ſmall teeth in the verge of the mouth, and ſome large ones, below. See Mustela, Lampetra, and Petromyzon.

EXOS, the name by which Rondeletius diſtinguiſhes the acipenſer huſo. See Sturgeon.

EXOSTOSIS, from εξ, *out of*, and οστεον, *a bone*. This term, in *Surgery*, ſignifies an oſſeous tumour growing on a bone. Alſo, a ſwelling of the bone itſelf.

Boyer remarks, that a ſwelling may take place in bones as well as other parts of the body. The particular kind of tumour which occaſionally forms on the ſurface of the bones, is that to which this writer aſſigns the appellation of *exoſtoſis*. He notices, however, that this name comprehends different ſpecies, which ſhould be conſidered in a diſtinct manner. Thus, *oſteo-ſarcoma* is one peculiar affection ; and there is another ſpecies of exoſteſis, different from all others, and which conſiſts principally in a thickening of the perioſteum. Boyer is of opinion, that the diſeaſe might be very properly named *perioſtoſis*.

In caſes of exoſtoſis, the bony ſwelling acquires, on ſome occaſions, ſuch a degree of hardneſs, that no veſtiges of a fibrous texture can be diſcerned, and it abſolutely reſembles ivory. In ſome inſtances, the ſtructure of the tumour is ſpongy ; and in others the ſwelling is compoſed of a maſs of fleſhy and bony matter blended together.

According to Boyer, the bones moſt frequently affected with exoſtoſis are the broad bones of the head, the lower jaw, ſternum, humerus, radius, cubitus, the bones of the carpus, and the femur, and tibia. However, he remarks, that there is bone, which may not become the ſeat of the diſeaſe, and the affection may extend to a ſmall, or a conſiderable portion of it. It is not uncommon to find the bones of the cranium affected with exoſtoſis over their whole extent ; and Boyer inſtances the oſſa parietalia, as ſometimes acquiring an inch in thickneſs, in conſequence of the affection.

In the majority of caſes, an exoſtoſis riſes from the ſurface of a bone, and appears in the form of a hard round tumour. It ſometimes occurs near the extremities of the long bones, and, at other times, near the middle portion. It is remarked, that exoſtoſes, originating from a venereal cauſe, and commonly called *nodes*, are found, for the moſt part, on compact bones, and ſuch of theſe as are not thickly covered with ſoft parts, as, for inſtance, the bones of the cranium and face, the internal ſide of the tibia, &c.

Mr. John Bell has treated of tumours of the bones in the third volume of his Principles of Surgery. The following extract will ſerve to ſhew ſome of this gentleman's opinions upon the ſubject : " Many things conſpire (ſays this author) to give the tumour proceeding from a bone a peculiar aſpect ; it is always irregular and anomalous, never ſimple. I have rarely ſeen a ſingle bony protuberance ariſing from the head, or ſhaft, of a ſingle bone. When a bone falls into diſeaſe, a large proportion of tendinous and muſcular parts of burſæ, and of cellular ſubſtance partake of the morbid action. The bone lies in the centre of the limb, connected by its larger head with a joint, and by its perioſteum with the tendons, burſæ, and muſcles ; and all this maſs of parts is, ſooner or later, affected ; and ſince every depoſition from veſſels appointed for the ſecretions of bone is ſolid, and every increaſe of ſuch a tumour permanent, it ſoon atttains a great ſize ; it is ponderous and maſſive from the proportion of bony ſecretion, and from the various ſtructure of theſe ſeveral parts, it has every irregularity of form and ſubſtance.

" When the tumour of a bone has attained a conſiderable ſize, much of the original ſtructure is deſtroyed, and a new irregular maſs of gelatinous and bony matter is ſubſtituted for it. The bony tumour is firm, bulky, and ponderous, but not ſolid ; feeling it from without, we can conjecture of what ſubſtance it is compoſed within ; we are ſenſible that the tumour is covered by a ſhell, bony in moſt parts of its circumference, cartilaginous in ſome parts, and, throughout the whole, yielding and elaſtic ; we are ſenſible, alſo, that within there are irregular points, or ſpiculæ traverſing the cavities, or cells, of the hollow tumour ; that theſe are mixed with the cartilaginous ſubſtance, and with irregular collections of matter, partly purulent, but chiefly gelatinous; we are ſenſible of ſuch ſoft cartilaginous and gelatinous parts being ſucceſſively added, in the progreſs of its growth to the tumour, which was, at the firſt, ſolid and firm; and we find at laſt, by pain and partial ulcerations, and by the increaſe of fluctuation and redneſs at particular points, that ulceration, the laſt ſtage of the diſeaſe, approaches. Then the limb is effectually ruined, and the patient muſt ſubmit to amputation, or die of hectic.

"When ſuch tumour is diſſected, we find our ſuſpicions of its internal ſtructure confirmed; we ſee that foul matter flow out, when we open into the centre of the tumour, which we felt but indiſtinctly through its walls; the parts which appeared the moſt ſolid are hollowed out by ulceration, and full of foul and putrid ſanies; while the bone has been declining into diſeaſe, the cancelli and marrow have been degenerating into a ſort of fatty maſs, with which much of the cavity of the tumour is filled, and thence ſuch diſeaſe has been very generally deſcribed under the name of *oſteo-ſteatoma*. This fatty excretion, occupying the diſeaſed cavity, is the part which, when the tumour burſts into an open ulcer, throws out ſuch prolific fungus, growing apparently from the ſubſtance of the bone, and ſprouting up, when amputated, in the courſe of a few hours. The ſolid bone, whether radius, or thigh-bone, is annihilated, and a mere ſhell of oſſeous matter ſubſtituted in its place, and that in a manner ſo peculiar, that it muſt ſeem to the unintelligent obſerver as if the ſmall and ſolid bone had been expanded into an extenſive and flat plate of oſſeous ſubſtance, whereas the proceſs is in truth very ſimple and very intelligible. The bone dies piecemeal of ulceration, what, in technical language, is termed caries, and is conveyed away by abſorption; but the bone being dead, the ſurrounding membranes, *viz.* the perioſteum and tendinous expanſions, which once formed a part of its ſyſtem of circulation, continue ſtill alive and ready to ſecrete new bone; and thus it happens, that while a carious abſceſs preſerves a large cavity full of foul matter, the ſurrounding membranes continue ſecreting bone, which, like a ſhell, thin and expanded, covers this cavity, and forms the walls of the tumour, of which ſome part is compoſed of thin expanded bone, reſembling a cranium, ſome of cartilage, ſome of thickened membrane; and this ſhell is formed in proportion as the original fabric of the bone is deſtroyed.

"Bone is deſtroyed by this internal ulceration, juſt as it is by open caries, piecemeal; the proceſs would not be ulceration, if, while one part were periſhing, the other were not active and ſecreting new matter; ſo vigorous ſtill is the general life of the bone, while the internal parts are thus ſuffering, that while one ſide is waſting with ulcer, the other ſide is often ſecreting bone irregularly and profuſely, and ſhooting out into fantaſtic forms among the membranes and ſurrounding ſoft parts, whence the centre of the tumour is cavernous and cellular, and the walls often rough with ſpinous and projecting points. So merely local is the action of arteries in a tumour, whether oſſeous or ſoft, that one ſide, or part, or bump of a tumour, grows viſibly and protrudes; the features and external form of the tumour gradually changing, without any ſenſible cauſe; and ſo peculiar is the ſecretion of each ſpecies of vaſcular ſtructure, according to the original deſtination of the part, that in one part of the tumour is generated bone, in another griſtle, in another gelatinous effuſion; while in another part, the vaſcular action is violent and deſtructive, and the ſolid bone, marrow, and ſurrounding membranes, are all reſolved into a foul and fetid ſuppuration. From the perioſteum is ſecreted bone: from the marrow, this ſteatomatous and ſolid fat, with which much of the tumour is filled; to the tendinous and aponeurotic parts we can diſtinctly trace the cartilaginous ſecretion; and the gelatinous effuſions, we can perceive, even during life, have their walls thicker, or thinner, according to the degree of inflammation.

"Theſe are the external characters and internal conditions of a tumour occupying any of the bones. Such tumour ariſes often from a bruiſe, or fracture; ſometimes from a leſs obvious cauſe, or from internal diſeaſe. The radius, for example, is fractured at the wriſt, re-unites and heals; but heals clumſily, the thickening never ſubſides, the pain never ceaſes, and, though not great, is greater than what is natural to a fracture. At length, a ſenſible tumour ariſes; at firſt it is firm, but in proportion as it increaſes in ſize, it becomes ſomewhat ſoft and elaſtic, the thin plate of bone, of which it is compoſed, yielding to the diſtention from within. From time to time the tumour changes its form, ſtill increaſing in bulk. On the ſide of the radius, it is firm and ſolid; it bends and yields at the parts moſt diſtant from it; it is plainly bony at its baſis, and as obviouſly cartilaginous in the extreme part of its circle; it plainly contains matter in thoſe ſofter parts, where it yields to the impreſſion of the finger. Cartilaginous knobs ariſe, and ſometimes are reddened on the ſurface; and, at certain points, the fluctuation is of ſuch a kind, as to imply that the effuſion is in part of a gelatinous nature. Thus the tumour grows and extends, with various irregularities in form and conſiſtence; it overhangs the dwindled hand, the uſe of the joint is loſt, and the patient, who might gladly have been delivered of it at an earlier period, has, in the end, no choice left; for, when once it burſts into carious ulceration, it never heals, the fetor is inconceivably overcoming, attended with hectic. You are alſo to remark, that, when ſuch diſeaſe takes place in the hand itſelf, the joints of each of the fingers grow out into tumours, at firſt of a heart-like form, correſponding with the articulations of the finger bones; but, in proceſs of time, they grow to globular, irregular, and almoſt tranſparent tumours, ſtill firm, or, at leaſt, of a cartilaginous firmneſs. The whole hand degenerates into a deformed maſs, diſcoloured, ulcerated, and fetid; from the individual knobs of which deformed maſs, the points of the reſpective fingers project like griffin's claws, with crooked nails of enormous length." Page 58—60.

The foregoing paſſage makes us tolerably well acquainted with Mr. John Bell's ſentiments relative to the pathology of exoſtoſes, and though we do not ourſelves adopt ſome of his concluſions, nor think that all bony tumours coincide with his account, yet many caſes certainly anſwer the deſcription which he has given.

Some exoſtoſes cannot be diſcovered before the patient's death. Such was the caſe referred to by Boyer, of a perſon whoſe parietal bone was found after death to be three times thicker than natural. A ſimilar caſe is alſo related in the memoirs of the academy of Dijon. In the latter example, the patient died from an exoſtoſis on the internal ſide of the os pubis. The tumour, by preſſing on the neck of the bladder, prevented the paſſage of the urine, and the introduction of the catheter.

Boyer notices the poſſibility of miſtaking the head of a luxated bone for an exoſtoſis. He informs us, that this happened with a young man, whoſe clavicle was diſlocated at the end, which is articulated with the ſternum. The tumour, formed by the end of the diſplaced bone, was miſtaken for an exoſtoſis, and was treated as ſuch, of courſe, with no benefit.

Boyer alſo adverts to the liability of miſtaking the enlargements of the ends of ricketty bones for exoſtoſes. Fungous excreſcences of the dura mater might likewiſe (as the ſame author explains) be erroneouſly conceived to be exoſtoſes; for, after they have deſtroyed a part of the bones of the cranium, they form an external protruſion. Their real nature, however, may be eaſily diſcriminated by attending to their conſiſtence and progreſs, and particularly their pulſatory motion, which correſponds with the action of the arteries in general. We need not here ſay more concerning theſe ſwellings, as they are already deſcribed in another part of this Cyclopædia. See Dura Mater, *Tumours of*.

There are certain ſymptoms which may be ſaid to be common to all exoſtoſes; ſuch are, a ſwelling; a ſenſe of weight; pain, or at leaſt a degree of uneaſineſs ariſing from the morbid action; and deformity.

Another claſs of ſymptoms may be called *particular*, becauſe they are entirely dependent on the ſituation of the tumour. Thus, as Boyer obſerves, and as we have related in the article Exophthalmia, if an exoſtoſis were to take place in the orbit, the eye would neceſſarily be expelled from that cavity. An exoſtoſis ariſing from the inner ſurface of the clavicle, or ſternum, might occaſion preſſure of conſiderable blood-veſſels, and on the thoracic viſcera, ſo as to induce a train of very dangerous and even fatal conſequences

An exoſtoſis, ariſing from the internal ſide of the os pubis, may give riſe to a fatal retention of urine, as, indeed, we have already detailed. A ſimilar tumour, ſimilarly ſituated, might alſo render parturition, in the natural way, impoſſible.

The generality of ſurgical writers repreſent ſcrofula as being a cauſe of exoſtoſes. This ſtatement, however, ſeems to reſt on no foundation whatever. The ſwelling of the joints, when they are affected with ſcrofulous diſeaſe, is not produced by an expanſion of the bones themſelves, but altogether by a thickening of the ſoft parts, ſometimes conjoined with a collection of a fluid reſembling glair, or of purulent matter in the capſular ligament. The head of a bone, really enlarged from ſcrofula, has never yet been demonſtrated, and cannot be found in any of the collections of morbid preparations in the various muſeums. The particular form of diſeaſe, with which ſcrofula affects the bones, we ſhall deſcribe in ſpeaking of the *White Swelling*.

A ſcorbutic diatheſis is alſo ſet down by authors as ſometimes exciting the growth of exoſtoſes: on this point, we can only profeſs our ignorance of any rational evidence in favour of the opinion.

The venereal diſeaſe does undoubtedly occaſion one ſort of exoſtoſes, denominated *nodes*; but, theſe we ſhall diſmiſs from preſent conſideration.

It is painful for us to be obliged to acknowledge, that we are almoſt in total ignorance, in regard to the cauſes of exoſtoſes; for, excepting contuſions and fractures, which ſometimes unqueſtionably lead to the production of bony tumours, we have no certain knowledge of any others.

Mr. John Bell informs us, that he has ſeen a woman's ankle fall into this diſeaſe, in conſequence of a very trivial accident; the tibia and fibula grew into a common tumour, the bones ſeemed annihilated, and a large oſſeous ſhell appeared to be ſubſtituted in their place. In the courſe of the diſeaſe, the leg became twiſted round in a ſingular manner, and enlarged to the ſize of a pillow of a ſettee. The woman died of hectic from the open caries of the tumour. The ſame author remarks, that the wriſt, which is more expoſed to ſprains and fractures, is moſt liable to be thus deformed and ruined. He repreſents the hand itſelf as being alſo particularly ſubject to ſimilar diſorder. The original injury is ſome ſlight blow, or ſprain; one finger is firſt deformed; joint after joint enlarges; one finger after another becomes crooked; the nails project like talons, and force their way into the very fleſh of the ſwelled and ulcerated hand, which, according to Mr. John Bell, they ſometimes penetrate through and through. At length, the hand degenerates into an unwieldy and irregular maſs, ſtudded with knobs and bony tumours. This ſurgeon tells us, alſo, that in conſequence of a neglected fracture of the collar-bone, in a ſtout young man, he once ſaw a tumour produced; partly conſiſting of bone, and partly of cartilage, riſing to the height of ſix inches, of round figure, and inſulated, moving when the arm was moved, too large and too critically ſituated over the axillary artery, to admit of extirpation, and which Mr. John Bell doubts not has by this time become carious, and occaſioned death.

When exoſtoſes originate from external violence, the exciting cauſe is involved in no obſcurity; but the cauſes in moſt other inſtances ſeem to baffle all human reſearch. Frequently, a conſtitutional diſpoſition to the formation of bony tumours, in various parts of the body, ſeems to prevail. Mr. Samuel Cooper, in his "Dictionary of Practical Surgery," quotes an example of a boy, who came out of Cornwall, ſo exceſſively afflicted with an apparent propenſity to exoſtoſes, or an exuberant depoſition of bony matter, that a very trifling blow would occaſion a bony ſwelling on any bone of his body. The ligamentum nuchæ was oſſified, and prevented the motion of his neck; the margins of the axillæ were alſo converted into bone, ſo that the poor lad was, as it were, completely pinioned.

There is one ſpecies of exoſtoſis remaining to be noticed, which is of a very peculiar kind, as it is in its appearance exceedingly like a bony fungus.

A ſtriking inſtance of ſuch a diſeaſe has been recorded by Mr. Abernethy. The caſe being highly intereſting, we ſhall take the liberty of quoting it. The patient, who was 34 years of age when the account was written, perceived, when about ten years old, a ſmall tumour on his left cheek, which gradually attained the ſize of a walnut, and then remained for ſome time ſtationary. About a year afterwards, the tumour having again enlarged, a cauſtic was applied to the integuments, ſo as to expoſe the bone. The actual cautery was next applied, and an opening thus made into the antrum. After the exfoliation, the antrum became filled with a fungus, which roſe out upon the cheek, and could not be reſtrained by any applications. Part of the fungus alſo made its way into the mouth, through the ſocket of the ſecond tricuſpid tooth, the other teeth remaining natural. The diſeaſe continued in this ſtate nine years, occaſionally bleeding in an alarming way. When the patient was in his 20th year, the whole fungus ſloughed away during a fever, and did not return. After this, the ſides of the aperture in the bone began to grow outwards, forming an exoſtoſis, which grew to a great magnitude. A ſmall exoſtoſis took place in the mouth, but became no larger than a horſe-bean. The exoſtoſis of the maxillary bone was of an irregular figure, and projected from the whole circumference of the aperture a great way directly forward. Mr. Abernethy compares its appearance, when he was writing, with that of a large tea-cup faſtened upon the face, the bottom of which may be ſuppoſed to communicate with the antrum. The diameter of the cup, formed by the circular edge of the bone, was three inches and a half: the depth two inches and ſeven-eighths. The general height of the ſides of the exoſtoſis, from the baſis of the face, was two inches; its walls were not thick, and terminated in a thin circular edge. The integuments,

teguments, as they approached this edge, became extenuated, and they extended over the edge into the cavity. The exoſtoſis reached to the noſe in front, and to the maſſeter muſcle behind; above it included the very ridge of the orbit, and below it grew from the edge of the alveolary proceſs. A line that would have ſeparated the diſeaſed from the ſound bone, would have included the orbit and noſe, and indeed one half of the face. Mr. Abernethy ſaw no means of affording the man relief. Med. Chirg. Tranſ. vol. 2.

In regard to the treatment of exoſtoſes, it is exceedingly difficult to lay down any determinate rules. With the exception of venereal nodes, we cannot ſay that we are acquainted with any remedy which has the power of diminiſhing bony tumours. Perhaps bliſters kept for a long while open, by means of the ſavin cerate, and applied to the neareſt ſurface of the integuments, might have the effect of exciting the action of the abſorbents, ſo that the depoſited bony matter would be at leaſt in part removed. That bliſters would operate in this manner, we may conclude from their having been known to diminiſh the ſwelling of venereal nodes, after mercury has ceaſed to be productive of any benefit. However, we do not mean to repreſent this plan as likely to anſwer fully in practice; for, even were it to prove ſucceſsful, it could only be after ſuch time and perſeverance as few patients would allot.

The chief method of getting rid of an exoſtoſis is by attacking the tumour with a cutting inſtrument, and it is obvious that this mode of proceeding cannot be adopted, except when no anatomical conſiderations forbid it. Hopes of its ſucceſs, alſo, ſhould never be ſanguine; becauſe, though you may ſucceed in removing every particle of the bony ſwelling, ſtill the depoſition of bone may continue, and the diſeaſe recur, and this even in a more malignant form.

When an exoſtoſis has acquired much magnitude, it ſeldom admits of being cut, or ſawn away. But there are exceptions to this remark; for Heiſter records an example of an exoſtoſis, ſituated on the middle of the ſternum, and as large as a child's head, being ſucceſsfully extirpated. If an exoſtoſis were to be met with, growing on the middle part of one of the long cylindrical bones, with rather a narrow baſe, an attempt might be prudently made to remove the tumour, notwithſtanding its ſize might be very great. When the attachment of the ſwelling is on the head of a bone, near a large joint, an endeavour to extirpate the diſeaſe is much more dangerous.

It would be in vain to pretend to detail particularly how the operator is to conduct himſelf in extirpating exoſtoſes. His firſt object ſhould be, if poſſible, to make ſuch inciſions through the ſoft parts as will expoſe the baſe of the tumour, ſo as to allow the ſaw to be applied to it. When this can be effected, it is manifeſt that the whole of the ſwelling may be removed by one ſection made with the ſaw. In the majority of caſes, ſmall ſhort ſaws with long handles, in a word, the inſtruments deſcribed in Mr. Hey's "Practical Obſervations in Surgery," will be found much more proper and convenient than larger ones.

Sometimes, when owing to depth of ſituation, or ſome other anatomical reaſon, no direct attempt to cut through the baſe of an exoſtoſis can be made, the ſurgeon may venture to remove the tumour by attacking its ſurface with trephines, the ſaws deſcribed by Hey, or with a gouge and mallet, as the French ſurgeons are ſo much in the habit of doing. When the conſiſtence of the exoſtoſis is not too hard, a ſtrong knife may be occaſionally employed for removing portions of the ſwelling, which purpoſe it will accompliſh better than any ſaw.

The ancients, indeed, we might ſay ſeveral of the moderns, have attempted to deſtroy exoſtoſes with the actual and potential cautery. Sometimes theſe violent means have fulfilled the object in view; but, frequently, inſtead of affording relief, they have killed a large portion of the bone, and converted the diſeaſe into the more afflicting one of necroſis, attended with large ſores and abſceſſes, and often with ſuch debility and hectical ſymptoms, as have ended in death.

Few good practitioners of the preſent day, in England, ever have recourſe to this plan for the extirpation of exoſtoſes.

When prudence prohibits an endeavour to cut away an exoſtoſis, the diſeaſe ſhould never be ſuffered to expand itſelf in ſo great a degree as to deprive the patient of the choice of parting with his limb for the preſervation of his life. Amputation ſhould always be performed ere the diſorder attains this deplorable ſtate.

We ſhall conclude the preſent article with this general obſervation, that if an attempt is to be made to extirpate an exoſtoſis, let it be done at an early period of the diſeaſe, before its ſize is very conſiderable.

EXOSTRA, in the *Ancient Theatre*, a place where ſuch parts of the play were recited as were ſuppoſed to be acted privately in the houſe.

Exostra was likewiſe the name of a warlike engine uſed in the ſieges of towns.

EXOTERIC and Esoteric, are terms denoting *external* and *internal*, and applied to the double doctrine of the ancient philoſophers: the one was public or exoteric, the other ſecret, acroamatic, or eſoteric. The firſt was that which they openly profeſſed and taught to the world; the latter was confined to a ſmall number of choſen diſciples. This method was derived originally from the Egyptians, who, according to the united teſtimony of Herodotus, Diodorus Siculus, Strabo, Plutarch, &c. had a two-fold philoſophy, one ſecret and ſacred, another public and common. The ſame practice alſo obtained among the Perſian Magi, the Druids of the Gauls, and the Brachmans of India. The Egyptian prieſts, with whom it originated, ſuſtained the character of judges and magiſtrates, and probably introduced this diſtinction with a view to the public welfare, and to ſerve the purpoſes of legiſlation and government. Clement of Alexandria informs us, that they communicated their myſteries principally to thoſe who were concerned in the adminiſtration of the ſtate; and Plutarch confirms the ſame declaration. However, others have ſuppoſed that they invented the fables of their gods and heroes, and the other external ceremonies of their religion, to diſguiſe and conceal natural and moral truths; but whatever was the motive of their practice, it was certainly applied to political purpoſes. See Aristotle.

EXOTIC, Εξωτικος, a term properly ſignifying *foreign*, or *extraneous*, *i. e.* brought from a remote or ſtrange country. In which ſenſe we ſometimes ſay, *exotic*, or *barbarous terms* or *words*, &c.

The word is derived from the Greek, εξω, εξωθεν, *extra*, *without*, *on the outſide*.

Exotic is chiefly applied to plants which are natives of foreign countries, particularly thoſe brought from the Eaſt and Weſt Indies, and which do not naturally grow in Europe.

The generality of exotics, or exotic plants, do not thrive in England without ſome peculiar care and culture; they require the warmth of their own climates, whence the uſe of hot-beds, glaſs-frames, green-houſes, &c. See Green-*houſe* and Stove.

In ſending plants from one country to another, particular cautions are neceſſary. The plants ſent from a hotter country to a colder, ſhould be always put on board in the ſpring of the year, that the heat of the ſeaſon may be advancing as they approach the colder climates; and on the contrary, thoſe which are ſent from a colder country to a hotter, ſhould be ſent in the beginning of winter.

The beſt way of packing up plants for a voyage, if they be ſuch as will not bear keeping out of the earth, is to have boxes with handles, filling them with earth, and planting the roots as cloſe together as may be; the plants ſhould be ſet in theſe boxes three weeks before they are to be put on board; and in good weather they ſhould be ſet upon the deck, and in bad removed, or covered with a tarpaulin.

If they are going from a hotter country to a cold one, they muſt have very little moiſture; if, on the contrary, they are going from a colder to a warmer, they may be allowed water more largely, and being ſhaded from the heat of the ſun, they will come ſafe.

Many plants, however, will live out of the earth a great while; as the ſedums, euphorbiums, ficoides, and other ſucculent ones. Theſe need no other care than the packing of them up with moſs in a cloſe box, and there ſhould be a little hay put between them, to prevent them from wounding or bruiſing one another, and holes bored in the boxes to keep them from heating and putrefying. In this manner they will come ſafe from a voyage of two or three, or even four or five months.

Several trees alſo will come ſafely in the ſame manner, taking them up at a ſeaſon when they have done growing, and packing them up with moſs. Of this ſort are oranges, olives, capers, jaſmines, and pomegranate-trees. Theſe, and many others, are annually brought over thus from Italy; and though they are three or four months in the paſſage, ſeldom miſcarry. And the beſt way of ſending over ſeeds is in their natural huſks, in a bag, or packed up in a gourd-ſhell, keeping them dry, and out of the way of vermin. Miller.

Dr. Liſter has a diſcourſe in the Philoſoph. Tranſ. on Exotic Diſeaſes, *i.e.* ſuch diſeaſes as are never bred among us, but brought, from time to time, by infection from other countries. Such, according to this author, are, 1. The plague, which is properly a diſeaſe of Aſia, where it is epidemic. 2. The ſmall-pox, which is an Oriental diſeaſe, and not known to Europe, or even Aſia Minor or Africa, till a ſpice-trade was opened to the remoteſt part of the Indies, whence it originally came, and where it ſtill rages more cruelly than among us. 3. The griping of the guts, which he takes for a diſeaſe peculiar to the Weſt Indies, and yearly received from thence: for this, he adds, is a quite different diſeaſe from the tormina ventris of the ancients, and is ſcarce ever known in the midland counties, or far in the north of England.

EXOUCONTII, in *Church Hiſtory*, a kind of Arian heretics, who maintained that the Son of God was made out of nothing: *i. e.* Ἐκ των εκ οντων, ſuppoſed by Gothofred to be the ſame with the Exocionitæ; but this opinion is contradicted by the authority of Theodoret.

EXPAND, in a *Military Senſe*, relates to the exterior of a line or front, either for the purpoſe of occupying a greater ſpace, or in order to outflank the enemy, thereby to beat in his wings upon his centre.

It is often of the greateſt importance to preſent a more extended line of fire, eſpecially if it can be directed towards any particular ſpot; for inſtance, when a column is iſſuing from a defile, a detroit, or paſs, the enemy will certainly endeavour to pour upon its front as heavy a fire as the ſpace may allow.

Thus, he will probably oppoſe a formidable cannonade thereto, ſo that the ſhots may range along the column, doing great havoc therein, not only among the ſoldiery, but deſtroying the cattle, and diſabling the artillery. The reſt of the field he will generally occupy in an inflected form, preſenting a creſcent; much the ſame as that oppoſed to the immortal Nelſon in his laſt victory! By this means every muſket becomes obnoxious, each being levelled at the head of the column.

If we imagine 3000 men to be drawn up in ſuch a manner as may produce this effect, and that five or ſix guns are brought to bear as above deſcribed, with perhaps a body of cavalry ready to charge in flank, when the column may have proceeded to contend with the centre of the oppoſing force, we ſhall then ſee how neceſſary it is for the column to expand with all poſſible celerity, and not to attempt ſuch an attack before a ſufficient front can be formed to make it with effect.

The mode of expanding may be ſeen under the article Deploy, where this particular operation will be found more fully deſcribed. We ſhall in this place remark, that expanſion is by no means proper where the enemy can bring a large body of cavalry to act in an open country, unleſs an equal number of ſuch troops may be at hand to oppoſe them.

Where a line of intrenchments is to be carried, expanſion is not eligible; yet the concentration muſt be managed with peculiar care whenever the enemy may be able to line their works with artillery, eſpecially howitzers of large calibre, which, by pouring grape among cloſe bodies of men, would ſoon thin their ranks, and probably occaſion, what is delicately called, "a precipitate retreat." The beſt authorities inſtruct us to ſay, that nine battles in ten are loſt by allowing the troops to be too expanded: in ſuch a condition they are every where weak; whereas, when properly concentrated, they are every where formidable.

We may from this collect, that allowing an army to cover too great an expanſe, is, generally ſpeaking, expoſing it to ruin; it enables the enemy to force a line in whichever quarter they may judge proper, and, after forcing it, to cut up the ſeveral parts in detail. Hence, blockades are, with few exceptions, extremely dangerous, as may be better underſtood by reference to *environ*, which ſee.

When a column is to expand or deploy, or when an augmentation of front is to be made, ſuch ought to be done with great promptneſs, and under a heavy fire from each diviſion, ſo faſt as it can arrive at its ſtation in the line. By this means, eſpecially if the wind be favourable, the whole may be done under cover of the ſmoke, and the enemy may be ſo rapidly gained upon, as in turn to render it neceſſary for him to change poſition; but without great coolneſs and firmneſs, nothing will be effected.

EXPANDING Rigger, or *Drum*, in *Mechanics*, is a wheel, or rigger, to receive an endleſs rope, which can be enlarged or diminiſhed in its diameter, to give a greater or leſs velocity to the rope.

The common expanding rigger is a caſt-iron wheel with twelve arms, in each of which a groove is formed, extending nearly from the centre to the circumference, as A A, *fig.* 5. *Plate* XXVI. *Mechanics.* Againſt each arm a piece of wood is placed, which has a rebate fitting into the groove, and a ſcrew-bolt paſſing through both wood and the arm of the wheel; a nut ſcrewed upon the bolt faſtens the bolt and wood at any place in the groove: each piece of wood has a groove in it to receive the rope which paſſes round the wheel. The diameter of this rigger can be altered by looſening the nuts, then placing the pieces of wood all in one circle of the propoſed diameter, and faſtening them there by the nuts. To facilitate the placing of the pieces of wood in one circle, each arm is divided into inches, and numbered from the centre.

Mr. Andrew Flint, of London, lately received a premium of fifty guineas from the Society of Ats, for two expanding band wheels, or riggers. *Figs*. 5, 6, and 7, are different views of the firſt of theſe; A A is a caſt metal wheel with twelve arms, each divided by a groove from near the centre to the circumference: theſe grooves receive rebates on the backs of twelve racks *a a*, *figs*. 6 and 7, which have projecting pieces *b*, *b*, with grooves to contain the endleſs rope *d d*. In *fig*. 5. which is a back view of the wheel *e e*, are nuts, which draw up the racks to ſlide in the grooves without ſhake, yet freely to and from the centre: the racks are moved all together by means of a circular plate *d d*, which has a ſpiral rib upon it entering between the teeth of each rack, ſo that when the plate is turned round, all the racks move to or from the centre at once: the ſpiral plate *d d* is ſcrewed to an iron croſs, which fits upon the axis *f f*, and is turned round by a pinion *g* of ſix teeth, working into a ring of teeth made in the inſide of the ſpiral plate *d*.

Another method of accompliſhing the ſame object is by means of twelve ſcrews *h* (*figs*. 8. and 9) pointing to the centre of the wheel; they are are all moved together by means of equal bevelled wheels fixed on them; by this means the ſcrews are turned about contrary ways alternately: they muſt, therefore, be alternately cut right handed and left handed, that they may produce the ſame effect. The ſcrews are turned, when the diameter of the rigger is to be altered, by a winch put upon any of the three ſquares *h*, *h*, *h*, on the ends of the ſcrews. In this machine the number of ſcrews muſt be even.

Figs. 10, 11, and 12, are drawings of an expanding rigger contrived by the writer of this article: it conſiſts of two wheels of caſt-iron A, A, (*figs*. 10, 11, and 12.) which have ſixteen ſectorial apertures marked *a*, which leave ſixteen arms between them; the arms and the ſpaces are exactly equal, and each arm has a triangular piece of wood *b d e*, (*fig*. 12.) ſcrewed upon it, by four ſcrews going through the arm into the wood, which is alſo kept firm and perpendicular to the face of the wheel, by a rib *f*, (*fig*. 11.) which projects from each arm, and is let into a groove cut in the wood. The wheels have ſockets *g*, *g*, (*figs*. 10 and 12.) which are bored out with a very true cylindrical hole to receive the ſhaft or ſpindle B B of the rigger, which is turned in the lathe to fit the ſockets without ſhake, yet at the ſame time allowing them to move backwards and forwards upon the axis B B. The wheels are put together upon the ſpindle facing each other, the wooden triangles of one wheel entering the ſpace between the arms of the other, as is ſhewn in *figs*. 10 and 12; in this manner it is plain that the points, or rather plane, of interſection of the triangles *b d e* of each wheel, will form a circular groove to receive a rope, which groove can be increaſed in its diameter by advancing the wheels towards each other, or diminiſhed by ſetting them farther apart, as in *fig*. 10. The wheels are prevented from turning on the ſpindle by means of a fillet, which is inſerted partly into a groove cut in the axis, and partly in another groove made in the ſocket of the wheel. The wheels may be brought nearer together, or thrown farther apart, by two ſcrews *h*, *h*, (*fig*. 12.) which have ſockets in one wheel, and are tapped into the other: two equal cog-wheels *i*, *i*, are keyed faſt upon the ſcrews, and an intermediate cog-wheel *k*, placed looſely upon the main axis between them, cauſes both ſcrews to turn at the ſame time. A more ſimple method of altering the diameter is by puſhing the wheels together by hand, and faſtening them to the axis by ſcrews *e*, *e*, *fig*. 10.

EXPANSION, in *Metaphyſics*, expreſſes the idea we have of laſting or preſerving diſtance, *i. e.* of diſtance, all the parts whereof exiſt together.

EXPANSION, from the Latin *expando*, in *Philoſophy*, denotes the increment of ſurface or of bulk, of which natural bodies are ſuſceptible. With reſpect to the expanſion of ſurface, ſee the articles DUCTILITY and GOLD *Beating*.

Bodies of every kind, as far as we are acquainted with them, are expanded in bulk by heat, and are contracted by cold; and to this law there are very few exceptions, which will be noticed in due time. The expanſions, or the increments of bulk, are not exactly proportional to the increments of heat in the ſame body; nor are different bodies expanded alike by the like elevation of temperature. Thus, if a quantity of water be increaſed one inch in bulk, by the communication of ten degrees of heat, the communication of twice or thrice as much more heat will not cauſe it to expand two or three inches more. Alſo, if a rod of gold, and another ſimilar rod of glaſs, be heated to the ſame degree, their increments of bulk, ariſing thereby, will not be equal, the gold expanding more than the glaſs.

Of the three principal ſtates of natural bodies, *viz.* ſolids, liquids, and elaſtic fluids, the ſolids are expanded leaſt; the liquids are expanded more than the ſolids, but the elaſtic fluids are expanded a vaſt deal more than the liquids. The knowledge of the preciſe quantities of theſe expanſions of bodies is of great uſe in philoſophy, in mechanics, and in other ſcientific ſubjects; hence no pains have been ſpared by philoſophers to inveſtigate and aſcertain them; various inſtruments have been contrived for that purpoſe; innumerable experiments have been inſtituted; and a great many uſeful reſults have been obtained. Of theſe reſults we ſhall now endeavour to give a regular and diſtinct account.

The inſtruments which have been contrived for the purpoſe of meaſuring the expanſions of ſolids ariſing from an elevation of temperature, are called *pyrometers*. The objects which muſt be had in view in the conſtruction of pyrometers, are to form a ſteady frame, wherein ſolids of a certain length may be applied either ſucceſſively, or ſeveral of them at the ſame time, ſome contrivance by which thoſe metallic bodies may be heated to any required degree, and a mechaniſm capable of meaſuring the increaſe of bulk which is cauſed by the heat; and this may be accompliſhed by means of multiplying wheels, by levers, by ſcrews, by a microſcopical micrometer, or otherwiſe. See PYROMETER.

Some of the firſt determinations of the expanſion of bodies, that may be conſidered as being ſufficiently accurate, were made by Mr. Ellicot with a pyrometer of his contrivance. Mr. Ellicot determined the proportional expanſions of ſeven metallic bodies by the ſame elevation of temperature. They are as follows:

Gold.	Silver.	Braſs.	Copper.	Iron.	Steel.	and Lead.
73.	103.	95.	89.	60.	56.	149.

Mr. Smeaton contrived a much better pyrometer, and with it he determined the expanſions of ſeveral ſolids. Mr. De Luc alſo contrived a pyrometer of a peculiar conſtruction; but Mr. Ramſden's pyrometer is ſuperior to any other contrivance of the kind.

The following table ſhews, in parts of an inch, how much one foot length of different ſubſtances is expanded by 180° of heat, Fahrenheit's ſcale, between the freezing and the boiling points of water. To the firſt ſeven ſubſtances, (which were examined in Mr. Ramſden's moſt accurate pyrometer,) there are added the expanſions for a ſingle degree of heat. The others were determined by Mr. Smeaton with his pyrometer.

	Fahrenheit's Scale.	
	By 1°	By 180°.
Standard braſs ſcale, ſuppoſed to be Hamburgh braſs - -	0.0001237	0.0222646
Engliſh plate braſs in form of a rod - - - - - -	0.0001262	0.0227136
Engliſh plate braſs in form of a trough - - - - -	0.0001263	0.0227386
Steel rod - - - -	0.0000763	0.0137368
Caſt-iron priſm - - -	0.0000740	0.0133126
Glaſs tube - - - -	0.0000517	0.0093138
Solid glaſs rod - - -	0.0000539	0.0096944
White glaſs barometer tube - - -		0.0100
Martial regulus of antimony - - -		0.0130
Bliſtered ſteel - - - - -		0.0138
Hard ſteel - - - - - -		0.0147
Iron - - - - - - -		0.0151
Biſmuth - - - - - -		0.0167
Copper hammered - - - - -		0.0204
Copper eight parts, with tin one part - - - - - - -		0.0218
Caſt braſs - - - - - -		0.0225
Braſs ſixteen parts, with tin one part - - - - - - -		0.0229
Braſs wire - - - - - -		0.0232
Speculum metal - - - - -		0.0232
Spelter ſolder, *viz.* braſs two parts, zinc one - - - - -		0.0247
Fine pewter - - - - - -		0.0274
Grain tin - - - - - -		0.0298
Soft ſolder, *viz.* lead two parts, tin one - - - - - -		0.0301
Zinc eight parts, with tin one, a little hammered - - - - -		0.0323
Lead - - - - - - -		0.0344
Zinc or ſpelter - - - - -		0.0353
Zinc hammered half an inch *per* foot - - - - - - -		0.0373

Iron, inſtead of being condenſed into a ſmaller bulk, expands in its tranſition from a fluid into a ſolid ſtate; ſo that a quantity of iron occupies more room in the ſolid form than it does in a fuſed ſtate.

Dr. Wollaſton, in order to form ſome eſtimate of the comparative rate of expanſion of platina and palladium, ſays, "I rivetted together two thin plates of platina and palladium, and obſerving that the compound plate, when heated, became concave on the ſide of the platina; I aſcertained that the expanſion of palladium is in ſome degrees the greater of the two. By a ſimilar mode of compariſon I found that palladium expands conſiderably leſs than ſteel by heat." Phil. Tranſ. for 1805.

It muſt be remarked with reſpect to the expanſion of glaſs, that ſometimes glaſs tubes are extended more than ſolid glaſs rods: their dilatation, however, is not conſtant; for tubes of different diameters, or of different ſorts of glaſs, are expanded differently by the like degrees of heat.

Wood is not expanded much longitudinally; that is, in the direction of its fibres, by heat, and this is particularly the caſe with deal and other ſtraight-grained wood. Probably, upon the whole, the longitudinal expanſion of wood is leſs than that of glaſs. It has been obſerved, (eſpecially by Dr. Rittenhouſe, Tranſ. of the American Phil. Society) that very dry and ſeaſoned wood, if not expoſed to a very high or to a very low temperature, will expand in length pretty regularly: otherwiſe its expanſion by heat, and its contraction by cold, are very irregular: for they ſeem to depend partly upon the heat, and partly upon the moiſture, which the wood acquires in certain circumſtances, and is deprived of in others.

It is hardly neceſſary to mention, that the ſolids of the preceding table contract their dimenſions by cooling as much as they are expanded by heating; thus, for inſtance, if a yard length of any particular metallic body, by being heated 100° above the actual temperature of the atmoſphere, be lengthened one fiftieth part of an inch; afterwards, when cooled down to the temperature of the atmoſphere, it will be found to have loſt exactly that fiftieth part of an inch which it had acquired by heating.

From the experiments hitherto made on the expanſions of ſolids by heat, no correſpondence has been obſerved between the expanſions and the quantities of caloric they are capable of abſorbing. The fuſibility of metals ſeems to coincide with the dilatations; platina, the leaſt fuſible of the metals, dilates the leaſt; lead dilates moſt; and the moſt fuſible glaſs is alſo the moſt dilatable. We may therefore conclude with Mr. Berthollet, that bodies are ſo much the more expanſible, the leſs caloric they require to change their conſtitution from ſolid to liquid, and from liquid to gaſes or vapours.

There is a ſubſtance which expands when heated; but does not contract when cooled; and of this ſingular property Mr. Wedgwood availed himſelf for the conſtruction of his ingenious thermometer for meaſuring the higheſt degrees of heat; *viz.* thoſe degrees which exceed the ſcale of the mercurial thermometer. (See Thermometer.) The ſubſtance alluded to is the argillaceous earth or clay, and it appears that the above-mentioned property belongs, more or leſs, to argillaceous bodies of every kind. This property may at firſt ſight appear to be an unaccountable exception from the general law: the difficulty, however, will vaniſh, if it be conſidered that bodies of the argillaceous genus contain a conſiderable quantity of water, and that the contraction of theſe bodies, when expoſed to the action of a ſtrong fire, is in great meaſure due to the eſcape of the water, and hence they do not contract by ſubſequent cooling.

The method of meaſuring the expanſions of fluids is to incloſe them in a certain veſſel, and to meaſure that part of the cavity of the veſſel, which is occupied by the fluid under trial, in different temperatures. It is evident that the ſubſtance of the veſſel is likewiſe expanded by the heat, and of courſe the cavity of the veſſel is enlarged. Therefore, when we find that the bulk of the fluid is increaſed, that increment is only the difference between the enlarged capacity of the veſſel and the increaſed bulk of the fluid. This ſhews the neceſſity of forming thoſe veſſels of ſuch ſubſtances as are leaſt expanſible by heat. Indeed glaſs is the ſubſtance which is univerſally uſed for ſuch purpoſes, both on account of its little expanſibility, and of its tranſparency; beſides its having other uſeful properties. A glaſs veſſel, filled to a certain degree with a liquid, for the purpoſe of ſhewing the expanſions of that liquid in different temperatures, or for the purpoſe of ſhewing the temperature of the correſponding expanſion of that liquid, is called a thermometer; *viz.* a meaſure of the temperature. See Thermometer.

The propereſt ſhape for a thermometer is that of a long tube with a narrow bore, having a globular cavity at one end; which, familiarly ſpeaking, may be called a globular glaſs bottle with a long and narrow neck. The globular cavity, and part of the tube of one of theſe veſſels, is filled with the liquor whoſe expanſion is to be examined, and the veſſel is then heated, in conſequence of which the liquor, which is contained in it, is expanded, and not being able to extend itſelf any other way, all the increment of bulk muſt be manifeſted in the tube; *viz.* the ſurface of the fluid will riſe in the tube; or, if cooled, it will deſcend in it. If the ſame veſſel of the above-mentioned ſhape be ſucceſſively filled with different fluids, and with each fluid it be expoſed to certain degrees of temperature, (which muſt be determined by an accurate thermometer,) the proportional expanſions of the different fluids may thereby be aſcertained. The ſame object may be obtained by filling ſeveral ſuch veſſels with the different fluids, that are to be examined, and heating or cooling them all at the ſame time; but in this caſe the correſponding capacities of the different veſſels muſt be previouſly aſcertained; which may be done by filling all the veſſels with the ſame kind of fluid, and expoſing them all to different degrees of temperature; ſo that the correſponding elevations of the fluid in the different veſſels may be marked on the tubes. Theſe veſſels are afterwards emptied and filled again with the fluids, &c. Thus the proportional expanſions of liquids may be determined; but when the actual or abſolute increaſe of bulk is required, then the capacity of the veſſel muſt be accurately gauged. This meaſurement of the capacity may be accompliſhed in the following manner. In the firſt place weigh the empty glaſs tube; ſecondly, fill part of the tube with a convenient fluid, (mercury, for inſtance, which is the fitteſt for ſuch purpoſes); thirdly, meaſure the length of the tube which is occupied by the mercury, and weigh the inſtrument a ſecond time; then, by ſubtracting this ſecond weight from the former, you will have the weight of mercury which fills up a certain length of the cavity of the tube; fourthly, fill the bulb of the veſſel entirely with mercury, and weigh the veſſel a third time. This weight being ſubtracted from the firſt, *viz.* from that of the empty veſſel, will leave the weight of the mercury in the bulb. Now, having the weight of the mercury in the bulb, as well as of that which fills a certain length of the tube, the ratio of the former to the latter may be eaſily determined by ſimple diviſion. Alſo the abſolute quantity in bulk of the former is obtained from the well known ſpecific gravity of mercury, and from the weight of a cubic inch of diſtilled water, which (when the barometer is at 29.74 inches, and Fahrenheit's thermometer at 66°) is equal to 252.42 grains Troy; one pound Troy being equal to 5760 of thoſe grains. An Engliſh cubic inch of mercury of the ſpecific gravity 13.6 weighs 3443.2 Engliſh grains. Inſtead of mercury, ſome other fluid may be employed for this purpoſe; but not ſo conveniently as mercury. The expanſions of a fluid, which are cauſed by different degrees of heat, may likewiſe be determined by aſcertaining the ſpecific gravity of that fluid in different temperatures; for the ſpecific gravity decreaſes in proportion as the fluid is expanded, and *vice verſâ;* but this method is not capable of as much accuracy as the former.

Liquids differ from each other in regard to their expanſibility; ſome expanding more than others. Alſo the expanſions of the ſame liquid by equal degrees of heat are not quite regular; and it has been obſerved that this irregularity is greater when they approach the ſtate of vapour. Upon the whole, mercury has been found to be expanded by heat more regularly that any other fluid; yet its increments of bulk are not perfectly regular. Mr. De Luc, with great care and patience, has endeavoured to aſcertain the real expanſibility of mercury, or rather the real quantities of heat that are required for expanding mercury arithmetically, *viz.* by equal augmentations. Theſe are expreſſed in the following table, the firſt column of which contains the degrees of Reaumur's ſcale, from five to five, which are equal parts; the ſecond ſhews the real quantities of heat which are required to raiſe the mercury to the correſponding degrees, where z is a fixt but unknown quantity; and the third column ſhews the differences of thoſe quantities. De Luc's Recher. ſur les Modif. de la Atmoſph. 1772, p. 309.

	Mercurial Thermom.	Real quantities of heat.	Real differences of heat correſponding to the variations of the Mercury in the thermom. from 5 to 5 degrees.
Point of boil. water	80°	z + 80.00	−4.72
	75	z + 75.28	−4.72
	70	z + 70.56	−4.79
	65	z + 65.77	−4.81
	60	z + 60.96	−4.81
	55	z + 56.15	−4.89
	50	z + 51.26	−4.89
	45	z + 46.37	−4.97
	40	z + 41.40	−5.00
	35	z + 36.40	−5.08
	30	z + 31.32	−5.10
	25	z + 26.22	−5.10
	20	z + 21.12	−5.18
	15	z + 15.94	−5.20
	10	z + 10.74	−5.31
	5	z + 5.43	−5.43
Point of melt. ice	0	z	

From the third column it appears, that the differences of heat requiſite to make equal and progreſſive additions to the bulk of the mercury, though not exactly equal, yet are not very far from the ratio of equality. If the bulk of a quantity of mercury, at the temperature of 32° Fahrenheit's ſcale, be conceived to be divided into 100,000 equal parts, and then be heated as high as the temperature of boiling water; (*viz.* 212°) its bulk will thereby be increaſed by 1836 of thoſe parts.

The expanſion of water is attended with a ſingular deviation from the general law; *viz.* this fluid is expanded by heat from about the 40th degree of Fahrenheit's thermometer upwards; but below 40° its bulk is expanded by a farther decreaſe of heat, or increaſe of cold; and in fact ice is lighter than water, ſo as to float upon it; the ſpecific gravity of ice being to that of water nearly as 7 to 8. The bulk of ice is to that of the water, when the ice is melted, as 9 to 8 very nearly. The bulk of water, from its moſt contracted ſtate at the temperature of 40°, increaſes continually; but that increaſe is not very regular; for inſtance, the increaſe of bulk from 180° to 212°, is conſiderably greater than from 40° to 72°. If the bulk of water at 40° be called 1, its bulk at 212° will be 1.04785. Beyond that degree of heat water becomes vapour; *viz.* an elaſtic fluid, and the formation of this elaſtic fluid on the ſides of the veſſel within the water, forms the bubbles, the eſcape of which conſtitutes the boiling. The bulk of ſteam at the boiling point is ſomewhat leſs than 1800 times the bulk of the water from which it originated.

The expanſion of freezing water is not owing to the extrication of air; for water deprived of air expands like other water in freezing. Mr. Mairan attributes it to a ſtrong tendency the particles of water have to arrange themſelves into ranks and lines, which croſs one another at angles of 60° and 120°. This tendency ſeems to begin at the temperature of 40°. The expanſion of freezing water has a prodigious force. It is owing to this that in hard froſts timber is burſt, plaiſter is removed from walls, and even iron mortar ſhells filled with water, and accurately ſtopped, have been burſt by the freezing of the water.

This ſingular property of water, *viz.* its expanding from the temperature of 40° downwards, ſo as to become lighter and lighter in proportion as it becomes colder and colder, is a moſt ſtriking inſtance of the wiſdom of the Creator, and is a property of immenſe conſequence to the very exiſtence of animals and vegetables. A quantity of water is indiſpenſably neceſſary to animals and to vegetables at all times of the year. In winter, when the cold air freezes the ſurface of the water, that effect ſeldom penetrates lower than two or three feet. Below that depth the water continues fluid, and the cruſt of ice itſelf contributes to preſerve its fluidity. The heat of the earth, which has been acquired during the ſummer, undoubtedly prevents the formation of ice below a certain depth. But if water in cooling had continued to increaſe in ſpecific gravity, and had ice been actually heavier than water, the heat of the earth would not have been ſufficient to prevent the total freezing of all the waters of lakes, ſeas, rivers, &c. "For," ſays count Rumford, "as the particles of water on being cooled at the ſurface would, in conſequence of the increaſe of their ſpecific gravity, on parting with a portion of their heat, immediately deſcend to the bottom, the greateſt part of the heat accumulated during the ſummer in the earth, on which the water repoſes, would be carried off and loſt before the water began to freeze; and when ice was once formed, its thickneſs would increaſe with great rapidity, and would continue increaſing during the whole winter; and it ſeems very probable that in climates which are now temperate, the water in the large lakes would be frozen to ſuch a depth in the courſe of a ſevere winter, that the heat of the enſuing ſummer would not be ſufficient to thaw them; and ſhould this once happen, the following winter would hardly fail to change the whole maſs of its waters to one ſolid body of ice, which never more could recover its liquid form, but muſt remain immoveable till the end of time." (7th Eſſay.)

The following table ſhews the expanſions of the principal liquids that have been ſubmitted to ſuch experiments, according to Mr. De Luc's obſervations. With reſpect to this table it muſt be underſtood that different thermometers (each being filled with a particular fluid, ſuch as is mentioned at the top of each column, and each being divided into 80 equal parts between the freezing and the boiling points of water) are placed with their bulbs in the ſame veſſel full of water, and that the water is gradually heated. Then when the mercurial thermometer ſtands at 5°, 10°, 15°, &c. the ſurfaces of the fluids in the other thermometers will be found at the degrees which ſtand on the ſame levels; for inſtance, when the mercurial thermometer ſtands at 40°, the water thermometer will be found to ſtand at 20°.5, the ſpirit thermometer will be found to ſtand at 35°, the oil thermometer at 39°.2, &c.

	Mercury.	Water	Water ſaturated with ſalt.	Alcohol.	Alcohol 3 parts, water 1.	Alcohol and water equal parts.	Alcohol 1 part, water 3.	Oil of olives.
Boiling water	80°	80.0	80.0	80.0	80.0	80.0	80.0	80.0
	75	71.0	74.1	73.8	73.7	73.2	71.6	74.6
	70	62.0	68.4	67.6	67.5	66.7	62.9	69.4
	65	53.5	62.6	61.5	61.5	60.6	55.2	64.4
	60	45.8	57.1	55.5	55.8	54.8	47.7	59.3
	55	38.5	51.7	50.3	50.2	49.1	40.6	54.2
	50	32.0	46.6	45.1	44.9	43.6	34.4	49.2
	45	26.1	41.2	40.0	39.7	38.4	28.4	44.0
	40	20.5	36.3	35.0	34.8	33.3	23.0	39.2
	35	15.9	31.3	30.1	29.8	28.4	18.0	34.2
	30	11.2	26.5	25.5	25.2	23.9	13.5	29.3
	25	7.3	21.9	20.9	20.7	19.4	9.4	24.3
	20	4.1	17.3	16.5	16.2	15.3	6.1	19.3
	15	1.6	12.8	12.0	11.8	11.1	3.4	14.4
	10	0.2	8.4	7.9	7.7	7.1	1.4	9.5
	5	0.4	4.2	3.9	3.8	3.4	0.1	4.7
Freezing	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	5		4.1					
	10		8.0					

The expanſions of elaſtic fluids, ſuch as common air, the gaſes, and vapours, are more difficultly aſcertained; for the expanſions of thoſe fluids are occaſioned by a diminution of preſſure, as well as by an increaſe of temperature; and it is difficult to ſubject any of thoſe fluids to the action of one of theſe cauſes only at a time, in order that the effect of each may be duly eſtimated.

When common air is acted upon by preſſure only, independent of any alteration of temperature, its bulk is found to increaſe and to decreaſe in the inverſe proportion of the preſſure; thus, the air cloſe to the ſurface of the earth is compreſſed into the bulk which we experience, by the ſuperincumbent atmoſphere. If that preſſure be increaſed, the bulk of the lower air will be contracted, which is manifeſted by an augmentation of its weight; if that preſſure be diminiſhed, the bulk of the lower air will be increaſed, as is manifeſted by a diminution of its weight. And this expanſion and contraction of the air is exactly but inverſely proportional to the preſſure; ſo that a double preſſure will compreſs it into half the ſpace, a treble preſſure into one third of the original ſpace, &c. The ſame thing, *mutatis mutandis*, may be ſaid of the removal of preſſure, and of the expanſion thereby ariſing. This elaſticity of the air has not been found to be impaired by a long continuance of the preſſure; for air has been left during ſeveral years very much compreſſed in proper veſſels, wherein there was nothing that could have a chemical action upon it; and afterwards on removing the unuſual preſſure, and replacing it in the ſame temperature, the air has been found to recover its original bulk. It is not known how far a quantity of air may be expanded by removing the preſſure, nor how much it may be compreſſed by increaſing the preſſure; for no experiments have as yet been able to aſcertain either limit.

The inſtrument, in which the expanſion of air is tried, has been called *manometer*, (which ſee,) It is a ſort of large air thermometer, conſiſting of a tube five or ſix feet long, having a bulb at one end, and being open at the other end. The bore of the tube is about a 20th of an inch in diameter. A ſmall quantity of quickſilver is placed in ſome part of the cavity of the tube, and the expanſion of the air in the bulb, when heated, forces the quickſilver to move towards the open end of the tube. The degree of heat to which the manometer is expoſed is meaſured by means of a thermometer; the quantity of expanſion of the air is meaſured by gauging the manometer, and making marks on the tube, which may indicate parts of the cavity of the tube that are proportional to the capacity of the manometer; as for inſtance 100dths, 1000dths, &c. By placing the manometer horizontal or vertical, either with the bulb downwards or upwards, the air in it may either be left of the natural denſity, or it may be condenſed, or, laſtly, it may be rarefied; for when the manometer ſtands horizontal, the quickſilver in the tube does not preſs upon the air in the bulb, nor on that of the atmoſphere; when the bulb is downwards, the quickſilver preſſes upon the air of the manometer, and when the bulb is upwards, the quickſilver preſſes againſt, and counteracts, in ſome meaſure, the gravity of the atmoſphere. Hence this preſſure, and this expanſion of the air within the manometer, may be increaſed to any required degree by increaſing the quantity of quickſilver within the tube: and thus the expanſibility of common, or of condenſed, or of rarefied air, may be tried. The expanſion of air, by the ſame degrees of heat, differs according to its denſity, and to the quantity of moiſture it contains; nor are the increments of its bulk proportional to the degrees of temperature.

It appears from Col. Roy's very numerous experiments (Phil. Tranſ. vol. 67th) that 1000 parts of air, of the denſity of the common atmoſphere, at 0° of heat, become 1484.21 at 212°; *viz.* are expanded 484.21, by 212° of heat.

1000 parts of air loaded with $2\frac{1}{2}$ atmoſpheres, are expanded 434 of thoſe parts, by 212° of heat.

1000 parts of air preſſed only with $\frac{5}{6}$ths of an atmoſphere, are expanded nearly 484 of thoſe parts by 212° of heat.

1000 parts of air preſſed with $\frac{1}{5}$th of an atmoſphere, are expanded about 141 parts by 180° of heat; *viz.* from the freezing to the boiling point of water.

"From theſe laſt experiments," Col. Roy ſays, "it would ſeem that the particles of air may be ſo far removed from each other, by the diminution of preſſure, as to loſe a very great part of their elaſtic force."

The above-mentioned expanſions of air are by no means regular: *viz.* they are not proportional to the number of the degrees of heat. The maximum of expanſion takes place between 52° and 72°: and the minimum is conſtantly at the boiling point of water. Moiſt air expands a great deal more than dry air, eſpecially when it approaches the boiling point of water; ſo that between 192°, and 212°, moiſt air expands about eight, or nine, times as much as dry air in ſimilar circumſtances.

The expanſions of gaſes may be tried and determined in the ſame manner as the expanſion of common air. From a long ſeries of experiments, Meſſrs. Guyton and Prieur deduced a dilatation peculiar to each gas; but Mr. Guy-Luſſae has ſhewn, that all gaſes, without exception, poſſeſs the ſame expanſibility at the ſame degree of temperature, and that the preſence of water in gaſes occaſioned the errors into which his predeceſſors had fallen. He is led to conclude from his experiments made on gaſes reduced to the utmoſt degree of dryneſs, that 100 parts of each of the permanent gaſes acquire an increaſe of $\frac{1}{213}$ by every degree of the thermometer from 0° to 80° Reaumur's ſcale. Vapours, he alſo thinks, follow the ſame laws of dilatation as gaſes, provided the temperature be ſufficiently elevated to keep them in the elaſtic ſtate. Therefore, Mr. Chaptal ſays, it may be laid down as a principle, that gaſes and vapours are equally dilatable, and equally compreſſible; but it will be neceſſary to be more particular with reſpect to the expanſibility of the vapour of water, upon the elaſticity of which numerous natural phenomena, and the action of ſeveral important machines, depend.

Mr. Schmidt alſo made a ſeries of experiments upon the expanſibility of air, made as dry as poſſible by expoſure to hot potaſh. He found the expanſion of a quantity of air which meaſured one inch at the freezing point, *viz.* at the temperature of 0° Reaumur's thermometer, to expand as below.

Degrees of Reaumur.	Expanſion of one inch.
1	0.0044675
4	0.0178700
8	0.035740
12	0.0536100
16	0.0714800
20	0.0893500
24	0.1072200
28	0.1250909
32	0.1429600
36	0.1608300
40	0.1787000

This table alſo ſhews, by its differing from the reſults of D'Amontons, De Luc, Lambert, Schuckburgh, Berthollet, and others, that thoſe gentlemen operated upon air more or leſs charged with moiſture. They alſo took the barometers at different altitudes. In Mr. Schmidt's experiments the barometer was taken at 29,841 Engliſh inches. Theſe variations of the rates of expanſibility of moiſt air, ſaturated at different temperatures, Schmidt attributes to the variations of the degrees of affinity between air and vapour.

Water heated to the 212th degree of Fahrenheit's thermometer (or thereabout, for the different gravity of the atmoſphere occaſions a conſiderable difference) overcomes the ordinary preſſure of the atmoſphere and becomes ſteam, an elaſtic ſubſtance, the bulk of which at that point is ſomewhat leſs than 1800 times the bulk of the water from which it originated. Beyond that point vapour is expanſible in a moſt aſtoniſhing degree; for 30° more of heat (*viz.* the temperature of 242°) will double the elaſtic force of ſteam; 30° more added to that (*viz.* the temperature of 272°) will render the elaſtic force of ſteam nearly equal to four atmoſpheres; and ſo forth. This immenſe expanſibility of ſteam, when the heat which produces it is quickly ſupplied, is capable of producing prodigious effects. When water is cauſed to boil in a veſſel upon a common fire, the heat which is communicated cannot convert all the water at once into ſteam; but if the quantity of water be ſmall in proportion to the heat which can be communicated in a given time, then the converſion of water into ſteam is quickened to any degree, and it may be rendered inſtantaneous; in which caſe it produces a ſudden and violent expanſion, or an exploſion. A drop of rain in boiling linſeed oil, falls to the bottom, is inſtantly converted into vapour, and occaſions dangerous conſequences. "It has ſometimes," Dr. Black ſays in his Chemical Lectures, "happened that a perſon, by careleſsly ſpitting into a copper foundery, has occaſioned an exploſion that deſtroyed the whole building." Count Rumford attributes the vaſt force of gun-powder to the ſudden converſion into vapour of that quantity of water which naturally enters into the compoſition of that powder; it being a component of the nitre. Phil. Tranſ. for 1797.

Water at the temperature of 212° is converted entirely into ſteam, or rather, under the ordinary preſſure of the atmoſphere, water cannot be heated higher than 212°; but water is gradually converted into ſteam or vapour at a much lower temperature. Mr. Pictet inſtituted a ſeries of experiments on the elaſticity of pure vapour in low temperatures. He found that a grain of warm water in vacuo evaporates in forty minutes in the temperature of 38° Fahr. under a receiver containing 1452 Engliſh cubic inches, but that it did not diffuſe itſelf equally in leſs than ſix hours and then raiſed the hygrometer from 17° to 60°, that is, 43°; and during this whole time the cold under the receiver was conſtantly decreaſing, though ſlowly: which decreaſe undoubtedly contributed to the diffuſion of the vapour. Eſſais de Phyſique, p. 157.

The beſt, or moſt extenſive experiments upon the expanſive force of the ſteam of water, and of the ſteam of alcohol, were made by the Chev. de Bettancourt; and are related by Prony in the ſecond volume of his "Architecture Hydraulique;" from which the following compendious ſketch is derived.

The fluid with which the experiments were made was confined in a very ſtrong copper boiler, being eight inches at its greateſt diameter, and fourteen inches in height. The upper part of it was cloſed by a cover made of copper, through which paſſed three tubes. The firſt ſerved to introduce the fluid into the boiler, and could be cloſed by means of a ſcrew. The ſecond was occupied by a thermometer, having its ball about two inches above the bottom of the boiler, and the ſcale, which was on the outſide, contained from 0° to 110° of Reaumur. To the third was adapted a bent barometer tube, having two lines of internal diameter; the aſcending branch of which was 110 inches in length. By means of a lateral cock a communication was eſtabliſhed between the boiler and an air-pump, which ſerved to make a vacuum before the fire was kindled in the furnace below the apparatus. This circumſtance of evaporation in a vacuum forms an eſſential difference between the experiments of Bettancourt and thoſe made before by Ziegler, and renders them applicable to the theory of the ſteam-engine, where the vapour acts in a ſpace freed from air.

A vacuum having been made in the boiler, the mercury brought as nearly as poſſible to a level in the two branches of the barometric tube, and the thermometer reduced to zero by means of ice, the ice was removed, and a fire was kindled, which was excited gently and with much equality, that the thermometer paſſed over about a degree per minute. One perſon then ſtood by to obſerve the barometer, and another to obſerve the thermometer, and each kept a regiſter from degree to degree of the preſſure and correſponding temperatures; the preſſure being expreſſed by the height, in French inches, of the columns of mercury, which roſe above the level in the long branch of the barometer.

Theſe obſervations of the expanſive force of the ſteam of water furniſh 110 reſults, proceeding from degree to degree of the thermometer, and beginning at zero. Theſe reſults are contained in the following table, where the degrees of preſſure are expreſſed in French inches of perpendicular height of mercury, and the temperature is denoted according to Reaumur's ſcale. The experiments on the expanſive force of the ſteam of alcohol were made by the like proceſs, and with the ſame apparatus.

TABLE of the Expanſive Force of the ſteam of Water and of Alcohol.

Temperature.	Preſſure.		Temperature.	Preſſure.		Temperature.	Preſſure.	
	Water.	Alcohol.		Water.	Alcohol.		Water.	Alcohol.
0	0.00	0.00	37	2.45	5.55	74	20.60	48.10
1	0.00	0.00	38	2.57	6.00	75	21.75	50.20
2	0.00	0.00	39	2.75	6.45	76	22.90	52.60
3	0.00	0.05	40	2.92	6.90	77	24.15	55.30
4	0.02	0.09	41	3.10	7.35	78	25.50	57.90
5	0.02	0.12	42	3.27	7.82	79	26.67	61.00
6	0.05	0.18	43	3.47	8.37	80	28.00	63.80
7	0.07	0.25	44	3.70	8.92	81	29.60	66.90
8	0.10	0.32	45	3.95	9.48	82	31.30	69.8
9	0.12	0.38	46	4.25	10.15	83	33.00	73.40
10	0.15	0.45	47	4.45	10.80	84	34.60	76.90
11	0.18	0.50	48	4.75	11.50	85	36.45	79.60
12	0.22	0.62	49	5.00	12.20	86	38.10	83.60
13	0.27	0.72	50	5.35	12.35	87	40.00	87.10
14	0.30	0.82	51	5.70	13.75	88	42.20	90.80
15	0.35	0.93	52	6.05	14.60	89	44.30	95.00
16	0.40	1.02	53	6.50	15.50	90	46.40	98.00
17	0.45	1.12	54	6.90	16.40	91	48.40	
18	0.52	1.25	55	7.32	17.65	92	50.50	
19	0.58	1.38	56	7.85	18.85	93	53.00	
20	0.65	1.52	57	8.40	20.00	94	55.30	
21	0.75	1.65	58	8.85	21.20	95	57.80	
22	0.82	1.80	59	9.35	22.30	96	60.50	
23	0.90	1.95	60	9.95	23.70	97	63.40	
24	0.97	2.10	61	10.40	24.80	98	66.20	
25	1.05	2.32	62	11.00	26.10	99	69.00	
26	1.12	2.52	63	11.70	27.40	100	71.80	
27	1.22	2.75	64	12.40	28.90	101	75.00	
28	1.32	2.95	65	13.20	30.60	102	78.20	
29	1.42	3.20	66	13.80	32.00	103	81.00	
30	1.52	3.40	67	14.50	33.50	104	84.00	
31	1.65	3.70	68	15.25	35.10	105	86.80	
32	1.78	4.00	69	16.10	37.20	106	89.00	
33	1.90	4.30	70	16.90	39.40	107	91.30	
34	2.00	4.60	71	17.80	41.30	108	93.50	
35	2.15	4.95	72	18.70	43.50	109	95.60	
36	2.27	5.28	73	19.50	46.00	110	98.00	

The expanſive force of the ſteam of water has alſo been determined by Mr. Schmidt, with all the accuracy that the experiments ſeem to admit of: but the reſults which he has not ſtated for every degree of the thermometer, do not agree exactly with thoſe of Bettancourt. We deem it therefore neceſſary to ſubjoin thoſe reſults in the following ſhort table, wherein the temperature is expreſſed in degrees of Reaumur's thermometer, as in the preceding table, and the expanſive force in French inches of perpendicular altitude of mercury.

Table of the Expanſive Force of the pure vapour of Water, according to Mr. Schmidt.

Temperature.	Expanſive Force.	Temperature.	Expanſive Force.
0	0.0	22	1.01
5	0.11	25	1.30
6	0.15	27	1.42
10	0.28	30	1.93
12	0.38	33	2.23
13	0.44	35	2.68
15	.0.55	37	3.20
16	0.61	39	3.40
18	0.76	40	3.64
20	0.90	80	28.00

Mr. Dalton has likewiſe endeavoured to determine the expanſive force of the vapour of water; but the reſults of his experiments nearly coincide with thoſe of the preceding tables, which ſuperſedes the neceſſity of ſtating them in the preſent article. See Evaporation.

From a careful examination of all the experiments made on this ſubject, Dr. Young has deduced a formula by which the expanſive force of ſteam may be determined for any degree of the thermometer, pretty near the real reſults of the experiments. The formula is as follows:

Let f denote the temperature according to Fahrenheit's thermometer, and e the number of inches in perpendicular height of mercury, which the ſteam is capable of ſupporting; then the formula is $e = .1781\ (1 + .006f)^7$.

The reader might perhaps expect to find in the preſent article the particulars relative to the expanſions of heat, and of electricity; but the uncertain natures of the fluids, to which the effects of heat and of electricity are attributed, beſides other conſiderations, oblige us to refer him to other parts of this Cyclopædia. See Heat, Caloric, and the articles belonging to electricity.

Dr. Gregory, in his Aſtron. p. 407, proves, that a globe of our air, of an inch diameter, if it were removed to the diſtance of a ſemidiameter of the earth, would expand itſelf ſo as to fill all the planetary region as far as, nay, far beyond the ſphere of Saturn. See Air.

EXPANSUM Foliaceum. See Foliaceum.

EX PARTE, i. e. *partly*, or of *one part*, in *Law*. A commiſſion ex parte, is that taken out and executed by one part only; where both parties join it is called a joint commiſſion. See Commission.

Ex Parte Talis, a writ that lies for a bailiff or receiver, who, having auditors aſſigned to take his account, cannot obtain of them reaſonable allowance, but is caſt into priſon. The courſe in this caſe is to ſue this writ out of chancery, directed to the ſheriff, to take four mainpernors to bring his body before the barons of the exchequer at a certain day, and to warn the lord to appear at the ſame time. F. N. B. 129.

EXPECTANT Fee, where lands are given to a man and his wife, and the heirs of their bodies; in which ſenſe it differs from fee-ſimple, where lands are given to a man and his wife in frank marriage, to hold to them and their heirs.

EXPECTANCY, Estates in, are of two ſorts; one created by act of the parties, called a *remainder*; the other by act of law, called a *reverſion*. See theſe articles; and alſo Estate and Executory *Deviſe*.

EXPECTATION, in the *Doctrine of Chances*, is applied to any contingent event, and is capable of being reduced to the rules of computation. Thus, a ſum of money in expectation, when a particular event happens, has a determinate value before that event happens; ſo that if a perſon is to receive any ſum, *e. gr.* 10*l.* when an event takes place which has an equal probability of happening and failing, the value of the expectation is half that ſum or 5*l.* and in all caſes, the expectation of obtaining any ſum is eſtimated by multiplying the value of the ſum expected by the fraction, which repreſents the probability of obtaining it. The expectation of a perſon who has three chances in five of obtaining 100*l.* is equal to $\frac{3}{5} \times 100$ or 60*l.* and the probability of obtaining 100*l.* in this caſe is equal to $\frac{60}{100} = \frac{3}{5}$.

If the obtaining of any ſum requires the happening of ſeveral events that are independent on each other, the value of the expectation of that ſum is found by multiplying together the ſeveral probabilities of happening, and by multiplying the product by the value of the ſum expected. *E. gr.* Suppoſe, that in order to obtain 90*l.* two events muſt happen, one of which has three chances to happen and two to fail, and the other has four chances to happen, and five to fail; the value of the expectation is $= \frac{3}{5} \times \frac{4}{9} \times 90 = \frac{12}{45} \times 90 = \frac{4}{15} \times 90 = \frac{360}{15} = 24$*l.* for if the firſt event had actually happened, the value of the expectation depending ſolely on the ſecond event, would be $\frac{4}{9} \times 90 = 40$*l.* and therefore the happening of the firſt event is the condition of obtaining an expectation worth 40*l.* but the probability of the firſt happening is $\frac{3}{5}$, and the expectation ſought for is evidently worth $\frac{3}{5} \times 40 = \frac{3}{5} \times \frac{4}{9} \times 90 = 24$*l.* The rule will be the ſame if an expectation depends on the happening of one event and the failing of another; and alſo on the failing of two events; and on the happening or failing of any number of events that may be aſſigned. It is here ſuppoſed that the events are independent, or that the happening of one, neither forwards nor obſtructs the happening of the other. But if two events are dependent, *i. e.* if they are ſo connected together as that the probability of either's happening is altered by the happening of the other, the probability of their happening is the product of the probability of the happening of one of them by the probability which the other will have of happening, when the firſt is conſidered as having happened; and the ſame rule will extend to the happening of any aſſigned number of events: thus, in a heap of thirteen cards of the ſame colour, the probability of taking out the ace is $\frac{1}{13}$; and the probability of taking the ace out of another heap of the ſame number is $\frac{1}{13}$; and the probability of both theſe independent events happening will be $\frac{1}{13} \times \frac{1}{13} = \frac{1}{169}$: but the probability of taking the ace firſt out of a ſingle heap of thirteen cards is $\frac{1}{13}$; and that of taking the deuce afterwards is $\frac{1}{12}$; and therefore the probability of both happening is $\frac{1}{13} \times \frac{1}{12} = \frac{1}{156}$. If a perſon has ſeveral expectations on ſeveral ſums, the value of his expectation on the whole is the ſum of his expectations on the particulars: thus, let one event be ſuch, that the probability of obtaining any ſum, *e. gr.* 90*l.* in caſe it happens, may be $\frac{3}{5}$; in which caſe the value of the expectation is $\frac{3}{5} \times 90 = 54$*l.* Let the probability of another event, on which depends a ſecond ſum of 90*l.* be $\frac{4}{9}$, and the value of the expectation in this caſe be $\frac{4}{9} \times 90 = 40$*l.* and the value of the expectation on the whole $54 + 40 = 94$*l.* But if a perſon is to receive 90*l.* once for all for the happening of one or other of the two forementioned events, then the expectation of the firſt event being worth 54*l.* as before, yet the expectation of the ſecond will be different; becauſe this depends on the happening of the firſt, and takes place only in caſe the firſt happens to fail, the probability of which is $\frac{2}{5}$; and on the ſuppoſition of its having failed, the expectation of the ſecond will be 40*l.*; therefore $\frac{2}{5}$ is the meaſure of the probability of obtaining an expectation worth 40*l.*; and conſequently the expectation will be worth $\frac{2}{5} \times 40 = 16$*l.* and the value of the expectation on the whole will be $54 + 16 = 70$*l.* See the farther illuſtration and application of theſe principles and rules in De Moivre's Doctrine of Chances, edit. 3. 1776. See CHANCES and GAMING.

EXPECTATION *of Life*, in the *Doctrine of Life Annuities*, donotes, according to the moſt obvious ſenſe of the term, that particular number of years which a life of a given age has an equal chance of enjoying, or the time which a perſon of a given age may juſtly expect to continue in being. But Mr. Simpſon has ſhewn, that this period does not coincide with what the writers on annuities call the expectation of life, except on the ſuppoſition of an uniform decreaſe in the probabilities of life; and Dr. Price adds, that even on this ſuppoſition, it does not coincide with what is called the expectation of life, in any caſe of joint lives: for two lives of 40 have an even chance, according to Mr. De Moivre's hypotheſis (ſee COMPLEMENT *of life*) of continuing together only $13\frac{1}{2}$ years. According to that hypotheſis, the *probability* that a life aged 40 will continue $13\frac{1}{2}$ years will be expreſſed by $\frac{32.5}{46}$; and this fraction multiplied by itſelf is the probability that two lives of this age ſhall both continue $13\frac{1}{2}$ years; *i.e.* $\frac{32.5}{46} \times \frac{32.5}{46} = \frac{1056.25}{2116}$, equal nearly $\frac{1}{2}$, which repreſents an even chance; but the expectation of two joint lives being (according to the ſame hypotheſis) always a third of the common complement, will be in this caſe $15\frac{1}{3}$ years. Therefore, the expectation of life may ſignify the mean continuance of any given ſingle, joint, or ſurviving lives, according to any given table of obſervations, or the number of years which, taking them one with another, they actually enjoy; ſo that if 46 perſons are alive, all 40 years of age, and one be ſuppoſed to die every year, according to Mr. De Moivre's hypotheſis, till they are all dead in 46 years, half 46 or 23 will be their expectation of life; *i.e.* the number of years enjoyed by them all will be the ſame as if every one of them had lived 23 years, and then died; and ſuppoſing no intereſt of money, the value of an annuity payable for life to every ſingle perſon in ſuch a ſet, would juſt be equal to 23 years purchaſe.

The expectation of life coincides with the ſums of the preſent probabilities, that any given ſingle or joint lives ſhall attain to the end of the firſt, ſecond, third, &c. moments, from this time to the end of their poſſible exiſtence; or (in the caſe of ſurvivorſhips) with the ſum of the probabilities, that there ſhall be a ſurvivor at the end of the firſt, ſecond, third, &c. moments, from the preſent time to the end of the poſſible exiſtence of ſurvivorſhip. From theſe principles Dr. Price has ſhewn how to deduce the demonſtrations of Mr. De Moivre's rules for finding the expectations of lives, which he has omitted; we ſhall here ſubjoin them for the information and amuſement of our mathematical readers. Let $\dot{x}$ ſtand for a moment of time, and n be the *complement* of any aſſigned life; then $\frac{n - \dot{x}}{n}, \frac{n - 2\dot{x}}{n}, \frac{n - 3\dot{x}}{n}$, &c. will be the preſent probabilities of its continuing to the end of the firſt, ſecond, third, &c. moments; and $\frac{n - x}{n}$ the *probability* of its continuing to the end of x time: therefore, $\frac{n - x}{n} \times \dot{x}$ will be the fluxion of the ſum of the probabilities, or of an area repreſenting this ſum, whoſe ordinates are $\frac{n - x}{n}$, and axis x. The fluent of this expreſſion, or $x - \frac{x^2}{2n}$, is the ſum itſelf for the time x; and this, when $x = n$, becomes $\frac{1}{2}n$, the expectation of the aſſigned life, or the ſum of all the probabilities juſt mentioned for its whole poſſible duration. In like manner $\frac{n - x}{n} \times \frac{n - x}{n}$ or $\frac{\overline{n - x}|^2}{n^2}$ is the probability that two equal joint lives will continue x time, and $\frac{\overline{n - x}|^2}{n^2} \times \dot{x}$ will be the fluxion of the ſum of the probabilities; the fluent of which, or $x - \frac{x}{n} + \frac{x^3}{3n^2}$, becomes, when $n = x$, $\frac{n}{3}$, or the expectation of two equal joint lives. Again, ſince $\frac{n - x}{n} \times \frac{2x}{n}$ is the probability that there will be a ſurvivor of two equal joint lives at the end of x time, $\frac{n - x}{n} \times \frac{2x}{n} \times \dot{x}$ will be the fluxion of the ſum of the probabilities; and the fluent, or $\frac{x^2}{n} - \frac{2x^3}{3n^2}$ is, when $x = n$, $\frac{1}{3}n$, or the expectation of ſurvivorſhip between two equal lives, which appears to be equal to the expectation of their joint continuance. The expectation of two unequal joint lives found in the ſame way is $\frac{m}{2} - \frac{m^2}{6n}$, m being the complement of the oldeſt life, and n the complement of the youngeſt. The whole expectation of ſurvivorſhip is $\frac{n}{2} - \frac{m}{2} + \frac{m^2}{3n}$; and the expectation of ſurvivorſhip of the oldeſt will be to that of the youngeſt as $\frac{m^2}{6n}$ to $\frac{n}{2} - \frac{m}{2} + \frac{m^2}{6n}$.

From the definition already given of the expectation of life, it follows, that if in a ſociety limited to a fixed number of members, a 28th part of its members dies annually, 28 would appear to be their common expectation of life at the time they entered; and if it were found in any town or diſtrict, where the number of births and burials are equal, that a 20th or 30th part of the inhabitants die annually, it would appear that 20 or 30 was the expectation of a child juſt born in that town or diſtrict.

Having a table of obſervations, ſhewing the number that die annually at all ages out of a given number alive at thoſe ages, it is eaſy to find the expectation for all ſingle lives by the following rule: divide the ſum of all the living in the table at the age whoſe expectation is required, and at all greater ages, by the number in the table of the living at that age, and ſubtract half unity from the quotient, the remainder will be the expectation required.

The reaſon of this ſubtraction may be underſtood by conceiving the recruit neceſſary to ſupply the waſte of every year to be made always at the end of the year, ſo that the dividend ought to be the medium between the number living at the beginning and the end of the year; that is, it ſhould be taken leſs than the ſum of the living in the table at and above the given age by half the number that die in the year; the effect of which diminution will be the ſame with the ſubtraction here directed. This rule may be illuſtrated by taking the ſum of all the living at 20 and upwards in Tab. I. and dividing it by 360, the number living at that age, and the quotient leſs half unity, will be nearly 28.9 the expectation of 20 in Tab. II.

Table I.—Shewing the Probability of the Duration of Life in London, deduced by Mr. Simpſon from Obſervations on the Bills of Mortality in London for 10 Years, from 1728 to 1737.

Ages.	Perſons living.	Decr. of life.	Ages.	Perſons living.	Decr. of life.	Ages.	Perſons living.	Decr. of life.
0	10 0	320	27	321	6	54	135	6
1	680	133	28	315	7	55	129	6
2	547	51	29	308	7	56	123	6
3	496	27	30	301	7	57	117	5
4	469	17	31	294	7	58	112	5
5	452	12	32	287	7	59	107	5
6	440	10	33	280	7	60	102	5
7	430	8	34	273	7	61	97	5
8	422	7	35	266	7	62	92	5
9	415	5	36	259	7	63	87	5
10	410	5	37	252	7	64	82	5
11	405	5	38	245	8	65	77	5
12	400	5	39	237	8	66	72	5
13	395	5	40	229	7	67	67	5
14	390	5	41	222	8	68	62	4
15	385	5	42	214	8	69	58	4
16	380	5	43	206	7	70	54	4
17	375	5	44	199	7	71	50	4
18	370	5	45	192	7	72	46	4
19	365	5	46	185	7	73	42	3
20	360	5	47	178	7	74	39	3
21	355	5	48	171	6	75	36	3
22	350	5	49	165	6	76	33	3
23	345	6	50	159	6	77	30	3
24	339	6	51	153	6	78	27	2
25	333	6	52	147	6	79	25	
26	327	6	53	141	6			

Table II.—Shewing the Expectations of Life in London, according to the preceding Table.

Age.	Expectation.	Age.	Expectation.	Age.	Expectation.
0	19.2	27	25.1	54	14.5
1	27.0	28	24.6	55	14.2
2	32.0	29	24.1	56	13.8
3	34.0	30	23.6	57	13.4
4	35.6	31	23.1	58	13.1
5	36.0	32	22.7	59	12.7
6	36.0	33	22.3	60	12.4
7	35.8	34	21.9	61	12.0
8	35.6	35	21.5	62	11.6
9	35.2	36	21.1	63	11.2
10	34.8	37	20.7	64	10.8
11	34.3	38	20.3	65	10.5
12	33.7	39	19.9	66	10.1
13	33.1	40	19.6	67	9.8
14	32.5	41	19.2	68	9.4
15	31.9	42	18.8	69	9.1
16	31.3	43	18.5	70	8.8
17	30.7	44	18.1	71	8.4
18	30.1	45	17.8	72	8.2
19	29.5	46	17.4	73	7.8
20	28.9	47	17.0	74	7.5
21	28.3	48	16.7	75	7.2
22	27.7	49	16.3	76	6.8
23	27.2	50	16.0	77	6.4
24	26.6	51	15.6	78	6.0
25	26.1	52	15.2	79	5.5
26	25.6	53	14.9	80	5.0

Table III.—Shewing the Probabilities of Human Life in Northampton.

Age.	Living.	Decr.	Age.	Living.	Decr.	Age.	Living.	Decr.
0	11650	1340	31	4310	75	65	1632	80
3 mon.	10310	554	32	4235	75	66	1552	80
6 mon.	9756	553	33	4160	75	67	1472	80
9 mon.	9203	553	34	4085	75	68	1392	80
1 Year	8650	1367	35	4010	75	69	1312	80
2 Years	7283	502	36	3935	75	70	1232	80
3	6781	335	37	3860	75	71	1152	80
4	6446	197	38	3785	75	72	1072	80
5	6249	184	39	3710	75	73	992	80
6	6065	140	40	3635	76	74	912	80
7	5925	110	41	3559	77	75	832	80
8	5815	80	42	3482	78	76	752	77
9	5735	60	43	3404	78	77	675	73
10	5675	52	44	3326	78	78	602	68
11	5623	50	45	3248	78	79	534	65
12	5573	50	46	3170	78	80	469	63
13	5523	50	47	3092	78	81	406	60
14	5473	50	48	3014	78	82	346	57
15	5423	50	49	2936	79	83	289	55
16	5373	53	50	2857	81	84	234	48
17	5320	58	51	2776	82	85	186	41
18	5262	63	52	2694	82	86	145	34
19	5199	67	53	2612	82	87	111	28
20	5132	72	54	2530	82	88	83	21
21	5060	75	55	2448	82	89	62	16
22	4985	75	56	2366	82	90	46	12
23	4910	75	57	2284	82	91	34	10
24	4835	75	58	2202	82	92	24	8
25	4760	75	59	2120	82	93	16	7
26	4685	75	60	2038	82	94	9	5
27	4610	75	61	1956	82	95	4	3
28	4535	75	62	1874	81	96	1	1
29	4460	75	63	1793	81			
30	4385	75	64	1712	80	Tot.	299198	11650

Table IV.—Shewing the Expectations of Human Life, deduced from the preceding Table.

Age.	Expect.	Age.	Expect.	Age.	Expect.	Age.	Expect.
0	25.18	25	30.85	50	17.99	75	6.54
1	32.74	26	30.33	51	17.50	76	6.18
2	37.79	27	29.82	52	17.02	77	5.83
3	39.55	28	29.30	53	16.54	78	5.48
4	40.58	29	28.79	54	16.06	79	5.11
5	40.84	30	28.27	55	15.58	80	4.75
6	41.07	31	27.76	56	15.10	81	4.41
7	41.03	32	27.24	57	14.63	82	4.09
8	40.79	33	26.72	58	14.15	83	3.80
9	40.36	34	26.20	59	13.68	84	3.58
10	39.78	35	25.68	60	13.21	85	3.37
11	39.14	36	25.16	61	12.75	86	3.19
12	38.49	37	24.64	62	12.28	87	3.01
13	37.83	38	24.12	63	11.81	88	2.86
14	37.17	39	23.60	64	11.35	89	2.66
15	36.51	40	23.08	65	10.88	90	2.41
16	35.85	41	22.56	66	10.42	91	2.09
17	35.20	42	22.04	67	9.96	92	1.75
18	34.58	43	21.54	68	9.50	93	1.37
19	33.99	44	21.03	69	9.05	94	1.05
20	33.43	45	20.52	70	8.60	95	0.75
21	32.90	46	20.02	71	8.17	96	0.50
22	32.39	47	19.51	72	7.74		
23	31.88	48	19.00	73	7.33		
24	31.36	49	18.49	74	6.92		

We ſhall here ſubjoin ſome other tables, calculated by Dr. Price, on account of their connection with the ſubject of this article.

Proportion of the inhabitants annually dying in

Pais De Vaud	Country Pariſh in Brandenburg	Holy Croſs near Shrewſbury	London	Vienna	Berlin.
1 in 45	1 in 45	1 in 33	1 in 20¾	1 in 19½	1 in 26⅓

Ages to which half the born live.

Pais De Vaud	Country Pariſh in Brandenburg	Holy Croſs	London	Vienna	Berlin.
41	25½	27	2¾	2	2¾

Proportion of the inhabitants who reach eighty years of age.

Pais De Vaud	Country Pariſh in Brandenburg	Holy Croſs	London	Vienna	Berlin.
1 in 21½	1 in 22½	1 in 11	1 in 40	1 in 41	1 in 37

The probabilities of living one year in

Odds	Pais De Vaud	Country Pariſh in Brandenburg	Holy Croſs	London	Vienna	Berlin.
At birth	4¼ to 1	3½ to 1	4½ to 1	2 to 1	1⅕ to 1	1¼ to 1
Age 12	160 1	112 1	144 1	75 1	84 1	123 1
25	117 1	110 1	100 1	56 1	66 1	50 1
30	111 1	107 1	96 1	45 1	56 1	44 1
40	83 1	78 1	55 1	31 1	36 1	32 1
50	49 1	50 1	50 1	24 1	27 1	30 1
60	23 1	25 1	26 1	18 1	19 1	18 1
70	9½ 1	11 1	16 1	12 1	11 1	12 1
80	4 1	6 1	8 1	7 1	7 1	7 1

Expectations of life.

	Pais De Vaud	Country Pariſh in Brandenburg	Holy Croſs	London	Vienna	Berlin.
At birth	37 y^rs	32½ years	33¼ y^rs	18 y^rs	16½ y^rs	18 y^rs
Age 12	44⅕	44½	43½	33½	35¾	35½
25	34¾	35½	35	26	28⅓	27¼
30	31¼	31½	32	23½	25½	25¼
35	27½	28	28¼	21½	22½	22¾
40	24	25	25¾	19½	20½	20¾
45	20½	21½	23¼	17¾	17¾	18¾
50	17½	18	20	16	16	16⅓
55	14½	15	17	14⅕	13½	14
60	12	12¼	14½	12½	11¾	12½
65	9½	9¾	11¾	10½	9¾	10½
70	7½	7½	10	8¼	8½	8½
75	5½	5½	8	7	6½	7
80	4½	4½	5	5	5½	6

Dr. Price has applied his reaſoning on this ſubject to the ſolution of a curious queſtion in political arithmetic, or to determine the number of inhabitants in any place from a table of obſervations, or the bills of mortality for that place, on the ſuppoſition that the yearly births and burials are equal. For this purpoſe find by the table the expectation of an infant juſt born; and this, multiplied by the number of yearly births, will be the number of inhabitants

Were the bills of mortality conſtructed with the leaſt regard to truth, and were a regular account kept of all the perſons who annually migrate from the country, this rule of Dr. Price might be ſafely applied towards aſcertaining the number of inhabitants in London, but in their preſent form the London tables are ſo very incorrect that it can hardly be ſafe to derive any concluſions from them.

It appears from Tab. I. that though an infant juſt born in London has not an equal chance (the probability being $\frac{406}{1000}$) of living three years, his expectation is twenty years, and by Tab. III. that though the expectation of ſuch a child in Northampton is twenty-five, it has only an equal chance of living eight years. This difference proceeds from the greater probability of life in the more mature ages, than in the firſt moments of exiſtence. Were the decrements of life, however, the ſame through every period of it, theſe quantities would always be equal; but as this is not the caſe, neither in the earlier nor the latter ages, the computations founded on ſuch an hypotheſis can in general be of very little uſe. De Moivre's Doctrine of Chances, applied to the Valuation of Annuities, p. 288, &c. Simpſon's Select Exerciſes, p. 253, &c. and particularly Dr. Price's Obſervations on Reverſionary Payments, eſſ. i. vol. ii. or Phil. Tranſ. vol. lix. p. 89. See COMPLEMENT *of Life*, LIFE *Annuities*, MORTALITY, SURVIVORSHIP.

EXPECTATIVE, in the *Canon Law*, a hope founded on a promiſe of obtaining the next benefice that ſhall become vacant, or a right to the reverſion of the next. See BENEFICE.

EXPECTATIVE *Canons*. See CANON.

EXPECTATIVE *Graces*, *Gratiæ Expectativæ*, called alſo *preventions*, were bulls frequently given by the popes or kings for future benefices. The biſhops were exceedingly mortified with them, becauſe they encroached on their privileges; beſides, that ſuch expectatives are odious, as they induce people to wiſh for the death of others.

The uſe of expectatives is very ancient, though it was not near ſo frequent in the firſt ages as afterwards. Originally they were no more than ſimple requeſts made on the part of kings or popes, which the biſhops conſented to with the more willingneſs, as they only preſented to them perſons fit to ſerve the church: but the frequent exerciſe of this privilege made it at length be deemed a matter of obligation and neceſſity.

The council of Trent annulled all expectatives; but the canons relating thereto were never admitted in France, where the right of conferring expectative graces is looked on as one of the regalia.

EXPECTORANT MEDICINES, are thoſe which facilitate the excretion of the mucous diſcharges from the cells and paſſages of the lungs; or *ex pectore*, from the breaſt.

This evacuation muſt be accompliſhed by more or leſs of coughing, which the irritation of the collecting mucus, &c. naturally occaſions. It were, therefore, obviouſly uſeleſs and ſuperfluous to give medicines with a view to excite coughing, (if indeed we were acquainted with any ſubſtance poſſeſſed of ſuch quality,) or to uſe any external means, as the ancient Cnidians are ſaid to have done, for that purpoſe. The principal object, in attempting to facilitate the diſcharge of the contents of the bronchial veſſels and cells, muſt conſiſt in changing the nature of thoſe contents, ſo as to render them thinner, leſs tenacious, and more moveable than before. Whether we are poſſeſſed of any medicines, however, capable of producing ſuch a direct effect, may admit of a queſtion. The generality of writers on the materia medica, and of phyſicians, ſpeak of the utility of ſuch medicines as they have termed *attenuantia* and *incidentia*, for this purpoſe: but we believe, with Dr. Cullen, that their hypotheſis on this ſubject is altogether erroneous, and that no ſuch medicines exiſt. The only probable explanation of the action of an expectorant medicine appears to be, that by increaſing the ſecretion from the exhalent arteries in the lungs, the mucus may be diluted and rendered leſs viſcid and the paſſages from the cells may be more fully moiſtened with a leſs tenacious fluid. We know that there is a conſtant and conſiderable exhalation of moiſture from the cavity of the lungs; and there are many reaſons for believing that this is an excrementitious ſecretion, connected with the other excrementitious ſecretions, particularly with the perſpiration from the ſurface of the body. If, therefore, there are medicines diſpoſed to paſs by perſpiration, it may be preſumed that the ſame are diſpoſed to paſs by the exhalation from the lungs: and this exhalation may not only be increaſed, but the mucus, produced by the follicles, may alſo be poured out in a leſs viſcid form, and conſequently in a ſtate to be more eaſily brought up by expectoration.

It would appear, that ſome ſuch increaſe of the thinner ſecretion of lungs is produced, by ſympathy with the ſtomach, when a condition approaching to nauſea is induced, and that, therefore, medicines which poſſeſs an emetic quality, when uſed in ſmall doſes, operate in ſome degree as expectorants; ſuch as the ſquill, ipecacuanha, nicotiana, antimony, &c. A full doſe of an emetic ſeems to produce this effect more completely, and affords conſiderable relief to thoſe aſthmatic complaints, as they are called, in which the lungs are loaded with a quantity of viſcid phlegm. Many expectorant medicines are mentioned by different writers, ſuch as the tuſſilago, or colt's foot, enula campana, iris florentina, petaſites, &c. which recent experience ſeems to have rejected, from their failure to anſwer the expectation which thoſe writers had excited.

Many other medicines which give relief to coughs have been employed under the appellation of expectorants; but their operation is to be explained upon principles altogether different from that of facilitating expectoration. Among theſe are ſpermaceti, liquorice, oil of almonds, and other vegetable and animal oils, various mucilaginous vegetables, ſuch as mallow, horehound, &c. all of which give a temporary alleviation to the irritation about the glottis, and thus appeaſe the cough, but do not in the ſmalleſt degree aid the expectoration. See Catarrh.

In the chronic coughs of old people, expectoration appears to be facilitated by the uſe of the ſtimulant gums, and of volatile alkali. But perhaps theſe medicines operate indirectly, by ſupporting the ſtrength of the patients, and thus enabling them to uſe greater muſcular exertion in the act of coughing.

EXPECTORATION, the act of bringing up the mucous and other excretions from the lungs, by coughing, hawking, &c. The word has the ſame derivation as the preceding.

EXPEDITATION, in the *Foreſt-Laws*, ſignifies a cutting out the balls of a dog's fore-feet for the preſervation of the king's game.

Every one that keeps any great dog, not expeditated, forfeits three ſhillings and four-pence to the king. In maſtiffs, not the ball of the feet, but the three claws, are to be cut to the ſkin. Inſtit. part. iv. p. 308. "Nullos Dominicos canes abbatis & monachorum expeditari cogat." Chart. Hen. III. "Et ſin quieti de eſpeditamentis canum." Ex. Mag. Rot. Pip. de ann. 9 Ed. II.

The expeditation was to be performed once in every three years, and was done to every man's dog who lived near the foreſt, and even the dogs of the foreſters themſelves.

EXPEDITION, the march of an army to ſome diſtant place, with a view of hoſtilities.

Such were the expeditions of Cyrus againſt Xerxes, and of Bacchus and Alexander to the Indies.

Expeditions for the recovery of the Holy Land were called croiſades.

The ſucceſs of an expedition depends on rapid and unexpected movements. An expedition is planned and governed by the following principal maxims, *viz.* ſecrecy, if poſſible, of preparation, and a concealment of deſign, &c.; a juſt proportion of the means to the end; a knowledge of the ſtate and ſituation of the country, which is intended to be the ſcene of action, and of the place or object that is to be attacked; the appointment of a commander, poſſeſſed of thoſe abilities, and of that diſpoſition, which are adapted to the warfare propoſed; and the arrangement of the plan of the expedition before it is undertaken or carried into effect. The French uſe the word expedition to expreſs any particular military quality, which an officer or ſoldier may poſſeſs. Thus, "cet officier eſt un homme d'expedition," that is, this officer is a man of enterpriſe, or courageous and daring.

EXPENCES, in *Book-keeping*. See Book *of Expences*.

EXPENDITORS, in *Law*, are the perſons appointed by commiſſioners of ſewers, to pay, diſburſe, or expend the money collected by the tax for the repairs of ſewers, &c. when paid into their hands by the collectors on the reparations, amendments, and reformations ordered by the commiſſioners; for which they are to render accounts when required for that purpoſe.

Theſe officers are mentioned in the ſtatute 37 H. VIII. cap. 11. and other ſtatutes. The ſteward who ſuperviſes the repair of the banks and water-courſes in Romney Marſh is likewiſe called the expenditor.

EXPENSE Magazine, is a ſmall receptacle for ſuch quantities of ammunition as may be required on emergency, or for the ſupply of powder, &c. in that ordinary courſe which enables the proper officers to eſtimate with correctneſs what quantity ſhould be kept at hand for the purpoſe of annual exerciſe, or for the furniſhing the neighbouring camps, poſts, or batteries, with ſuch ſtores as may be neceſſary for their uſe. Thus we ſee, in almoſt every fortreſs, various expenſe-magazines built in commodious and ſafe ſituations, for the expreſs purpoſes of enabling the commiſſaries, and the ordnance officers, to prevent the defenders of the ſeveral works in their vicinity from being at a ſtand for want of ammunition. Some of theſe little ſtores are occaſionally built even upon the terre-pleine of the batteries they are to ſupply; but we have heard this practice cenſured; for, though it may be true, that owing to their very ſolid conſtruction they may ſucceſsfully reſiſt the enemies' ſhot, ſtill, as they are liable to explode from other accidents, we cannot join an unqualified approval of ſuch poſitions. We avail ourſelves of a ſuggeſtion offered to us, in which we think the foregoing objection is greatly diminiſhed, if not totally removed. The ſuggeſtion is, that in lieu of allowing any expenſe-magazines to be built on a terre-pleine, a ramp ſhould be thrown up at the back of every ſixth or ſeventh piece of ordnance on the defences, the interior of which ſhould be a magazine of this deſcription. The ramp would ſerve as a paſſage for the perſons employed in conveying the powder to the gunners, and ſhould have a door at that ſide leaſt expoſed to enfilades, or to accidental ſhots. The entrance might, indeed, be either above or below the ramp; though we are diſpoſed to recommend the latter; as the delay occaſioned by aſcending would not be of any conſequence in ordinary defences, and would be fully counter-balanced by the ſafety with which all the expenſe-magazines might be worked. Poſſibly, the ſuggeſtion might be rather improved if the expenſe-magazines were to be built partly under the reſpective ramparts; thereby becoming mines on occaſion. (See *Plate* I. *Tactics*, *fig*. 4.)

Againſt works of maſonry built upon the terre-pleine, we cannot too powerfully inveigh: the immenſe numbers of ſplinters which are generally created by ſuch being ſufficient grounds for their condemnation. If, however, it is deemed proper to have ſmall magazines in ſuch ſituations, (for there may be localities which afford no alternative,) ſuch ought to be ſunk ſo far as to allow the ſummits of their arches to be little more than level with the terre-pleine. Being then covered with ſoil, and well gazoned, (*i. e.* turfed,) they would become uſeful, by cauſing ſuch ſhots as might be ſent over the epaulement to throw up, inſtead of allowing them to trundle along the terre-pleine. (See ENFILADE.)

The entrances of all magazines of this deſcription ought to be towards the back of the battery, and certainly might be rendered ſafer by making a few ſteps down upon the inner revetement; ſo as completely to cover not only the magazine itſelf; but the perſons who might be employed to hand up the cartridges. (See *fig*. 5.)

EXPENSIS *Militum Levandis*, in *Law*, was a writ anciently directed to the ſheriff, for levying allowance for the knights of parliament. See PARLIAMENT, and REPRESENTATIVE.

EXPENSIS *militum non levandis*, &c. an ancient writ to prohibit the ſheriff from levying any allowance for knights of the ſhire upon thoſe that hold lands in ancient demeſne. Reg. Orig. 261.

EXPERIENCE, a kind of knowledge acquired by long uſe without any teacher.

Experience conſiſts in the ideas of things we have ſeen or read, which the judgment has reflected on, to form for itſelf a rule or method.

Authors make three kinds of experience: the firſt is the ſimple uſes of the external ſenſes, whereby we perceive the phenomena of natural things, without any direct attention thereto, or making any application thereof.

The ſecond is, when we premeditatedly and deſignedly make trials of various things, or obſerve thoſe done by others, attending cloſely to all effects and circumſtances.

The third is that preceded by a fore-knowledge, or at leaſt an apprehenſion of the event, and determines whether the apprehenſion were true or falſe; which two latter kinds, eſpecially the third, are of great ſervice in philoſophy.

Dr. Campbell, in his "Philoſophy of Rhetoric," (vol. i. p. 129, &c.) inveſtigates the nature and origin of experience; and obſerves, that thoſe ſources in our natures which give being to it, and conſequently to all thoſe attainments, moral and intellectual, that are derived from it, are ſenſe and memory. The ſenſes, both external and internal, are the original inlets of perception; and the articles of information exhibited by them are devolved on the memory. As remembrance inſtantly ſucceeds ſenſation, the memory becomes the ſole repoſitory of the knowledge received from ſenſe; and hence it is the only original voucher extant of thoſe paſt realities for which we had once the evidence of ſenſe. In order to render the knowledge thus acquired and preſerved uſeful to us, in diſcovering the nature of things and regulating our conduct, a further proceſs of the mind is neceſſary, and this is aſſociation. This retention and aſſociation are called experience. We may here obſerve, that though memory gives birth to experience, which reſults from the compariſon of facts remembered, the experience, or habitual aſſociation, remains, when the individual facts on which it is founded are all forgotten. We cannot purſue the reaſoning of this ingenious writer in his illuſtration of the evidence of experience, which he conſiders as one ſpecies of moral evidence, (analogy and teſtimony being the two others,) and which, in his opinion, is the criterion, if not the foundation, of all moral reaſoning whatever, and the principal organ of truth in all the branches of phyſiology, in the largeſt acceptation of the term. See TESTIMONY.

EXPERIMENT, from the Latin *experimentum*, is a trial, or practical proof of ſomething. In philoſophy it means the reſult of certain applications, diſpoſitions, or combinations, of natural bodies, made with ſome particular view. Experiments are ſaid to be mechanical, or chemical, or electrical, or magnetical, &c. according to the ſubject to which they more immediately belong. The object of making experiments is to aſcertain either certain cauſes or certain phenomena; and for the proper attainment of theſe objects care muſt be had to inſtitute experiments that admit of no equivocal reſult, and ſo as to anſwer the purpoſe in the quickeſt and moſt direct way. The main object, however, of the inquiry can ſeldom be determined by a ſingle deciſive experiment; hence, in moſt caſes, it becomes neceſſary to divide the queſtion into parts, and to aſcertain each part ſeparately by one or more appropriate experiments. When the experiment is ſo preſcribed as to decide the queſtion without any poſſible doubt or equivocation, it has in that caſe frequently been called *experimentum crucis*; meaning a capital or deciſive experiment; ſuch as ſuperſedes the neceſſity of inſtituting more experiments for the ſame purpoſe. The origin of the expreſſion *experimentum crucis* has probably been derived from its being a kind of torture, whereby the nature of the queſtion is, as it were, extorted by force. It has been alſo attributed, though with leſs apparent probability, to the guide or inſtruction which it affords, like that of a direction poſt, which is ſhaped ſomewhat like a croſs.

It is not practicable to give any inſtructions for the right performance of experiments in general; for not only every ſubject, but every particular queſtion belonging to any ſubject, muſt be determined by a peculiar mode of inveſtigation. The experimenter can only be inſtructed by practice. The nature of the ſubject, a ſtrict attention to every apparent circumſtance, an accurate ſtatement of particulars, and an unprejudiced mode of reaſoning, will eaſily ſuggeſt a proper train of experiments which the ſubject in queſtion may admit of. It deſerves to be remarked, that though in the inveſtigation of any ſubject, the philoſopher propoſes a certain order of inveſtigation, (and it is always proper to propoſe to oneſelf ſome ſuch plan or train of experiments;) yet it is but ſeldom that the propoſed plan can, or deſerves to be ſtrictly executed; for the reſult of the firſt or ſecond experiment frequently points out a new track or a more promiſing road; in conſequence of which, new and different trials muſt be inſtituted; and it is in the ready adoption of ſuch plans as may be more ſuited to the laſt indications, that the genius of the philoſopher is rendered conſpicuous.

Such mode may ſuffice for the determination of any doubtful point; but when a diſcovery has been made and is to be explained to other perſons; then it is of uſe to ſhew the ſame reſult by different experiments; for it is not only a ſatisfaction to have ſeveral concurring proofs of the ſame propoſition; but it is alſo rendered intelligible to a greater number of readers or hearers; it being ſeldom the caſe, that the ſame experiment conveys an equal degree of conviction and ſatisfaction to the mind of every body.

EXPERIMENTAL Farm, in *Agriculture*, that ſort of farm eſtabliſhment which is chiefly applied to, or calculated for, the purpoſe of making experiments, with the view of aſcertaining unknown cauſes, effects, or reſults in the various departments of huſbandry. This is a plan which has often been attempted, both individually and collectively, by numbers of perſons warmly intereſted in promoting the improvement of agricultural knowledge; but hitherto, we believe, without that ſort of ſucceſs which might naturally be expected. The cauſe of which has probably been the want of a due combination of real practical agricultural information with that of the ſcientific kind, as without a full comprehenſion of both theſe, in perſons who have the direction and management of ſuch eſtabliſhments, it muſt be utterly impoſſible that they can be ſo highly advantageous as they ought to be. But a writer, who has beſtowed much attention on the ſubject, ſeems to ſuppoſe that there is much doubt of any real benefit being at all produced in this way; as he conſiders both experience and experiment the two means by which facts concerning the art may be aſcertained as equally liable to objection. The term *experience* he conceives to denote thoſe deductions which a perſon draws as the average reſult of practice continued for a conſiderable length of time, and which is unqueſtionably the ſureſt guide that can be followed, where the obſervations are ſufficiently correct, and the circumſtances diſcriminated in ſo clear a manner as to create no ſort of confuſion; ſtill where theſe peculiarities are wanting, the concluſions thus drawn may be extremely fallacious. And what increaſes the evil in this caſe is, that when concluſions have been once drawn in conſequence of an imperfect diſcrimination of circumſtances, there is ſcarcely any chance of eradicating the error; as the mind, when once accuſtomed to think in a certain way, is apt to proceed in the ſame ever afterwards; and that the ſame indiſcrimination which cauſed the firſt error will induce a ſucceſſion of others of the ſame ſort *ad infinitum*. Unfortunately, too, it happens that in agriculture, things which are capable of affecting the reſult of a proceſs or operation, are ſo jumbled and thrown together into one chaotic maſs, that it is a matter of extreme difficulty even for the moſt nice obſerver to diſtinguiſh ſuch as are eſſential, from thoſe which are merely accidental, conſequently extremely eaſy to miſtake one for the other. The inaccuracy likewiſe, which too much prevails in the operations of the farmer, concerning the actual expence of different proceſſes, as affecting any particular object; and all the difficulty of keeping the different produce of different fields ſeparate, render it, in moſt caſes, almoſt impoſſible for the actual farmer to aſcertain, with any ſort of preciſion, either the expence or the value of the produce of any one of his fields; conſequently the profit or loſs of any operation or proceſs is merely gueſſed at, not aſcertained by the teſt of his experience; in conſequence of which he is at liberty, and will of courſe draw the concluſion, which ſeems moſt to confirm his own pre-conceived notion on the head, whatever it may be. Under ſuch circumſtances experience muſt, he conceives, be a very fallacious and imperfect guide. It may, indeed, it is ſuppoſed, furniſh hints or indications of what ought to be purſued or laid aſide and avoided; but that unleſs facts be aſcertained with much greater preciſion than it admits of, they muſt, it is conceived, afford a very unſtable foundation for promoting the ſcientific improvement of agriculture.

In conſequence of which, experiment, he thinks, has been introduced and adapted, in order to ſupply the deficiencies which are thus produced; but which, though, at the firſt ſight, it may promiſe fair to accompliſh ſuch purpoſes, upon a nearer view has not been found adequate in any material degree. An experiment in this art is, it is conceived, a particular operation, undertaken with the deſign of elucidating and explaining ſome fact which is involved in doubt or difficulty; of courſe extreme accuracy, in order to guard againſt every circumſtance that may unintentionally affect or influence the reſult, is an indiſpenſable requiſite in the conducting of it; as, unleſs this be the caſe, the ſame experiment, under different circumſtances, may lead to a variety of concluſions. In general, however, farmers, from their having been but little accuſtomed to the nice diſcriminations of ſcientific inveſtigation, are but indifferently qualified to guard againſt the ſecret influence of cauſes, which they have never even ſo much as ſuſpected of having any power upon the reſult of their experiment. It is, therefore, contended, that from theſe cauſes the experiments made by actual farmers frequently prove extremely defective; and when amateurs of a higher rank project experiments, the detail of them muſt be left to ſervants and dependants, who commonly put down at random all the circumſtances which their careleſſneſs prevented them from noticing; ſo that theſe experiments, though they may aſſume a more engaging appearance of accuracy, are, in fact, for the moſt part, more inaccurate and erroneous than the former. Conſequently, with the view of remedying theſe evils, the notion of an experimental farm has preſented itſelf to many perſons as the only means of forwarding the progreſs of ſcientific agriculture, and upon a ſlight view, the benefits that might reſult from it have indeed ſeemed ſo obvious, that in ſeveral diſtricts of this country funds have been provided, as has been already hinted, for the ſupport of ſuch eſtabliſhments, but on trial they have all found ſuch difficulties in the way, as have not hitherto been capable of being ſurmounted. The chief reaſon of which, it is conceived, is, as has been ſuggeſted before, that of the difficulty of procuring a perſon in every way properly qualified for conducting ſuch an undertaking. On theſe grounds, the expectations of the benefits that are to be derived from the eſtabliſhment of an experimental farm are not by any means ſo great as may be ſuppoſed. It is, indeed, contended, that there are many experiments of the very firſt importance in ſcientific agriculture, which are totally out of, or beyond the ſphere of a farm of this kind. Of this deſcription, it is conceived, are all thoſe facts which have a relation to the original conſtitution of ſoils, and the infinitely diverſified, though little obvious qualities theſe poſſeſs in conſequence of peculiar impregnations, which they may have derived from the operations of nature or of art. It is ſuppoſed that an experimental farm, in ſo far as this particular is concerned, is preciſely the ſame as another farm, in which the experimenter, like the farmer, may in time acquire a knowledge of what will ſuit his own ſoil. But if theſe experiments were preſented to the public under the idea that the reſults which they afforded ſhould be deemed generally concluſive in all diſtricts, ſuch a deciſion would turn out fallacious, as it would ſoon be found, that, in many other caſes, the reſults would be extremely different. Nor is it believed that the practical farmer could derive much advantage from the experimental farm, in what reſpects the economical diſtribution or arrangement of the neceſſary buſineſs which is to be purſued in the conducting of the work, which is a branch of the art that is of the greateſt conſequence to be well underſtood by the real farmer, but that is totally incompatible with the complex arrangements and continually varying operations of the experimental farm.

But however true many of theſe remarks may be, there can be little doubt, but that the eſtabliſhment of experimental farms in different parts of the country muſt, under proper management, be attended with great advantage in throwing additional light on different branches and modes of cultivation, as well as in bringing agriculturiſts acquainted with a variety of new and intereſting facts.

When conducted under a proper ſyſtem of management, farms of this kind might readily aſcertain the following important queſtions.

1ſt. What is the beſt mode of cultivating arable land ?

2d. What is the beſt ſyſtem for the management of graſs land ?

3d. What are the moſt uſeful implements of huſbandry ?

4th. What are the moſt profitable breed of animals, and the beſt, and cheapeſt modes of feeding and fattening them? and,

5th. What is the beſt plan for rendering waſte or barren land productive ?

All theſe queſtions are evidently to be conſidered in relation to the differences of ſoils, circumſtances and ſituations.

Mr. Arthur Young, in ſpeaking of the eſtabliſhment of a farm of this nature, as being properly an undertaking only fit for a ſovereign, in the fourth volume of his "Annals of Agriculture," remarks, that it would have great effects in promoting agriculture in this country, but in others, where that art is ſtill leſs underſtood, it is abſolutely eſſential to the progreſs of it. And that if, in ſome future age, this art, ſo neceſſary to the welfare of mankind, ſhould receive an attention that has hitherto been denied it, and a farm of this ſort ſhould be eſtabliſhed, the following hints may be found of uſe. It is conceived, that a divided attention to complex queſtions ſhould be avoided; and thoſe great leading objects moſt nearly connected with the deficiencies of the national agriculture demand the firſt exertions to aſcertain. With this view the ſoil of the farm ſhould regulate the plan of it. If it were a ſand one in this country, it ſhould, it is ſuppoſed, be thrown into the Norfolk huſbandry, and the object of theſe experiments would be to examine how far that ſyſtem, by means of carrots, turnip-cabbage, and other new plants, equi-diſtant drilling, manuring for the roots and graſſes inſtead of the wheat, &c. could be improved. And connected with this inquiry would be the collateral one of the breed of ſheep, proper for this ſoil; with other objects too numerous to recite, which are at preſent unaſcertained.

If the ſoil were of the clayey or loamy kind, too wet for turnips, the great objects would, it is ſuppoſed, be, the means of baniſhing ſummer fallows, an inquiry of great inportance ; the culture and uſe of cabbages ; the modes of draining by hollow cuts and arched lands ; the beſt means of converting ſuch lands to meadows, and the proper breed of cattle.

And on a loamy ſoil, ſtrongly inclining neither to clay nor ſand, very intereſting inquiries are to be purſued. Every plant, common on all other ſoils, is to be cultivated on this. The rotations of crops; the culture of potatoes and carrots, and their application to all ſorts of cattle; lucerne, and its uſe in ſummer feeding a dairy of cows, that are ſupported in the winter on the roots, &c. are among the numerous inquiries to be proſecuted on this ſort of ſoil. On chalky ſoils the principal object is, it is ſuppoſed, the culture of ſaintfoin, and the beſt means of converting it to corn and turnips preparatory to a renewal.

But on a peat-moor many dubious points are to be aſcertained ; the beſt means of reclaiming, whether by paring and burning, fallow, or mere manuring. The graſſes proper to lay down with ; and the means by roots or cabbages, of ſupporting the greateſt poſſible ſtock of that breed of cattle and ſheep, which are found by experiment moſt proper for the ſoil ; the method of draining, manuring, and giving ſolidity to bogs, &c. Upon all, or either of theſe ſoils, collateral inquiries would ariſe in relation to manures, tillage, inſtruments, &c. and a great variety of doubtful points to be decided in the culture and management of all the plants uſually raiſed on any of them.

A ſmall botanical garden of two or three acres, under a botaniſt, for ſmall experiments upon plants not cultivated but promiſing ; and a laboratory for chemical trials on ſoils, manures, and vegetables, would, it is ſuggeſted, be two neceſſary additions to ſuch an eſtabliſhment ; and with a ſmith's and wheelwright's work-ſhop would render the whole complete.

The great features of ſuch a plan would, it is ſuppoſed, be of utility ; it would, however, be ſuſceptible of no inconſiderable ornament. The lines of the incloſures might be decorated in any imaginable way, provided the contents of the field applicable to uſeful graſs or corn were traced by right lines. Every tract of land, of a conſiderable extent, has ſome broken ground, ſteep ſlopes, water-courſes in glens, or pieces where the plough cannot move with convenience, and where graſs is not an equal object with more level ſpaces ; theſe, by a judicious diſpoſition of the ground, might be connected with the margins of the fields, and, by walks being traced through them, might be made highly ornamental and pleaſing. It is ſuggeſted that one of Brown's winding walks, with its uſual accompaniment of ſhrubs and velvet lawn, ſurrounding thirty, forty, or more acres of graſs, is never ſeen, but it brings to the mind the variety ſuch a ſpace is capable of, by being thrown into experiments that yield a food for the mind as well as the eye. Some delicious ſpots, it is true, unite ſo happily in all their parts, melting by an eaſy gradation into ſo rich a harmony of diſtribution, that any change would offend as much as diſſonance in a piece of pleaſing muſic. But ſuch ſpots are rare : in general, the variety of neat and elegant experiments would not injure the effect at all. The Leaſſowes was, it is ſtated, in all its parts, a farm, and much more agreeable to the eye, than if the whole had been lawn. But in the preſent ſyſtem of decorating ground, variety of effect is wanting ; ſomething to bring variations to the ſcene, in which the owner ſhall be intereſted. The lawn that was ſmooth yeſterday is ſmooth to day, and the revolution of the ſeaſons that bids the roſe breathe its perfume in June, and wither in November, brings to the eye a ſucceſſion of the ſame images which pleaſe this year, as they pleaſed the laſt, without novelty in the cauſe, or increaſe of pleaſure in the effect. The higheſt decoration of landſcape will not give it the power of variety ; it will be the ſame this Auguſt as it was the laſt ; it will be gay in ſummer ; and dreary in December ; its forcible effect is for others not yourſelf ; for at every repetition of viewing the colours fade, and what once excited rapture, now brings no other emotion than cold approbation. The beauty of a mere garden-ſcene is like that of a fine face ; it moves admiration at firſt, and we feel ourſelves under the enchantment of a ſpell that chains all our ſenſes ; but let the enchantreſs ſpeak, and prove herſelf a pretty fool, the inanity of her converſation breaks the ſpell, and ſhe is from that moment leſs than a pretty picture, ſince no one claims a merit in making her. The beauty of a garden-ſcene is much of the ſame kind; it holds little converſation with you; it ſuggeſts no new ideas; it furniſhes no food to an inquiſitive mind. If a perſon be told that he may contemplate the works and wiſdom of God; and hold converſe with the vegetable and animal creation, he replies, not becauſe he is in a garden, for a nettle is as wonderful a production of divine power as a lily, and the ſtructure of a toad an object to philoſophize on, as much as a nightingale. Hence the contemplative pleaſures of a decorated ſcene are not appropriated; they ariſe from the parts and not the combination; and therefore, in this reſpect, might as well not be combined at all. But when the ornamented walks lead you to ſomething that offers novel information with evey ſeaſon, when you are in the purſuit of unknown facts, to aſcertain which is to promote not your own ſolitary pleaſures and contemplations only, but a ſcience intimately connected with the proſperity of a nation; when every incloſure is pregnant with inſtruction, the field of a purſuit, and conſequently of a pleaſure; in ſuch a caſe, it is not a queſtion of an arrangement of a lawn, and water, and ſhade, that ſhall pleaſe the eye for a time; it is not the bloom of a flower, or the bend of a walk, but a ſubject where the renovation of the year brings perennial employment for the mind: your landſcape becomes the ſource of thought; the eye may be pleaſed, but the underſtanding is ſatisfied; and inſtead of modes of duration that have been repeated to ſatiety, a novel ſcene is created, at once the theatre of private pleaſure and public inſtruction; where uſeful knowledge is ſought, not in vain theories, and indolent ſpeculation, but in the vigour and activity of experimental exertion. Compared with ſuch an application of a tract of land, what are parks and gardens, ſhrubberies and decorated grounds, but ſo many baubles to pleaſe children; frivolous efforts to fill the eye, but leave the mind vacant. The prince that raiſes palaces, and embelliſhes the gardens that ſurround them, may be commended for his taſte, and praiſed for his magnificence. Verſailles was called a creation; but had Lewis XVI. eſtabliſhed ſuch a farm as has been deſcribed; had the experiments been regiſtered and publiſhed for the benefit of France; how little would the reputation of that creation now be found, compared with the genuine and never dying fame that would have ſprung from a different application of the ſame ground. The prince that rears a palace, does what princes have done before him; but he who founds an eſtabliſhment for the inſtruction of his people in the moſt neceſſary of all arts, does that which none have done before him, and deſerves a title more truly valuable than that of *Great*, ſo often ill applied to the deſtroyers, not the protectors, of humanity; he will enjoy the title of the "Friend of Mankind."

A late writer on modern huſbandry, however, ſeems to think more favourably of this method of bettering the ſtate of agriculture than the author mentioned above, as he conſiders it as a mean by which a general ſpirit for ſuch improvements may be the moſt effectually introduced. It is a meaſure, he ſuppoſes, which there is every reaſon to believe would be attended with good conſequences, in regard to the determining with exactneſs the proper quantities of the different ſorts of manures that ought to be applied to the different kinds of ſoils; the ſorts beſt adapted to each; and the effects they produce when applied ſingly or in their compound ſtate. But the utility of public experimental farms in every county, if put under the direction and management of perſons of extenſive knowledge and experience, ſhould not, it is contended, be eſtimated by a reference to any particular branch: huſbandry, in all its departments, would be greatly improved in this way; and ſhould the period ever arrive when the obſtacles that ſtand in its way ſhall be removed, and proper means be had recourſe to, for diffuſing a general knowledge of the beſt methods of conducting the various operations connected with that ſcience, that which has been ſuggeſted muſt not be overlooked. It is ſuppoſed that ſuch ſorts of farms would become ſo many ſeminaries, at which youth might be inſtructed in the nature, principles, and practice of agriculture, and to which the common farmer might occaſionally reſort for information, in reſpect to the ſucceſs of experiments made as it were under his own eye, and on ſoils, in ſituations ſimilar to thoſe of his own.

And the author of "Rural Economy of the Midland Counties," in ſpeaking of the advantages of theſe ſorts of farms, aſks, "what man, whether of the ſuperior claſs of yeomanry or tenants, or of a ſuperior claſs of tradeſmen or others, who are now bringing up their ſons to huſbandry, would not, after his ſon had gone through a courſe of private tuition, and received the rudiments of inſtruction from himſelf or ſome profeſſional friend, wiſh to perfect his education in a public ſeminary; where he would have not only an opportunity of ſeeing practice in its higheſt ſtate of improvement, and of converſing with profeſſional men of the moſt enlightened underſtandings; but where he would be duly initiated in the theory of rural knowledge, in the method of making, regiſtering, and obſerving the reſult of experiments; of aſcertaining the inherent qualities, and improving the various breeds of live ſtock; where he would ſee order and ſubordination, and learn the proper treatment of ſervants; and among a variety of other branches of uſeful knowledge, the form and method of keeping farm-accounts, and of aſcertaining with accuracy the profit or loſs upon the whole, and every part of his buſineſs; conſequently of bringing it, as nearly as in its nature it is capable of being brought, to a degree of certainty."

But whatever may be the opinion of ſome concerning the utility of public eſtabliſhments of this nature, we are inclined to believe that they will be found more beneficial when under the direction and management of private individuals who are ſufficiently qualified for ſuch undertakings, for though they may be far leſs extenſive, they will be much more uſefully conducted from their being leſs ſubject to thoſe improper checks and controuls, which are continually taking place when a number of perſons are concerned.

EXPERIMENTAL *philoſophy*. Pythagoras is ſaid to have been the firſt perſon who called himſelf philoſopher, *viz.* a lover of knowledge or wiſdom, from the Greek words φιλος, *a friend* or *lover*, and σοφιας, *knowledge* or *wiſdom*; from which appellation the word philoſophy was derived, meaning the love of general knowledge; and according as this knowledge relates to the manners, the duties, and the conduct of human beings, conſidered in a rational and ſocial light, or to the phenomena of natural bodies, ſo it has been called either *moral philoſophy* (from the Latin *mos* or *mores* its plural, which means *behaviour* or *manners*) or *natural philoſophy*.

The philoſophers of the primitive ages, among the Greeks, Romans, &c. in explanation of the phenomena of nature, ſuch as the motions of the celeſtial bodies, the rain, ſnow, froſt, thunder and lightning, the rainbow, the combuſtion of fuel, the production of animals and vegetables, and ſo forth, generally offered the inadequate ſuggeſtions of their imaginations, which, though moſtly unintelligible, and frequently abſurd in the greateſt degree, were nevertheleſs received with deference by their ſcholars, and were propagated with fidelity or diligence from one generation to another. Their acquieſcence reſted merely on the authority of the teacher. That theſe explanations were generally inadequate and abſurd, is eaſily evinced by obſerving that different contemporary philoſophers entertained and taught opinions diametrically oppoſite to each other, though they related to the very ſame queſtion; and that ſubſequent philoſophers have by actual obſervations, and unerring demonſtrations, ſhewn their fallacy. It may amuſe an inquiſitive mind to obſerve, that whilſt the exertions of the early mathematicians, whoſe productions have obtained the admiration of ſubſequent generations, were ſtrictly rational and correct, the inveſtigations of their contemporary philoſophers were conducted in a manner altogether ſlovenly and ſuperficial. This method of philoſophiſing prevailed for a very long period, and in conſequence of it ſeveral centuries elapſed, during which the knowledge of nature made no progreſs deſerving of notice, excepting a few rare and accidental diſcoveries.

The 15th century, which was productive of the greateſt events and the moſt conſequential diſcoveries that hiſtory can record, ſeems to have given a new turn to the ſubject of natural philoſophy. The old tenets began to be doubted, and the energies of the human mind began to manifeſt their unfettered powers. In the next century, the incoherent dogmas of the preceding ages were freely combated; the authority of names and ſects was diſregarded, and in lieu of opinions, the explanation of natural phenomena was referred to the evidence of actual experiments; and this introduced the appellation of *experimental philoſophy*, meaning the knowledge of natural powers and natural effects, acquired by means of experiments or trials. The leaſt reflection readily ſhewed the ſuperiority of this new method of philoſophiſing; but, independent of any other conſideration, its eſtabliſhment is principally due to the ſucceſs with which it was attended, and which exceeded even the moſt ſanguine expectations of its firſt promoters; for it was no ſooner adopted, than diſcoveries of importance were made, old-eſtabliſhed errors were detected, and the ſubject of philoſophy aſſumed an entirely new aſpect.

It is undoubtedly true, that in this mode of inveſtigation the experiments muſt be preceded by hypotheſis, or ſuppoſition; for a man cannot begin to make experiments without the previous formation of a certain plan; but then the plan, the ſuppoſition, or the hypotheſis goes no farther than to propoſe ſomething, the confirmation or refutation of which is referred to the reſult of experiments, aſſiſted by mathematical calculation.

In the 13th century, the neceſſary preliminaries for the improvement of natural knowledge began to be made; *viz.* collections of what then prevailed under the denomination of ſcientific knowledge, natural knowledge, ſecrets of nature, and the like; and the farrago of truths, errors, inconſiſtencies, doubts, and perplexities, which theſe works contain, is ſtrange indeed. Among the few who effectually began to work in the experimental mode of inveſtigation, during that century, friar Bacon held the moſt diſtinguiſhed place. His deſire of information was great; his views extenſive; his mind clear and capacious; and he is ſaid to have ſpent about 2000*l.* (a ſum very conſiderable at that time) in the performance of his numerous philoſophical experiments. Baptiſta Porta alſo diſtinguiſhed himſelf for ſimilar purſuits in Italy. This inquiſitive perſon lived at Naples, and about the year 1560 formed a ſociety of ſcientific perſons, who met in his own houſe. The great Galileo, who was born in Italy in the year 1564, became famous as a philoſopher and a mathematician towards the latter end of that century and the beginning of the next. His genius, ſuperior to the prejudices of the times, inveſtigated and eſtabliſhed ſeveral leading propoſitions in natural philoſophy; and his ſucceſs, his example, and his precepts diſſeminated an univerſal ardour for the true mode of inveſtigating the powers and the effects of natural bodies. His ſucceſſor, Torricelli, was not unworthy of a moſt diſtinguiſhed rank amongſt the philoſophers of the age; and the Torricellian tube, or the barometer, is a magnificent monument of his experimental inquiries.

In England, as we have already mentioned, friar Bacon was the firſt promoter of true knowledge; but a great part of the work of philoſophical reformation was accompliſhed by another inquiſitive genius of the ſame name. Francis Bacon, lord chancellor of England, gave a freſh and vigorous impulſe to the progreſs of experimental enquiry. He recorded a vaſt number of facts, propoſed and executed a great many experiments; and nothing that related to nature ſeemed to be below his notice.

Theſe early reformers of philoſophy, beſides other obvious difficulties, were obliged to ſtruggle againſt, and the ſucceſs of their labours was much impeded by, the wrong notions which then prevailed, and which had been long rooted in the minds even of the moſt able perſons then living. Galileo was nearly oppreſſed by the ignorance and prejudices of the clergy. Crichton, who flouriſhed about the latter end of the 16th century, wrote an able book expreſsly againſt the vain philoſophy of Ariſtotle, which had long been read in the ſchools. The two Bacons, and other able writers, frequently allude to, and ſtrenuouſly endeavour to remove, the wrong notions of their contemporaries, and, in ſhort, the demolition of the old defective fabric, proved nearly as laborious as the erection of the new ſtructure.

The reform which had been begun by the above-mentioned and other worthy perſons was ſoon after completed by the extraordinary genius of Newton. This truly great man, like a luminary of the firſt magnitude, illuſtrated whatever came within the limits of his notice, and his notice was employed in the greateſt and moſt admired works of the creation. His method was to inſtitute experiments, to examine the phenomena with accuracy, and to ground upon them the ſtricteſt mathematical reaſoning. The conviction which ſuch rational method conveyed, and the numerous diſcoveries with which it was attended, completely exploded the old tenets, and eſtabliſhed the only true method of inveſtigating nature.

The progreſs of experimental philoſophy might have been interrupted by the death of a ſingle individual; for it does but ſeldom occur that genius, health, opulence, and other opportunities concur in the qualification of an experimental philoſopher; but the danger was in great meaſure averted by the inſtitution of philoſophical ſocieties, which, by uniting the efforts of ſeveral ingenious labourers, by furniſhing in great meaſure the means of inveſtigation, by encouraging improvements, and by recording and propagating the reſults, have eſtabliſhed the progreſs of knowledge in a regular and permanent channel.

The firſt ſociety of the kind which we find recorded, is that which we have already mentioned at the houſe of Baptiſta Porta in Naples, towards the latter end of the 16th century. It was called "Academia Secretorum Naturæ." Next to this, and before the end of the ſame century, the Academy, called of the Lyncei, was founded at Rome, and was rendered famous throughout the world principally by the renown of one of its members, the great Galileo. The Academy del Cimento, and ſeveral other aſſociations of ſcientific perſons, were eſtabliſhed in the ſucceeding, *viz.*

the 17th century. And amongſt thoſe aſſociations the firſt rank muſt be aſſigned to the Royal Society of London. This moſt learned and diſtinguiſhed ſociety had its origin ſoon after the middle of the 17th century. A few men of learning began to meet at ſtated times in Wadham college, Oxford; and among thoſe perſons there were the following conſpicuous characters; *viz.* Dr. Ward, Robert Boyle, Dr. Wilkins, ſir William Petty, Mr. Matthew Wren, Dr. Wallis, Dr. Goddard, Dr. Willis, Dr. Bathurſt, Dr. Chriſtopher Wren, and Mr. Rooke. From Oxford this aſſociation transferred its meetings to Greſham college in London, which took place in the year 1658. There they increaſed their number, and ſoon after the reſtoration of Charles II. that ſociety received a royal charter, which eſtabliſhed it into the form that has been continued ever ſince; but we muſt refer the reader to other articles of this Cyclopædia for the particular account of the Royal Society of London, as well as of other ſcientific aſſociations in this and other countries; and at the ſame time we muſt proceed to explain the new mode of philoſophiſing in a manner ſomewhat more particular.

The objects of the univerſe, or the natural bodies, which affect our ſenſes, become known and uſeful to us by their properties, ſome of which affect one of our ſenſes, whilſt others affect ſome other ſenſe. Thus we perceive luminous bodies through our eyes, ſound through our ears, heat or cold by the touch or feel, &c. Some of theſe properties are called general, like gravity and extenſion, becauſe they belong to all bodies; and others, like tranſparency and fluidity, are called particular, becauſe they belong to certain bodies only. The better we become acquainted with the properties of natural bodies, the more extended the ſphere of our powers and of our advantages becomes; and it is for the diſcovery of theſe properties, either in ſimple or in compound bodies, that experimental inquiries are inſtituted.

In the acquirement of knowledge, the human being has no other aſſiſtance beſides that of his ſenſes, and of his reaſoning faculty. By the firſt he obſerves and acquires ideas of ſelf evident propoſitions, or properties of natural bodies; ſuch as the human mind cannot diſſent from without manifeſt violence; by the ſecond he is led from one of theſe evident ſimple propoſitions, to another ſtrictly depending upon the firſt, then to a third ſtrictly depending upon the ſecond, and ſo on, to the acquiſition of ſome idea more complex, and leſs apparent at the firſt annunciation.

The conſtant obſervations of philoſophers, with ſir Iſaac Newton at their head, and the dictates of plain reaſoning, have furniſhed certain axioms and certain rules of philoſophizing, the propriety of which is too evident to be objected to.

The axioms of philoſophy, or the axioms which have been deduced from common and conſtant experience, are ſo evident, and ſo generally known, that it will be ſufficient to mention a few of them only.

1. Nothing has no property; hence

2. No ſubſtance, or nothing can be produced from nothing.

3. Matter cannot be annihilated, or reduced to nothing.

The propriety of the laſt axiom may perhaps be not readily admitted by certain perſons; obſerving that a great many things appear to be utterly deſtroyed by the action of fire; alſo that water may be cauſed to diſappear by means of evaporation, and ſo forth. But it muſt be obſerved, that in theſe caſes the ſubſtances are not annihilated; they are only diſperſed, or removed from one place to another, and by being divided into particles very minute, they elude our ſenſes, and eſcape our immediate notice. Thus, when a piece of wood is placed upon the fire, the greateſt part of it diſappears, and a few aſhes only remain, the weight and bulk of which do not amount to the hundredth part of the weight and bulk of the original piece of wood. In this caſe the piece of wood is divided into its conſtituent principles, which the action of the fire drives different ways. The fluid part, for inſtance, becomes ſteam, the light coaly part either adheres to the chimney, or is diſperſed through the air, &c. ſo that if, after the combuſtion, the ſcattered materials were collected, (which may in great meaſure be accompliſhed,) the ſum of their weights would equal the weight of the original piece of wood.

4. Every effect has, or is produced by, an adequate cauſe, and is proportionate to it.

It may in general be obſerved, with reſpect to theſe axioms, that we only mean to aſſert what has been conſtantly ſhewn, and confirmed by experience, and is not contradicted either by reaſoning or by any known experiment. But we do not mean to aſſert that they are as evident as the axioms of geometry; nor do we in the leaſt preſume to preſcribe limits to the agency of the Almighty Creator of every thing, whoſe power and whoſe ends are too far removed from the reach of our underſtandings.

Having thus ſtated the principal axioms of philoſophy, it is in the next place neceſſary to mention the rules of philoſophizing, which have been formed, after mature conſideration, for the purpoſe of preventing errors as much as poſſible, and of leading the ſtudent of nature along the ſhorteſt and ſafeſt path to the attainment of true and uſeful knowledge. Theſe rules are not more than four; *viz.*

1. We are to admit no more cauſes of natural things, than ſuch as are both true and ſufficient to explain the appearances.

2. Therefore to the ſame natural effects we muſt, as far as poſſible, aſſign the ſame cauſes.

3. Such qualities of bodies as are not capable of increaſe or of decreaſe, and which are found to belong to all bodies within the reach of our experience, are to be eſteemed the univerſal qualities of all bodies whatſoever.

4. In experimental philoſophy we are to look upon propoſitions collected by general induction from phenomena, as accurately or very nearly true, notwithſtanding any contrary hypotheſes that may be imagined, till ſuch time as other phenomena occur, by which they may either be corrected, or may be ſhewn to be liable to exceptions.

With reſpect to the degree of evidence which ought to be expected in natural philoſophy, it is but proper to remark that phyſical matters are not in general capable of ſuch abſolute certainty as the branches of mathematics. The propoſitions of the latter ſcience are clearly deduced from a ſet of axioms ſo very ſimple and evident, as to convey perfect conviction to the mind; nor can any of them be denied without a manifeſt abſurdity. But in natural philoſophy we can only ſay, that becauſe certain particular effects have been conſtantly produced under certain circumſtances, therefore they will moſt probably continue to be produced as long as the ſame circumſtances exiſt; and likewiſe that they do, in all probability, depend upon thoſe circumſtances. And this is what we mean by *laws of Nature; viz.* certain effects which are or have been uniformly produced by certain cauſes, as far as our obſervations reach.

We may, indeed, aſſume various phyſical principles, and by reaſoning upon them, we may ſtrictly demonſtrate the deduction of certain conſequences. But as the demonſtration goes no farther than to prove that ſuch conſequences muſt neceſſarily follow the principles which have been aſſumed;

the conſequences themſelves can have no greater degree of certainty than the principles are poſſeſſed of; ſo that they are true, or falſe, or probable, according as the principles upon which they depend are true, or falſe, or probable.

The foundations of experimental philoſophy, as we have already obſerved, are the properties of natural bodies, *viz.* of all thoſe bodies, either ſolid or fluid, which in any way affect any of our ſenſes: and ſince our ſenſes are affected by the properties of theſe bodies, *viz.* by their extenſion, colour, hardneſs, tranſparency, &c. we cannot know any more of theſe bodies than what is manifeſted to us by ſuch properties only as we are able to perceive. Were we furniſhed with other ſenſes, we might diſcover other properties which would make us more intimately acquainted with the nature of ſuch bodies.

Human art has not been able to diſcover more ſenſes than thoſe which every body knows; but it has, in great meaſure, improved ſome of thoſe which we poſſeſs, and this alone is ſufficient to point out the limited nature of our perceptions. Thus, for inſtance, the diſcovery of the microſcope, and the teleſcope, have ſhewn us wonders of which our forefathers were utterly ignorant; and the number and variety of theſe wonders have increaſed in proportion as the above-mentioned inſtruments have been improved. The improvements of theſe inſtruments have been ſuggeſted by the diſcoveries that have been made reſpecting the refrangibility of light, and the properties of tranſparent bodies, and theſe have been made in conſequence of the innumerable experiments that have been inſtituted by various intelligent perſons. Thus it appears, that by means of trials and obſervations new facts are aſcertained, which, beſides their being immediately uſeful to the human ſpecies, furniſh, at the ſame time, the means of making farther diſcoveries; and the treaſures of the natural world are far, indeed, from a ſtate of exhauſtion. Hence the improvements and the diſcoveries of experimental philoſophy proceed in a kind of increaſing geometrical progreſſion; unleſs they be impeded by ſome extraordinary occurrence.

In contemplating the intimate nature of natural bodies, when our mind goes beyond the bounds of our ſenſes, (and our ſenſes, even with the aſſiſtance of inſtruments and reaſoning, are only capable of perceiving a few properties of thoſe bodies;) we wander in the boundleſs field of probability and conjecture. Two principal hypotheſes have been entertained with reſpect to the primitive component particles of bodies. One is, that the particles of each peculiar ſpecies of bodies are different from the particles of another ſpecies of bodies. Thus the primitive particles of gold are ſuppoſed to be different from the particles of calcareous earth, different from the particles of water, &c. The other hypotheſis is, that there is one kind of primitive or original particles of matter, and that from the different arrangement of thoſe ultimate particles, the various bodies ariſe. Experience ſhews that certain bodies, which, at firſt ſight, appear to be abſolutely different from each other, are, upon further examination, exactly of the ſame nature. On the other hand, a vaſt number of bodies are ſo diſtinct from each other, that no art has been able to form one of them from the particles of another; thus gold cannot be converted into a diamond, iron cannot be converted into lead, &c. The former of theſe obſervations ſeems to favour the ſecond hypotheſis; the latter ſeems to favour the firſt hypotheſis; but it is not in our power to determine the real ſtate of the matter.

With reſpect to the number of bodies, which, by our not being able to change one of them into the other, are called elementary, or primitive and diſtinct, the reader will find ſufficient information under the article Element; but it may be remarked in this place, that new bodies are frequently diſcovered in proportion as new inſtruments, and the improvements of ſcience in general, furniſh us with the means of diſcriminating them from others; hence we are naturally led to conclude, that moſt probably there may exiſt a vaſt number of other bodies, of which we at preſent have not the leaſt ſuſpicion. Some of theſe may perhaps be diſcovered hereafter, whilſt others may remain utterly unknown to the human ſpecies.

The properties of natural bodies, which are the objects of reſearch to the experimental philoſopher, are either general, or particular. The general properties, which belong to all kinds of bodies, are, as far as we know, not more than ſix; *viz.* extenſion, diviſibility, impenetrability, mobility, vis inertiæ, or paſſiveneſs, and gravitation. We have ſaid that theſe are the general properties as far as we know, becauſe matter in general may poſſeſs other properties that are not yet come to our notice. And the ſame obſervation may be made with reſpect to the univerſality of theſe properties: for they are ſaid to be general, becauſe no body was ever found which wanted any one of them. But mankind are not acquainted with all the bodies of the univerſe, and even ſeveral of thoſe which are known to exiſt, cannot be ſubjected to experiments.

The peculiar properties, *viz.* thoſe which belong to certain bodies only, and not to others, are denſity, rarity, hardneſs, ſoftneſs, fluidity, rigidity, flexibility, elaſticity, opacity, tranſparency, the properties of light, the properties of heat, the properties of electricity, the properties of magnetiſm, and three other kinds of attraction, (independent of gravitation, of electricity, and of magnetiſm,) *viz.* the attraction of aggregation, which the homogeneous parts of matter have towards each other, or by which they adhere together; and ſuch is the power by which two ſmall drops of mercury, when placed contiguous to each other, ruſh, as it were, into each other, and form a ſingle drop; the attraction of coheſion, or that power by which the heterogeneous particles of bodies adhere to each other without any change of their natural properties, ſuch as the adheſion of water to glaſs, of oil to iron, &c.; and the attraction of compoſition, or of affinity, which is the tendency that the parts of heterogeneous bodies have towards each other, by which they combine, and form a body, differing more or leſs from any of its components.

It is to be remarked, that of all theſe properties we know their exiſtence only, and ſome of the laws under which they act; but we are otherwiſe utterly ignorant of their nature and dependence.

The inveſtigation of ſome of the above-mentioned properties, whether general or particular, has been carried much farther than the inveſtigation of other properties. The reſults of theſe inveſtigations have likewiſe been various, both in point of extent and of application. Some of them are ſo very extenſive and ſo uſeful, as to form the foundations of very important branches of ſcience or of art, under peculiar appellations. Thus, upon the mobility and the vis inertiæ of bodies, the doctrine of motion, or dynamics, is grounded, which comprehends mechanics, hydroſtatics, or the mechanical properties of fluids, pneumatics, &c. Tranſparency and the properties of light form the important foundation of optics. The attraction of affinity is the foundation of chemiſtry, as well as of various arts, and ſo forth. Whatever belongs to theſe properties, or to the extenſive ſubjects that are grounded upon the ſame, will be found under the various articles of their peculiar denominations.

The phenomena of the univerſe, are the appearances which take place in conſequence of the above-mentioned properties of natural bodies, together (reſpecting ſome of them at leaſt) with ſome original impulſe. The phenomena which take place amongſt the luminous celeſtial bodies, properly ſo called, ſuch as the ſtars, the planets, &c. are examined by a particular ſcience called aſtronomy; the meteors, or the phenomena, which take place within the limits of the terreſtrial atmoſphere, ſuch as ſhooting ſtars, northern lights, halos, rain, fogs, hail, winds, &c. form the ſubject of meteorology. The phenomena that take place upon the ſurface of, or within, the earth, are treated of under the comprehenſive denominations of *vegetation, earthquakes, volcanoes, combuſtion,* &c. all which will be found explained under their appropriate articles.

EXPERIMENTUM Crucis, denotes a capital, leading, or deciſive experiment; thus called, either, becauſe like a croſs or direction poſt, placed in the meeting of ſeveral roads, it guides and directs men to the true knowledge of the nature of the thing they are enquiring after; or as it is a kind of torture, whereby the nature of the thing is, as it were, extorted by violence.

EXPIATION, the act of ſuffering the puniſhments adjudged to a man's crimes, and thus paying off, or diſcharging the debt or guilt; and it is figuratively applied to the pardon procured for the ſins of the penitent by the interpoſition and death of Chriſt.

The Romaniſts hold, that ſouls after death are ſent to purgatory to expiate or atone for their ſins. See Purgatory.

Expiation is alſo applied to ſacrifices offered to the Deity, to implore his mercy and forgiveneſs.

Expiation, *the Feaſt of,* among the Jews, called by our tranſlators the *day of atonement,* was held on the tenth day of Tiſri, or the ſeventh month of the Jewiſh year, anſwering to part of our September and October. It was inſtituted by God himſelf, Levit. xxiii. 27, &c. On that day the high-prieſt, the figure or type of Jeſus Chriſt, entered into the moſt holy place, and confeſſed his ſins; and, after ſeveral ceremonies, made an atonement for all the people to waſh them from their ſins. Lev. chap. xvi. See Scape-*Goat.*

Expiation, among the *Heathens,* denoted a purification uſed for effacing or aboliſhing a crime, averting any calamity; and on a thouſand other occaſions, as purifying towns, temples, and ſacred places, and armies, before and after battle.

It was practiſed with divers ceremonies: the moſt uſual was ablution.

Expiations were performed for whole cities as well as particular perſons. After the young Horatius had been abſolved by the people for the murder of his ſiſter, he was farther purified by ſeveral expiations preſcribed by the laws of the pontifices for involuntary murders. Dion. Halicarnaſſ.

EXPILATION, from *expilo, I rob,* in the *Civil Law,* the act of withdrawing or diverting ſomething belonging to an inheritance, before any body had declared himſelf heir thereof.

This made a peculiar ſpecies of theft; for there could not properly be a theft in taking a thing not poſſeſſed by any body, or before the inheritance was accepted.

For this reaſon the Roman legiſlature introduced the action of expilation for the puniſhment of this crime.

Beſide this meaning, it was uſed in a more ſpecial manner to ſignify a robbery committed by night; whence an expilator was looked upon as a greater criminal than a common thief.

The expilators were ſo called from their robbing and ſtripping people of their cloaths.

EXPIRATION, in *Phyſiology,* is the act of expelling air from the lungs, produced by a diminution of the cavity of the cheſt. It is oppoſed to inſpiration, in which air is drawn into the cheſt. See Respiration.

Expiration is alſo uſed figuratively, for the end of a term of time granted, or agreed on, or adjudged.

EXPLEES, in *Law,* the rents or profits of an eſtate, &c. See Esplees.

EXPLICATION *of the Subject of a Diſcourſe,* in *Pulpit Oratory,* and in the compoſition of ſermons, comes in the place of narration at the bar, and ſhould be conducted in a ſimilar manner. It ſhould be conciſe, clear, and diſtinct, and in a ſtyle correct and elegant, rather than highly adorned. To explain the doctrine of the text with propriety, to give a full and perſpicuous account of the nature of that virtue or duty which forms the ſubject of the diſcourſe, is properly the didactic part of preaching; on the right execution of which much depends for all that comes afterward in the way of perſuaſion. The great art in ſucceeding in it is, to meditate profoundly on the ſubject, ſo as to place it in a clear and ſtrong point of view. Conſider what light other paſſages of ſcripture throw upon it; conſider whether it be a ſubject nearly related to ſome other from which it is proper to diſtinguiſh it, conſider whether it can be illuſtrated to advantage by comparing it with, or oppoſing it to, ſome other thing; by enquiring into cauſes, or tracing effects; by pointing out examples, or appealing to the feelings of the hearers; that thus a definite, preciſe, circumſtantial view may be afforded of the doctrine to be inculcated. Let the preacher be perſuaded, that by ſuch diſtinct and apt illuſtrations of the known truths of religion, it may both diſplay great merit in the way of compoſition, and, what he ought to conſider as far more valuable, render his diſcourſes weighty, inſtructive, and uſeful. Blair's Lectures, vol. ii. p. 297.

EXPLICATIVE Proposition, in *Logic.* See Complex *Propoſition.*

EXPLICITE, in the *Schools,* ſomething clear, diſtinct, formal, and unfolded.

The will or intention is ſaid to be explicite when it is fully explained in proper terms; and implicite, when it is only to be learnt by deductions and conſequences.

The Jews had not all an explicite knowledge of Jeſus Chriſt, but they had at leaſt an implicite one.

Such a teſtator has declared his will explicitely, *i.e.* in formal terms; there is no need to have recourſe to explications.

EXPLOITS, Bay *of,* in *Geography,* a bay of the Atlantic, on the eaſt coaſt of Newfoundland. N. lat. 49° 45′. W. long. 55° 20′.

EXPLOSION. It is a matter of great moment, in military engineering, ſo to load, and indeed to conſtruct, a mine, that it may explode with the greateſt preciſion, and with the maximum effect. A variety of theories has been given upon this ſubject, but it would be out of place to notice the whole of what appertains thereto in this place; therefore we ſhall refer our readers to the word Mine for the particular detail of what relates to this ſubject, contenting ourſelves with now offering a few remarks on the manner in which the exploſion is uſually effected.

It is of the firſt importance to aſcertain, ſo nearly as may be practicable, what depth, and what weight of ſoil is to be removed by an exploſion. This being done, the mine is formed, by a gallery leading to the chamber in which the powder is to be depoſited in a very ſtrong cheſt, let into a receſs, and firmly ſecured in every part. Now, it being the nature of the rarefied air to eſcape by that part which may be the weakeſt, it is evident, that if a mine is made under a rampart, ſo as to be within ſix feet of the ſurface, while all the ſides are thicker by far than that meaſurement, the exploſion will be directed towards that part which is thinneſt, and which from that circumſtance is called "the line of leaſt reſiſtance."

But, in order to direct the exploſion to that part, it will be neceſſary to conſider whether the ſoil be every where alike; for if the ſuperincumbent portion ſhould be part of a large ſtratified rock, while the ſides are of a looſe, inadheſive ſubſtance, the latter, though meaſuring more in diameter, will give the line of leaſt reſiſtance, which, in ſuch caſe, would follow the intenacity, and create a falſe exploſion. Hence exploſions may be lateral as well as vertical.

It was formerly ſuppoſed, that the diameter of the entonnoir, or exploſion, was equal to double the line of leaſt reſiſtance; but we find that *ſix times* that line may be exploded, by allowing a load of 300lbs. of gun-powder, duly concentrated, and fired in the middle of the maſs, for every foot of the line of leaſt reſiſtance. We are not to infer from this, that 300lbs. will be requiſite to lift one foot of ſoil; far from it; for as a cubic foot of excavation will contain only 75lbs. of powder, the above quantity (300lbs.) would require a ſpace of exactly four cubic feet; the proportion would therefore be prepoſterous. But when we calculate upon large maſſes of ſoil, ſuch as thoſe prodigious cones thrown out from entonnoirs of great extent, we then find, that, to produce the completeſt exploſion, an immenſe quantity of powder muſt be ſupplied.

It is ſelf evident, that the power of the powder, according to the above ſcale, is only computed to that extent which may be neceſſary towards the ordinary purpoſes of military devaſtation; for if we were to contribute, *ad infinitum*, 300lbs. of gunpowder for every foot in the line of leaſt reſiſtance, we ſhould be accumulating power only in arithmetical proportion, while the reſiſtance would be increaſing in a geometric ratio: of courſe the power muſt be in a regular ſtate of comparative diminution, in proportion as the line of leaſt reſiſtance is increaſed; and this muſt, after a while, occaſion the powder to be inert; or, if there ſhould be any exploſion, it could only follow the track of the train; its ignition to be ſure might be felt partially, like that of a ſlight earthquake, but no ſuperficial effects would be obſervable.

It has been already ſtated, that the powder muſt be lodged in bulk; and that it ſhould be ignited at the centre. This may, perhaps, appear ſuperfluous; but all military men know, that much powder is blown out of the muzzles of pieces without ever being ignited; and we have a moſt remarkable fact, a very recent one indeed, which ſhews that, unleſs in bulk, powder is not always ſure to be fired *in toto*. The incident alluded to is as follows.

In the month of March of this year, (1809,) a barge was proceeding along the new cut, from Paddington, laden with caſks of ſpirits and barrels of gunpowder. One of the crew, it is ſuppoſed, allured by the former, bored a hole for the purpoſe of drawing off a little wherewith to tipple. Unhappily the action of the gimblet ſet fire to the contents of that barrel, which the diſhoneſt navigator had miſtaken for one of ſpirits. The barrel exploded; and drove eleven other barrels, filled with gunpowder alſo, to the diſtance of near a hundred and fifty yards. It is curious, that although the whole of the powder-barrels were together, indeed in contact, only that in queſtion exploded.

Vauban gives us the following ſcale for exploding ſoils of various deſcriptions. He calculates, or perhaps found from experience, that for a cubic fathom (ſix feet) of ſoil, meaſuring in all 216 ſolid feet, the following proportions of gunpowder were needful.

1. Light earth, mixed with ſand,	11lb.
2. Common earth	12
3. Strong ſand	15
4. Clay, or fat earth,	16
5. Old, and good maſonry	18
6. Rock	20

In following this calculation, we are to conſider the entonnoir to be in diameter equal to only double the line of leaſt reſiſtance; and not according to a maximum exploſion.

Exploſion, from the Latin *explodo*, is the act of driving out ſomething with noiſe and violence. The cauſes, the report or noiſe, and the other effects of exploſions, however inſignificant they may appear at firſt ſight, are nevertheleſs, when duly conſidered, of great conſequence to the human ſpecies, and as ſuch they have been carefully inquired into by divers philoſophers. A variety of experiments have been inſtituted for determining the particulars that relate to them, and numerous conjectures have been offered in explanation of theſe concomitant circumſtances, which have not as yet been thoroughly inveſtigated.

Exploſions may be diſtinguiſhed into natural and artificial. The principal natural exploſions are thoſe of the atmoſpherical thunder, of volcanoes, of earthquakes, and to theſe there may be added the inferior exploſions ariſing from hard froſts. The artificial exploſions are ſuch as are produced by the force of fired gunpowder in the various engines in which it is uſed, the exploſions produced by other chemical compounds, and the pneumatic exploſions; meaning thoſe which are produced by the air ruſhing into a partial vacuum, by the diſcharge of air-guns and the like.

Of all theſe kinds of exploſions we ſhall now briefly treat, not in the order in which they have been enumerated, as this would prove a uſeleſs formality; but in a manner which may be more likely to elucidate the moſt intereſting part of the ſubject; and this undoubtedly is the ſtupendous force with which effects, in great variety, are produced in certain exploſions.

The firſt thing that ſtrikes the obſerver is the ſudden and violent noiſe of an exploſion. It is hardly neceſſary to obſerve that this noiſe or report is owing to the intermediation of the air between our ears and the cauſe, whatever that may be, of the percuſſion which is given to the air. Without that intermediation, or without air, the report could not be heard. But it muſt be farther obſerved, that the mere introduction of ſomething into the ambient air is not the principal cauſe of the report. That effect principally depends upon the ſudden replacing or collapſing of the air, after its having been removed or rarefied in any particular place. So that in order to account for the immediate cauſe of the noiſe in an exploſion, we muſt look out for ſomething which after having been introduced into the atmoſphere, whether ſlowly or quickly, is afterwards *ſuddenly* withdrawn or contracted. A few examples will eaſily illuſtrate this obſervation.

Take a common ſyringe, ſtop the aperture of it, then draw the piſton entirely out of its other extremity, and at that moment a report is heard, which is occaſioned by the replacing of the air within the ſyringe; for in drawing the piſton out of it, the air within the cavity of the ſyringe is rarefied, *viz.* a partial vacuum is formed, but as ſoon as the piſton is quite out, the air of the atmoſphere ſuddenly ruſhes in to ſupply that deficiency, and produces the noiſe or the report.

There is an experiment commonly ſhewn with the air-pump, and a glaſs veſſel open at both ends. To one of the apertures of the glaſs veſſel a wet piece of bladder is tied, and is ſuffered to become dry. The other aperture of the glaſs veſſel is then placed upon the plate of the air-pump. This done, the air is extracted by working the pump, by which means the glaſs veſſel covered over with the bladder is partially exhauſted, and of courſe the preſſure of the atmoſphere is in great meaſure removed from the under ſurface of the piece of bladder. The atmoſphere, then preſſing on the upper part of the bladder, and not being counteracted from below, diſtends the bladder towards the cavity of the veſſel, and at laſt breaks it with a conſiderable exploſion. The reaſon of which noiſe is the ſudden ruſhing in of the air.

An air-gun, when diſcharged, produces a trifling noiſe, the reaſon of which is, that after the expulſion of the condenſed air from the inſide of the inſtrument, which is impelled againſt the ambient air, there is no collapſion of the latter; for the condenſed air, on coming out of its confinement, expands itſelf to the tenſion of the ambient air, and remains in that ſtate; *viz.* without any ſubſequent contraction.

There are little glaſs balls, containing a ſmall quantity of water, which are made and ſold for diverting experiments, under the name of *glaſs granades.* A ball of this kind is nothing more than a diminutive glaſs bottle partially filled with water, and having a longiſh neck or tail, hermetically ſealed. One of theſe little bottles is ſtuck with its tail into the tallow or wax of a burning candle, and ſo that the little ball may be in the flame of the candle. In this ſituation the heat of the flame converts part of the fluid within the ball into vapour, and when the elaſticity of this vapour is ſufficient to overcome the reſiſtance of the glaſs the ball breaks, and produces a ſmart exploſion. The reaſon of which is, that the condenſed vapour, on coming out of the glaſs, diſplaces a conſiderable quantity of air, but being inſtantly cooled, it contracts, and the air collapſes.

A muſket loaded with gunpowder, on being fired off, produces a ſtrong exploſion. Now the difference between the diſcharge of ſuch a muſket and that of an air-gun is, that though in both an elaſtic fluid is diſcharged; yet in the muſket the elaſtic fluid contracts immediately after its coming into contact with the external air: but with the air-gun, the elaſtic fluid which iſſues out of it does not contract after its expulſion; hence the report is incomparably louder with the former than with the latter.

An electric ſpark, eſpecially in the diſcharge of a Leyden phial or battery, is accompanied with a ſmart report, in conſequence of its ſuddenly diſplacing the air from the ſpot in which it explodes; and of the ſubſequent collapſing of the air. And that the electric ſpark really diſplaces the air, is eaſily ſhewn by means of an electrical inſtrument, called "Kinnerſley's electrical air thermometer." In this inſtrument the ſpark is taken into a cloſe glaſs veſſel, which by an annexed narrow tube, partially filled with a liquor, indicates the rarefaction or diſplacing of the air within the veſſel. With this apparatus, whenever a ſpark or diſcharge of an electric jar is taken within the cloſe veſſel, the riſing and falling of the liquor within the annexed tube ſhews that the air is ſuddenly diſplaced, and is likewiſe heated in ſome degree; for the liquor riſes ſuddenly to a certain degree; and as ſuddenly deſcends, not quite to its former ſtation, but to a place a little above it, from which afterwards it deſcends gently to its original ſtation.

From theſe facts, and from a vaſt many more which might here be deſcribed, it clearly appears that the ſudden introduction of ſomething into the ambient air produces little noiſe; but that the noiſe of an exploſion is moſtly due to the collapſing of the air, which takes place in conſequence of the inſtantaneous contraction of that which has been introduced in it. The noiſe, *ceteris paribus*, is more or leſs loud in proportion as a greater or leſſer quantity of air is diſplaced and replaced, and likewiſe in proportion to the quickneſs of that operation.

When more reports than one are heard; theſe are produced either by an equal number of exploſions, or by a reverberation, *viz.* by an echo.

The air thus agitated conveys the ſound of an exploſion, or propagates its own vibrations, to immenſe diſtances. The firing of heavy ordnance has been ſometimes heard at the diſtance of 50 or 60, and even more miles. The exploſions of volcanoes, or thoſe which accompany earthquakes, have often been perceived at diſtances much more conſiderable; but with reſpect to the extent of this kind of communication, rate of moving, &c. the reader is referred to the article SOUND, *propagation of*, and HEARING. We ſhall, however, in this place, briefly mention an effect of this kind of violent aerial vibration: which it might be wiſhed that ſuch perſons as are opportunely ſituated, would examine with particular attention. The phenomenon is, that the exploſion of cannons, and eſpecially of powder magazines, or powder mills, renders the air conſiderably electrified, and that it electrifies the glaſſes of windows.

After the noiſe, or the report, the next ſtep is to inquire into the cauſe or cauſes which produce it: *viz.* into the nature of the elaſtic fluid which, in coming out of any confinement, diſplaces the circumambient air, and then ſuddenly gives way to it. Until very lately the immediate cauſe of moſt exploſions was principally attributed to the generation or extrication of permanently elaſtic fluids, *viz.* gaſes; and this is undoubtedly true in a great many caſes; but upon a cloſer examination of the concomitant particulars, the expulſion of theſe elaſtic fluids, even in a ſtate of incandeſcence, was found inadequate to the effects that were experienced in a variety of caſes; hence philoſophers began to look out for ſome other agent more active; and though the force of ſteam was known to be concerned in ſome kinds of exploſions; yet it muſt be acknowledged, that we are indebted to count Rumford for a maſterly examination of this particular point; for which purpoſe he inſtituted a long and laborious ſeries of well contrived experiments. His account at large under the title of "Experiments to determine the Force of fired Gunpowder," is contained in the Phil. Tranſ. for the year 1797, and from that account we ſhall extract ſuch particulars as may ſeem ſufficiently to illuſtrate this important part of the ſubject of exploſions. We call it important, becauſe it is the particular from which the cauſes of natural exploſions, ſuch as of volcanoes, earthquakes, &c. may be obviouſly manifeſted.

Count Rumford juſtly ſays, "The exploſion of gunpowder is certainly one of the moſt ſurpriſing phenomena we are acquainted with, and I am perſuaded it would much oftener have been the ſubject of the inveſtigations of ſpeculative philoſophers, as well as of profeſſional men, in this age of inquiry, were it not for the danger attending the experiments; but the force of gunpowder is ſo great, and its effects ſo ſudden and ſo terrible, that, notwithſtanding all the precautions poſſible, there is ever a conſiderable degree of danger attending the management of it."

Several able philoſophers had, at different times, endeavoured to determine the force of it. "But," count Rumford ſays, "the great deſideratum, the real meaſure of the initial expanſive force of inflamed gunpowder, ſo far from being known, has hitherto been rather gueſſed at than determined; and no argument can be more convincing to ſhew our total ignorance upon that ſubject, than the difference in the opinions of the greateſt mathematicians of the age, who have undertaken its inveſtigation."

The ingenious Mr. Robins thought, that the force of the elaſtic fluid, which is generated in the combuſtion of gunpowder, is 1000 times greater than the mean preſſure of the atmoſphere. Mr. D. Bernoulli reckoned it equal to 10,000 times that preſſure.

Count Rumford, in one of his firſt experiments, confined gunpowder in a ſtrong iron tube, and fired it by heating part of the tube, or rather of an appendage that had been fixed to it. This was done with a view of confining the elaſtic fluid, that was generated in the combuſtion. "The reſult," he ſays, "of this experiment fully anſwered my expectations. The generated elaſtic fluid was ſo completely confined, that no part of it could make its eſcape. The report of the exploſion was ſo very feeble, as hardly to be audible: indeed it did not by any means deſerve the name of a report, and certainly could not have been heard at the diſtance of twenty paces; it reſembled the noiſe which is occaſioned by the breaking of a very ſmall glaſs tube."

And farther on, he ſays, "It has generally been believed, after Mr. Robins, that the force of fired gunpowder conſiſts in the action of a permanently elaſtic fluid, ſimilar in many reſpects to common atmoſpheric air: which being generated from the powder in combuſtion, in great abundance, and being, moreover, in a very compreſſed ſtate, and its elaſticity being much augmented by the heat, (which is likewiſe generated in the combuſtion,) it eſcapes with great violence, by every avenue; and produces that loud report, and all thoſe terrible effects which attend the exploſion of gunpowder.

"But though this theory is very plauſible, and ſeems upon a curſory view of the ſubject to account in a ſatisfactory manner for all the phenomena, yet a more careful examination will ſhew it to be defective. There is no doubt but the permanently elaſtic fluid generated in the combuſtion of gunpowder, *aſſiſts* in producing thoſe effects which reſult from its exploſion; but it will be found, I believe, upon aſcertaining the real expanſive force of fired gunpowder, that this cauſe, alone, is quite inadequate to the effects actually produced: and that, therefore, the agency of ſome other power muſt neceſſarily be called in to its aſſiſtance."

This author then proceeds to deſcribe a variety of experiments and calculations which prove, beyond a doubt, that the above-mentioned theory is inſufficient to account for the effects which are produced by the inflammation of gunpowder; for he computes, in the ampleſt manner poſſible, the force of the gas which is generated even in the heat of red-hot iron, by which elevation of temperature air is known to be expanded not much above four times its ordinary bulk. He endeavoured to meaſure the force in queſtion by the lifting up of a very great weight, and his ingenious experiments were attended with reſults ſufficiently ſatisfactory; but we muſt refer the reader to the above-mentioned paper itſelf for the detail of theſe intereſting particulars; and we muſt here only add an abridgment of the latter part of the account, which more immediately relates to the principal object of our preſent enquiry.

"I will finiſh," the Count ſays, "this paper by a computation, which will ſhew that the force of the elaſtic fluid generated in the combuſtion of gunpowder, enormous as it is, may be ſatisfactorily accounted for upon the ſuppoſition that its force depends *ſolely* on the elaſticity of watery vapour or ſteam.

"It has been ſhewn by a variety of experiments made in England, and in other countries, that the elaſticity of ſteam is redoubled by every addition of temperature equal to 30 degrees of Fahrenheit's thermometer.

"Suppoſing now a cavity of any dimenſions (equal in capacity to one cubic inch for inſtance) to be filled with gunpowder, and that on the combuſtion of the powder, and in conſequence of it, this ſpace is filled with ſteam (and I ſhall preſently ſhew that the water exiſting in the powder *as water* is abundantly ſufficient for generating this ſteam); if we know the heat communicated to this ſteam in the combuſtion of powder, we can compute the elaſticity it acquires by being ſo heated.

"Now it is certain that the heat generated in the combuſtion of gunpowder cannot poſſibly be leſs than that of red-hot iron. It is probably much greater, but we will ſuppoſe it to be only equal to 1000 degrees of Fahrenheit's ſcale, or ſomething leſs than iron viſibly red-hot in day light."

"As the elaſtic force of ſteam is juſt equal to the mean preſſure of the atmoſphere, when its temperature is equal to that of boiling water, or 212° of Fahrenheit's thermometer, and as its elaſticity is doubled by every addition of temperature equal to 30 degrees of the ſame ſcale, with the heat of $212° + 30° = 242°$ its elaſticity will be equal to the preſſure of two atmoſpheres; at the temperature of $242° + 30° = 272°$ it will be equal to four atmoſpheres, &c.

"Following up our computations on the principles aſſumed, (and they are founded on the moſt incontrovertible experiments,) we ſhall find that at $692° + 30° = 722°$, the elaſticity will be equal to the preſſure of 131,072 atmoſpheres, which is 130 times greater than the elaſtic force aſſigned by Mr. Robins to the fluid generated in the combuſtion of gunpowder; and about *one-ſixth* part greater than my experiments indicated it to be.

"But even here the heat is ſtill much below that which is moſt undoubtedly generated in the combuſtion of gunpowder. That the elaſticity of ſteam would actually be increaſed by heat in the ratio here aſſumed, can hardly be doubted; it has abſolutely been found to increaſe in this ratio in all the changes of temperature between the point of boiling water, (I may even ſay of freezing water,) and that of 280° of Fahrenheit's ſcale, and there does not appear to be any reaſon why the ſame law ſhould not hold in higher temperatures.

"A doubt might poſſibly ariſe with reſpect to the exiſtence of a ſufficient quantity of water in gunpowder, to fill the ſpace in which the powder is fired, with ſteam, at the moment of the exploſion, but this doubt may eaſily be removed.

"The beſt gunpowder, ſuch as was uſed in my experiments, is compoſed of 70 parts (in weight) of nitre, 18 parts of ſulphur, and 16 parts of charcoal; hence 100 parts of this powder contain $67\frac{3}{10}$ parts of nitre, $17\frac{3}{10}$ parts of ſulphur, and of charcoal $15\frac{4}{10}$ parts.

"Mr. Kirwan has ſhewn that in 100 parts of nitre there are ſeven parts of water of cryſtallization; conſequently in 100 parts of gunpowder, as it contains $67\frac{3}{10}$ parts of nitre, there muſt be $4\frac{711}{1000}$ parts of water.

"Now as one cubic inch of gunpowder, when the powder is well ſhaken together, weighs exactly as much as one cubic inch of water at the temperature of 55° F. namely 253,175 grains troy; a cubic inch of gunpowder in its drieſt ſtate muſt contain at leaſt $10\frac{927}{1000}$ grains of water;

for it is 100 to 4,711, as 253,175 to 10,927. But beſides the water of cryſtallization which exiſts in the nitre, there is always a conſiderable quantity of water in gunpowder, in that ſtate in which it makes bodies damp or moiſt. Charcoal expoſed to the air has been found to abſorb nearly $\frac{1}{8}$th of its weight of water, and by experiments I have made on gunpowder, by aſcertaining its loſs of weight on being much dried, and its acquiring this loſt weight again on being expoſed to the air, I have reaſon to think that the power of the charcoal, which enters into the compoſition of gunpowder, to abſorb water, remains unimpaired, and that it actually retains as much water in that ſtate as it would retain were it not mixed with the nitre and the ſulphur.

"As there are 15$\frac{4}{10}$ parts of charcoal in 100 parts of gunpowder, in one cubic inch of gunpowder, (= 253,175 grains troy,) there muſt be 38,989 grains of charcoal; and if we ſuppoſe $\frac{1}{8}$th of the apparent weight of this charcoal to be water, this will give 4,873 grains in weight for the water, which exiſts in the form of moiſture in one cubic inch of gunpowder.

"If now we compute the quantity of water which would be ſufficient, when reduced to ſteam under the mean preſſure of the atmoſphere, to fill a ſpace equal in capacity to one cubic inch, we ſhall find that either that contained in the nitre which enters into the compoſition of one cubic inch of gunpowder, as water of cryſtallization, or even that ſmall quantity which exiſts in the powder in the ſtate of moiſture, will be much more than ſufficient for that purpoſe.

"Though the denſity of ſteam has not been determined with that degree of preciſion that could be wiſhed, yet it is quite certain that it cannot be leſs than 2000 times rarer than water, when both are at the temperature of 212°. Some have ſuppoſed it to be more than 10,000 times rarer than water, and experiments have been made which ſeem to render this opinion not improbable; but we will take its denſity at the higheſt poſſible eſtimation, and ſuppoſe it to be only 2000 times rarer than water. As one cubic inch of water weighs 253,175 grains, the water contained in one cubic inch of ſteam at the temperature of 212° will be $\frac{1}{2000}$dth part of 253,175 grains, or 0.12659 of a grain.

"But we have ſeen that one cubic inch of gunpowder contains 10,927 grains of water of cryſtallization, and 4,873 grains in a ſtate of moiſture; conſequently the quantity of water of cryſtallization in gunpowder is 86 times greater, and the quantity which exiſts in it in a ſtate of moiſture, is 38 times greater than that which would be required to form a quantity of ſteam ſufficient to fill completely the ſpace occupied by the powder.

"Hence we may venture to conclude, that the quantity of water actually exiſting in gunpowder is much more than ſufficient to generate all the ſteam that would be neceſſary to account for the force diſplayed in the combuſtion of gunpowder, (ſuppoſing that force to depend ſolely on the action of ſteam,) even though no water ſhould be generated in the combuſtion of gunpowder. It is even very probable that there is more of it than is wanted, and that the force of gunpowder would be ſtill greater, could the quantity of water it contains be diminiſhed.

"From this computation it would appear that the difficulty is not to account for the force actually exerted by fired gunpowder, but to explain the reaſon why it does not exert a much greater force."

Beſides the common gunpowder, there are ſeveral other chemical compoſitions which are capable of exploding with greater or leſs violence; and the moſt remarkable of theſe compoſitions are, the gunpowder formed with the ſuperoxygenated muriate of ſoda, inſtead of nitre; that preparation of gold which, from its remarkable property, is called fulminating gold; the fulminating ſilver, Howard's mercurial powder, the common fulminating powder, which conſiſts of nitre, potaſh, and ſulphur, &c. The exploſions of almoſt every one of theſe chemical compoſitions is louder than the exploſion of an equal quantity of the common gunpowder; yet when confined in a barrel or other fit inſtrument, few of theſe compoſitions exert a force, or produce an effect equal to that of gunpowder. This, which at firſt ſight may appear to be an inexplicable paradox, will be eaſily underſtood by conſidering, that the ſmartneſs of the report depends in great meaſure on the quickneſs of the inflammation or exploſion; whereas the force of the exploſion is moſtly proportional to the quantity of elaſtic fluid, be it gas or vapour, which is generated, and that the abovementioned chemical mixtures explode quicker than common gunpowder, may be eaſily proved. Let, for inſtance, two trains of equal length be formed upon a ſtone pavement; *viz.* one with the common gunpowder, and another with Howard's mercurial powder, and let one extremity of each train come into mutual contact; ſo that by applying a red-hot iron to that point, both trains may be fired at the ſame time. It will be found that the train of mercurial powder goes off viſibly much quicker than that of gunpowder; for when the former is entirely conſumed, the fire of the latter will hardly have proceeded half way of the whole train.

The exploſion of the gunpowder made with the ſuperoxygenated muriate of ſoda, and Howard's mercurial powder, exert an immenſe force when fired in barrels or other like veſſels. Fulminating gold and fulminating ſilver explode very readily, eſpecially the latter, which, when once prepared, can no longer be touched; for it will explode, not only when heated a few degrees above the temperature of the atmoſphere, but even when touched with any ſolid body. Yet when either of theſe preparations is confined in a barrel or other like inſtrument, and is inflamed, the force which it exerts is by no means equal to that which one who has heard the noiſe of their exploſions would be led to expect. It is worthy of remark, that, upon the whole, no other compoſition hitherto diſcovered has been found preferable to the common gunpowder, for muſkets, cannons, and other inſtruments of the like nature. Moſt of theſe preparations are conſiderably more expenſive than the common gunpowder; ſome of them are not nearly ſo manageable as the gunpowder, for they will explode by the leaſt touch or grinding, even by the friction of the ſtopple into the neck of the veſſel that contains them; but the principal fault is that very property by which they might be expected to have a ſuperior power; namely, the quickneſs of their exploſion.

There is a certain time requiſite for the motion of the wadding and bullet from the lower part to the muzzle of a gun, and the gradual inflammation of the gunpowder, when uſed in proportionate quantity, ſeems to correſpond with that gradual movement of the bullet, wadding, &c. When the exploding compoſition goes off much quicker than the common gunpowder, that force which is exerted ſpherically all round, and quicker than the time during which the wadding, &c. can get along the cavity of the barrel, frequently breaks the barrel, and endangers the byſtanders. We cannot illuſtrate this effect better than by mentioning the common and well-known obſervation, that though an open door may be ſhut by a gentle application of a child's hand, yet if you point a gun, and fire a bullet at it, the latter will make a hole through it without ſhutting, or cloſing it in the leaſt.

Speaking of the force of exploſions, it may naturally be required that we ſhould treat of the force and effects of electrical exploſions. But as the nature of ſuch exploſions cannot be properly underſtood without other particulars relative to the ſubject of electricity, their force and effects will be found deſcribed under the articles which belong to that extenſive ſubject; ſuch as Electric *Sparks*, Leyden Phial, Fire *Balls*, Lightning, &c.

It is in a manner ſimilar to the effects of gunpowder, that water projected upon red-hot or fuſed metal, occaſions a moſt powerful, and moſt dangerous exploſion. In both caſes the water is inſtantly reduced into ſteam, at a high temperature, conſequently of very high elaſticity; hence the force which is exerted is often prodigiouſly great; and there are inſtances recorded of whole founderies having been inſtantly demoliſhed, in conſequence of ſome perſons having inadvertently ſpit upon the liquid metal. If a ſmall quantity of water be poured upon red-hot charcoal, or red-hot glaſs, a hiſſing noiſe is heard; the part which is touched by the water loſes its redneſs, and nothing elſe remarkable takes place, becauſe the above-mentioned ſubſtances are bad conductors of heat, and it is only that part which is touched by the water that communicates its heat to the water, and this is not ſufficient to convert the water ſuddenly into ſteam of very great elaſticity. But metallic bodies are the beſt conductors of heat, and fuſed copper is particularly ſo; hence, when a ſmall quantity of water happens to fall upon a large quantity of that metal, in a ſtate of fuſion, the heat from a great part of the metal ruſhes to the ſpot where the water is fallen, and inſtantly converts it into ſteam of high elaſticity.

The exploſion of a mixture of hydrogen and oxygen gaſes, or of hydrogen gas and common air, does likewiſe exert a conſiderable force, but not to be compared with that of gunpowder. Theſe gaſes, when inflamed, expand conſiderably, but inſtantly after, they contract into an exceedingly narrow compaſs, which occaſions the report; for, by the combuſtion, they are converted principally into water, the bulk of which is leſs than the ten or twenty thouſandth part of the original bulk of the gaſes.

The laſt kind of exploſion we ſhall take notice of, is produced not by the generation or contraction of an elaſtic fluid, but by a ſort of mechanical derangement. Thoſe lumps of glaſs with a long tail, or prolongation, which are well known by the name of Glaſs Tears, or Prince Rupert's Drops, are an inſtance of this kind. If one of theſe drops be held in the hand, and part of the tail is broke, a ſmart kind of exploſion is heard, and the whole is inſtantly converted into powder. In order to underſtand the cauſe of this phenomenon, it is in the firſt place neceſſary to conſider how theſe drops are formed. For this purpoſe the glaſs manufacturers take a quantity of the fuſed glaſs, (about half an ounce of it, and green bottle glaſs is the fitteſt for it,) and drop it in that ſtate of incandeſcence into cold water; the conſequence of which is, that the external part of the lump of glaſs is cooled and rendered ſolid long before the internal part of it. Then when the internal part is cooled, and of courſe contracts its dimenſions, the external part being already cooled and ſettled, cannot follow it, ſo that it remains in a ſtate of ſuſpenſion ſomewhat like an arch; hence, when part of the lump is broken, the key-ſtone, as it were, of the arch, is removed, and the whole aſſemblage of particles is deranged. See Glass *Tears*, for a more detailed explanation of theſe their properties.

Several other ſubſtances explode and are broken upon analogous principles. Such are glaſs veſſels made for different purpoſes, and eſpecially for electrical machines; alſo large caſt-metal veſſels ſometimes ſpontaneouſly explode and break in the act of cooling. Sir William Hamilton mentions certain volcanic bodies, which he calls *volcanic bombs*, that explode probably on the ſame principle. They were large pieces of lava, which burſt in pieces like bombs as they fell to the ground. Theſe were obſerved in the great eruption of mount Veſuvius, which took place in the year 1779. The cauſe of volcanic exploſions, as well as of thoſe which accompany or precede earthquakes, is moſtly attributed to the action of ſteam; but theſe kinds of exploſions will be found particularly examined under the articles Earthquake and Volcano.

The uſe to which certain exploſions are applied is ſo well known as not to require any particular deſcription. Every body knows the various uſes of ſhooting with gunpowder, eſpecially in military affairs. The blaſting or breaking of rocks, by means of the exploſion of gunpowder, is likewiſe well known. But theſe uſes, together with all the particulars that relate to them, are often mentioned in various other articles of this Cyclopædia; ſuch as Gunnery, Mining, Shooting, &c.

EXPOLITION, in *Rhetoric*, a figure whereby we explain the ſame thing in different phraſes and expreſſions, in order to ſhew it more fully.

Expolition was the favourite figure of Balzac.

EXPONAS Venditioni. See Venditioni.

EXPONENT, from *expono*, *I expreſs*, in *Arithmetic*. Exponent of a power denotes the number which expreſſes the degree of the power, or which ſhews how often a given power is to be divided by its root before it be brought down to unity.

Thus, the exponent or index of a ſquare number is 2; of a cube, 3; the ſquare being a power of the ſecond degree; the cube of a third, &c.

Exponents are commonly written above, and ſomewhat towards the right-hand of the number or quantity whoſe power they expreſs. Thus, 3^5, a^5, ſignify the fifth power of 3, and of a. See Power.

Exponent is alſo uſed in the ſame ſenſe with index or logarithm.

Thus a ſeries of numbers in arithmetical progreſſion being placed under another ſeries in geometrical progreſſion, are called the exponents, indices, or logarithms thereof. *E. gr.* in the two progreſſions,

Geom. 1, 2, 4, 8, 16, 32, 64, 128, 256, 512
Arith. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

0 is the exponent, index, or logarithm of the firſt term 1; 5 that of the ſixth, 32, &c.

Hence, unity is to the exponent of a power as the logarithm of the root to the logarithm of its power; conſequently, the logarithm of the power is had by multiplying the logarithm of the root by its exponent; and the logarithm of the root is had by dividing the logarithm of the power by its exponent.

Exponent *of a ratio*, is the quotient ariſing upon dividing the antecedent by the conſequent.

Thus, in the ratio 3 to 2 the exponent is $1\frac{1}{2}$, and the exponent of the ratio 2 to 3 is $\frac{2}{3}$. See Ratio.

Hence, 1. If the conſequent be unity, the antecedent is the exponent of the ratio. Thus, *e. gr.* the exponent of the

the ratio 4 to 1 is 4; and again, the exponent of a ratio is to unity as the antecedent to the conſequent.

2. Since in a rational ratio the exponent of a ratio is had by dividing a rational number by another rational, the exponent of a rational ratio is a rational number.

EXPONENTIAL Calculus, *Calculus exponentialis*, is a method of differencing exponential quantities, and of ſumming up the differences of exponentials. See Calculus.

Exponential *curve* is that which is defined by an exponential equation.

Exponential curves partake both of the nature of algebraic and tranſcendental ones; of the former, becauſe they conſiſt of a finite number of terms, though thoſe terms themſelves are indeterminate; and of the latter, becauſe they cannot be algebraically conſtructed, or repreſented by an algebraic equation. Thus $a y = x^2$ is the equation of an algebraic curve; $y = a^x$ is the equation of an exponential curve: this equation $y = a^x$ denotes that any ordinate y is to a conſtant ordinate aſſumed equal to 1, as a conſtant quantity a raiſed to a power whoſe exponent expreſſes the ratio of the abſciſs x to the line equal to 1 is to the line taken for unit or 1, raiſed to the ſame exponent. Let b repreſent the line = 1, and the equation $y = a^x$ (ſince $y : b :: a^{\frac{x}{b}} : b^{\frac{x}{b}}$), will become $\frac{y}{b} = \frac{a^{\frac{x}{b}}}{b^{\frac{x}{b}}}$. Note, $y = a^x$ is the equation of the logarithmic curve. See Logarithmic. See alſo Curve.

Exponential *equation*, is that wherein there is an exponential quantity. See Equation, &c.

Exponential *quantity*, is a power whoſe exponent is an indeterminate or variable quantity.

Exponential quantities are of ſeveral degrees and orders: when the exponent is a ſimple indeterminate quantity, it is called an exponential of the firſt or loweſt degree.

When the exponent itſelf is an exponential of the firſt degree, then the quantity is an exponential of the ſecond degree. Thus, z^y is an exponential of the firſt degree, becauſe the quantity y is a ſimple flowing quantity; but z^{y^x} is an exponential quantity of the ſecond degree; becauſe y^x is an exponential of the firſt degree; ſo alſo, $z^{y^{x^y}}$ is an exponential of the third degree, the exponent y^{x^y} being one of the ſecond; and univerſally, the exponential quantity of any degree has for its exponent, the exponential quantity of the degree next preceding it. See Bernouilli Oper. tom. i. p. 182, &c.

EXPORTATION, in *Commerce*, the act of ſending commodities out of one country into another.

Exportation is a part of foreign commerce (ſee Commerce), diſtinguiſhed by the appellation *active*, or *ſelling part*, in oppoſition to *importation*, which is called the *paſſive*, or *buying part*. It is obſerved, as a general maxim, that commerce, when active, muſt produce a flow of riches, the balance being received in money; whereas, if it be paſſive, treaſures will be exhauſted, as the balance of trade muſt continually be made good out of the remaining coin. Hence, plenty of money in any place implies, that the quantity of goods exported far exceeds that of goods imported; and wherever money is ſcarce, it may be concluded that greater quantities of goods have been imported than exported. See Exchange.

It has been a principal object of commercial policy in almoſt every country, to encourage exportation, with the exception of a few articles; that of manufactured goods has been promoted with a view of encouraging the internal induſtry of the country, and that of foreign produce, as a means of drawing wealth from other countries by the profits of the carrying trade. The exceſs of the value of goods exported beyond that of the imports has uſually been conſidered as a criterion of the profits which a country derives from foreign trade; but this is a fallacious mode of determining this important point, becauſe advantageous foreign trade might long exiſt, even if the imports conſtantly exceeded the value of the exports. The laws in force relating to exportation conſiſt principally of prohibitory or reſtrictive regulations concerning bullion, corn, wool, machinery, and tools uſed in various branches of the manufactures, the exportation of which, it is thought, might diminiſh the neceſſary ſupply of proviſions for the conſumption of the country, or enable foreigners to rival valuable branches of its manufactures. The acts relative to the exportation of wool, prohibit the exportation, not only of the commodity itſelf, but alſo of live ſheep, rams, or lambs, from Great Britain, Ireland, Jerſey, Guernſey, Alderney, Sark, or Man, on penalty of the forfeiture thereof, and of the ſhips conveying them; alſo 3*l.* for every ſheep, &c. and three months' ſolitary impriſonment of the offender; for a ſecond offence, 5*l.* for every ſheep, &c. and ſix months' impriſonment; except wether ſheep for ſhips' uſe, put on board by licence of the port-officer of the cuſtoms. A limited quantity of wool, however, is allowed to be exported from the port of Southampton to Jerſey, Guernſey, Alderney, and Sark.

The duties on exportation, payable in Great Britain and Ireland, were formerly the principal branch of the revenue derived from foreign trade; but they are now of ſmall amount compared with the duties payable on goods brought into the country.

The *official* value of all exports from Great Britain, for three years ending the 5th of January 1809, was as follows:

		Britiſh produce and manufactures.	Foreign merchandize.
Year ending 5th Jan.	1807	£. 27,402,685	£. 9,124,499
- - -	1808	25,171,422	9,395,149
- - -	1809	26,692,288	7,863,207

The *actual* value of Britiſh produce and manufactures exported from Great Britain, agreeably to the prices current, and to the declarations of the exporters, was, in the year ending the 5th of January 1809, £. 40,881,871.

The official value of imports into Great Britain from Europe, Africa, and America, during the ſame periods, is as follows:

Year ending 5th January	1807	£. 25,085,136
- - - -	1808	25,453,149
- - - -	1809	23,784,516

The official value of imports into Great Britain from Eaſt India and China is as follows:

Year ending 5th January	1807	£. 3,746,771
- - - -	1808	3,401,509
- - - -	1809	not aſcertained.

The real value of Iriſh produce and manufactures exported from Ireland in the year ending the 5th of January 1809, computed at the average prices current, was £. 12,577,517 10*s.* 11*d.*

10*s.* 11*d.* See Customs, and Duty. See alſo Commerce.

Dr. Smith, in his "Nature and Cauſes of the Wealth of Nations," ſtates and explains the principles upon which the exportation trade is founded. When the produce of any particular branch of induſtry exceeds what the demand of the country requires, the ſurplus muſt be ſent abroad, and exchanged for ſomething for which there is a demand at home. Without ſuch exportation, a part of the productive labour of the country muſt ceaſe, and the value of its annual produce diminiſh. The land and labour of Great Britain produce generally more corn, woollens, and hard ware, beſides ſome other manufactures, than the demand of the home market requires. The ſurplus part of them muſt, therefore, be ſent abroad, and exchanged in the manner already mentioned. It is only by means of ſuch exportation, that this ſurplus can acquire a value ſufficient to compenſate the labour and expence of producing it. The neighbourhood of the ſea-coaſt, and the banks of all navigable rivers, are advantageous ſituations for induſtry, only becauſe they facilitate the exportation and exchange of ſuch ſurplus produce for ſomething elſe, which is more in demand there.

When the foreign goods, which are thus purchaſed with the ſurplus produce of domeſtic induſtry, exceed the demand of the home market, the ſurplus part of them muſt be ſent abroad again, and exchanged for ſomething more in demand at home. When the capital ſtock of any country is increaſed to ſuch a degree that it cannot be wholly employed in ſupplying the conſumption, and ſupporting the productive labour of that particular country, the ſurplus part of it naturally diſgorges into the carrying trade, and is employed in performing the ſame office to other countries. The carrying trade is the natural effect, and ſymptom of great national wealth; but it does not ſeem, ſays Dr. Smith, to be the natural cauſe of it. Holland had formerly the greateſt ſhare of the carrying trade of Europe, and in proportion to the extent of its land, and the number of its inhabitants, it was the richeſt country in Europe. England, now the richeſt country of Europe, has appropriated to itſelf the greateſt ſhare of this trade. This ingenious writer ſuggeſts, that, whether the capital, which carries this ſurplus produce abroad, be a foreign or a domeſtic one, is of very little importance. If the ſociety has not acquired ſufficient capital both to cultivate all its lands, and to manufacture in the completeſt manner the whole of its rude produce, there is even a conſiderable advantage derived from the exporting of that rude produce by a foreign capital, in order that the whole ſtock of the ſociety may be employed to more uſeful purpoſes.

Dr. Smith farther obſerves, in reference to this ſubject, that with a view of multiplying gold and ſilver, in which, it has been commonly ſuppoſed, the wealth of a country conſiſts, it neceſſarily became the great object of political economy to diminiſh, as much as poſſible, the importation of foreign goods for home conſumption, and to increaſe, as much as poſſible, the exportation of the produce of domeſtic induſtry: and, therefore, its two great engines for enriching the country have been reſtraints upon importation, and encouragement to exportation. The former were of two kinds, *viz.* reſtraints upon the importation of ſuch foreign goods for home conſumption as could be produced at home, from whatever country they were imported; and reſtraints upon the importations of goods of almoſt all kinds, from thoſe particular countries, with which the balance of trade was ſuppoſed to be diſadvantageous. Theſe different reſtraints conſiſted ſometimes in high duties, and ſometimes in abſolute prohibitions. Exportation was encouraged ſometimes by drawbacks, ſometimes by bounties, ſometimes by advantageous treaties of commerce, and ſometimes by the eſtabliſhment of colonies in diſtant countries. Thus it has been intended to increaſe the quantity of gold and ſilver in any country by turning the balance of trade in its favour. Our author has particularly examined what are likely to be the effects of theſe reſtraints and encouragements upon the annual produce of the induſtry of a country. According as they tend either to increaſe or diminiſh the value of this annual produce, they muſt evidently tend either to increaſe or diminiſh the real wealth and revenue of the country. See Exchange, Monopoly, and *Balance of* Trade. Of the encouragements to exportation above enumerated, thoſe which are called *Drawbacks* (ſee the article) ſeem to Dr. Smith to be the moſt reaſonable. Concerning the grant of bounties; ſee Bounty.

EXPOSING, the act of ſetting a thing to public view.

In the Romiſh church, the ſacrament is ſaid to be expoſed when it is ſhewn in public, uncovered, on feſtival days, and during the time of plenary indulgences.

Exposing is alſo uſed with a farther latitude; thus, we ſay it is prohibited to expoſe falſe and clipped money.

Such a houſe ſtands very high, and has a delicious proſpect; but it is expoſed to all the four winds. Such a city being on the frontiers, and not fortified, is expoſed to the inſults of every party of forces.

Exposing *of Children*, a barbarous cuſtom practiſed by moſt of the ancients excepting the Thebans, who had an expreſs law to the contrary, whereby it was made capital to expoſe children, ordaining at the ſame time that ſuch as were not in a condition to educate them, ſhould bring them to the magiſtrates, in order to be brought up at the public expence. (Ælian Hiſt. Var. l. ii. c. 7.) Among the other Greeks, when a child was born, it was laid on the ground; and if the father deſigned to educate his child, he immediately took it up; but if he forebore to do this, the child was carried away, and expoſed. Pitiſc. Lex. Ant. in voc. Expoſitio.

The Lacedæmonians, indeed, had a different cuſtom; for with them all new-born children were brought before certain tryers, who were ſome of the graveſt men in their own tribe, by whom the infants were carefully viewed; and if they were found luſty and well-favoured, they gave orders for their education, and allotted a certain proportion of land for their maintenance: but if weakly, or deformed, they ordered them to be caſt into a deep cavern in the earth, near the mountain Taygetus, as thinking it neither for the good of the children themſelves, nor for the public intereſt, that defective children ſhould be brought up. Plutarch takes notice of this law of Lycurgus, and paſſes no cenſure upon it.

Many perſons expoſed their children only becauſe they were not in a condition to educate them, having no intention that they ſhould periſh. It was the unhappy fate of daughters eſpecially to be thus treated, as requiring more charges to educate and ſettle them in the world than ſons.

The parents frequently tied jewels and rings to the children they expoſed, or any other thing whereby they might afterwards diſcover them, if Providence took care of their ſafety. Another deſign, in adorning theſe infants, was either to encourage ſuch as found them to nouriſh and educate them, if alive; or to give them human burial, if dead.

The places where it was uſual to expoſe children were ſuch as people frequented moſt. This was done in order that they might be found, and taken up by compaſſionate perſons who were in circumſtances to be at the expence of their education. With this intention the Egyptians and

Romans choſe the banks of rivers, and the Greeks the highways.

Dionyſius Halicarn. (Antiq. Rom. l. ii.) informs us, that Romulus obliged the citizens to bring up all their male children, and the eldeſt of the females. They were allowed therefore to deſtroy all their female children but the eldeſt. And even with regard to their male children, if they were deformed or monſtrous, he permitted the parents to expoſe them, after having ſhewn them to five of their neareſt neighbours. In Cicero's third book of laws, (cap. 8.) there is a paſſage, from which it has been concluded, that the law of Romulus, with regard to the expoſing and deſtroying of male children that were remarkably deformed, was confirmed by a conſtitution of the twelve tables. It appears, from a paſſage in Terence, that this inhuman cuſtom of expoſing and deſtroying children, eſpecially females, was not uncommon even among parents of the beſt character. Sentiments of this kind were publiſhed with applauſe on the Roman theatre: and we learn from Seneca (de Ira, l. i. c. 15.) that ſo late as in his time, it was uſual among the Romans to deſtroy weak and deformed children. "Portentoſos fœtus extinguimus: liberos quoque, ſi debiles monſtroſique editi ſunt, mergimus."

This unnatural practice was preſcribed and approved even by the more eminent philoſophers. Plato (Republ. l. v.) recommends it to be ordered by law that men or women, who are paſt the age of having ſtrong children, ſhould take care that their offspring, if they ſhould have any, ſhould not come to the birth, or ſee the light; or if that ſhould happen, that they ſhould expoſe them without nouriſhment. Ariſtotle (Politic. l. vii. c. 16.) expreſsly ſays, that it ſhould be a law not to bring up or nouriſh any child that is weak or maimed; and that when the law of the country forbids to expoſe infants, it is neceſſary to limit the number of thoſe who ſhould be begotten; and if any one begets children above the number limited by the laws, he adviſes to procure abortion before the fœtus has life and ſenſe. The practice that has long prevailed among the Chineſe, and that ſubſiſts among them even to this day, is well known.

EXPOSITION, the act of expoſing. See Exposing.

Exposition is likewiſe applied to the interpretation or explication of an author, or paſſage therein. See Exegesis.

Exposition *of deeds*, in *Law*, ſhall be favourable, according to the apparent intent; and be reaſonable, and equal, &c. Co. Litt. 313.

Exposition, *expoſitio*, in *Rhetoric*, is ſometimes uſed for diviſion. See Division; and ſee alſo Exergasia.

Exposition, in *Gardening*. See Exposure.

EXPOSITOR, or Expository, a title which ſome writers have given to a leſſer kind of dictionaries or vocabularies, ſerving to expound or explain the meaning of the obſcure or difficult words of a language.

It is alſo uſed in the ſame ſenſe with commentary and paraphraſe.

EX POST FACTO, in *Law*, denotes ſomething done after another thing that was committed before. An eſtate granted may be made good by matter ex poſt facto, that was not ſo at firſt, by election, &c.

EXPOSTULATION, Expostulatio, in *Rhetoric*, a complaint addreſſed to a perſon from whom we have received ſome injury. It varies according to circumſtances.

EXPOSURE, or Exposition, in *Gardening*, the aſpect or ſituation of a garden wall, building, or the like, with reſpect to the ſun, wind, &c.

There are four regular kinds of expoſures, *viz*, eaſt, weſt, north, and ſouth; but it muſt be obſerved that among gardeners theſe terms ſignify juſt the contrary to what they do among geographers.

The gardeners, in effect, do not give the names eaſt, weſt, &c. to the places where the ſun is, but to thoſe whereon he ſhines; and they conſider the manner wherein he ſhines, whether as to the whole garden, or ſome of its ſides.

If they find, that the ſun at his riſing, and during the firſt half of the day, continues to ſhine on one ſide of a garden or wall, they call that an eaſtern expoſure, or eaſt wall, &c. and if the ſun begin to ſhine later, or end ſooner, it is not a proper eaſtern expoſure.

For the ſame reaſon, they call the weſt the ſide the ſun ſhines on the latter half of the day; *i. e.* from noon to night; and accordingly, the ſouth, or ſouthern expoſure, is the place whereon he ſhines from about nine o'clock in the morning till night; or which, in the general, he ſhines longeſt on in the whole day; and the part he ſhines leaſt on is the north, or ſouthern expoſure, at what hour ſoever it begin or end, being uſually from eleven o'clock to one.

The eaſtern and ſouthern expoſures are, by common conſent of all gardeners, the two principal, and have a conſiderable advantage above the reſt. A weſt expoſure is not much amiſs; at leaſt, it is better than a northern one, which is the worſt of all: each has its inconveniences.

The eaſtern, commencing differently at different ſeaſons of the year, and ending about noon, ſubjects the trees, &c. to the N.E. winds, which wither the leaves and new ſhoots, blow down the fruit, &c. beſide that it has little benefit of rains, which come moſtly from the weſt. Yet does the reverend Mr. Laurence judge the eaſt better than the weſt-wall for all kinds of fruit; not that it has more hours of ſun, or that there are any peculiar virtues in the eaſtern rays, but becauſe the early rays of the ſun do ſooner take off the cold chilly dews of the night.

M. Gentil recommends the eaſtern expoſure as beſt for all kinds of peaches; adding, that they ripen ſooneſt, grow bigger, are better coloured, and of a finer taſte, than in any other: but Mr. Carpenter reſtrains the rule to the early and middle ſorts; for the backward, he rather chooſes a ſouthern, or ſouth-eaſt expoſure, which is beſt for all late fruits, becauſe the influence of the ſun is ſtrongeſt, and continues longeſt.

The weſtern, accounted from half an hour paſt eleven till ſun-ſet, is backwarder than an eaſtern one by eight or ten days; but it has this advantage, that it receives little damage from the froſts, which melt before the ſun comes to ſhine upon the fruit, and fall off like dew, without doing any prejudice; ſo that it may bear apricots, peaches, pears, and plums; but it is incommoded with north weſt winds in the ſpring, as alſo with the autumnal winds, which blow down a great quantity of fruit.

According to Mr. Miller, the beſt aſpect or expoſure for walls in England is the point to the eaſtward of the ſouth; becauſe thoſe will enjoy the benefit of the morning ſun, and be leſs expoſed to the weſt and ſouth-weſt winds, which are very injurious to fruits in England, than thoſe walls which are erected due ſouth; the next beſt expoſure is due ſouth, and the next to that ſouth-eaſt, which is preferable to the ſouth-weſt. Other walls, however, may be planted with fruit-trees that ſuit their ſeveral expoſures.

The northern expoſure is the leaſt favourable of any in England, as having very little benefit from the ſun even in the height of ſummer, therefore can be but of little uſe, whatever may have been advanced to the contrary. For although many ſorts of fruit-trees will thrive and produce fruit in ſuch poſitions, yet ſuch fruit can be of little worth, ſince they are deprived of the kindly warmth of the ſun to correct their crude juices, and render them well taſted and wholeſome. It is therefore to little purpoſe to plant fruit-trees againſt ſuch walls, except it be for fruit intended for baking, &c. in which caſe the fire will ripen and render thoſe juices wholeſome which could not be performed while growing.

In ſuch ſituations, morelli cherries for preſerving may be planted, and white and red currants to come late, after thoſe which were more expoſed to the ſun are gone; and if the ſoil be warm and dry, ſome ſorts of ſummer pears will do tolerably well on ſuch an expoſure, and will continue longer in eating than if they were expoſed to the ſun. But winter pears ſhould by no means be planted in ſuch an aſpect, as has been practiſed by many ignorant perſons, if we find that the beſt ſouth walls in ſome bad years are barely warm enough to ripen them. Duke cherries planted againſt walls expoſed to the north will ripen much later in the ſeaſon; and if the ſoil be warm, will be well flavoured, and continue a month later than others. Miller.

The ſouthern expoſure, accounted from about nine till four, is recommended for peaches, pears, grapes, and plums.

EXPRESS, ſomething that is preciſe in formal terms, or for ſome particular deſign. I told him as much in expreſs terms; he gave me a commiſſion expreſs; he had expreſs orders; a courier was diſpatched expreſs.

We alſo ſay, ſomewhat abuſively, to ſend an expreſs, meaning a courier.

Express *Condition*, *Contract*, *Malice*, and *Warranty*. See the ſubſtantives.

EXPRESSED Oils, are ſuch as are procured from bodies only by preſſing; as the oils of olives, almonds, and the like. See Oil.

Expressed *ſpecies*. See Species.

EXPRESSION, in *Algebra*, denotes the value of a quantity expreſſed or repreſented under an algebraic form: thus, if $x = \sqrt{a^2 + b^2}$, and *a* and *b* are known, the value of *x* is known. See Equation.

Expression, in *Chemiſtry*, *Pharmacy*, &c. the act of expreſſing out, or extracting the juices of oils or plants, fruits, or other matters, by ſqueezing, wringing, or preſſing them in a preſs. This is one of the three modes of obtaining them; the other two being *infuſion* and *decoction*, which ſee. The hard fruits ſhould be well bruiſed, and herbs moderately bruiſed, before expreſſion. They are then to be incloſed in a hair or other bag, and preſſed between wooden plates in the common ſcrew preſs, till the juice ceaſes to run. The expreſſion of oils is performed nearly in the ſame manner as that of juices, by means of iron plates, or the apparatus of an oil-mill, adapted to this purpoſe. The inſipid oils of all unctuous ſeeds are obtained uninjured by this operation, if performed without the aid of heat, which, though it may promote the extraction of the oil, gives it an ungrateful flavour. The oils expreſſed from aromatic ſubſtances generally carry with them a portion of their eſſential oil.

Expression, in *Muſic*, is a quality by which a muſician manifeſts his feeling, and executes with energy all the ideas with which he ought to impreſs the hearer, and all the ſentiments which the compoſer intended to expreſs. There is an expreſſion in compoſition as well as in its execution, and it is by their concurrence that the moſt pleaſing and agreeable effect reſults.

To give an expreſſion to his works, a compoſer ought to ſeize and compare all the relations which can be found between the features of his object, and the productions of his art; in a muſical drama, he ought to know and feel the peculiar caſt of all the characters, in order ſeverally to exhibit them exactly as delineated by the poet; for as a good painter does not throw the ſame light on every figure, neither will the able muſician give the ſame energy to all the ſentiments, nor the ſame force to every figure, but will put each part in its true place, leſs to give it weight, individually, than to contribute to the effect of the whole.

After having well conſidered what a character has to ſay, he meditates how he ſhall ſay it; and here begins the application of the precepts of his art, which is to find the particular language in which the actor would wiſh to make himſelf underſtood.

Melody, harmony, movement, choice of inſtruments and voices, are the elements of the muſical language; and melody, by its immediate connection with the grammatical and oratorical accent, is that which gives a character to all the reſt. So that it is conſtantly from melody that the principal expreſſion ſhould be derived, as well in inſtrumental as vocal muſic.

What a compoſer therefore has to expreſs by melody is tone of voice, with which the ſentiments can beſt be rendered; and care ſhould be taken not to mimic that of theatrical declamation, which is in itſelf only an imitation, but the voice of nature ſpeaking without affectation and without art.

The compoſer will therefore at firſt ſeek a kind of melody which ſhall furniſh muſical inflections the moſt conſonant to the ſenſe of the words, always lowering their expreſſion to the thought, and the thought to the interlocutor's ſtate of mind; for when we are ſtrongly affected, all that we ſay in a manner ſavours of the general ſentiments which govern us; and we never chide what we love in the ſame tones as we ſhould an indifferent perſon. Our ſpeech is differently accented according to the different paſſions by which we are agitated; ſometimes acute and vehement, ſometimes languid and monotonous, ſometimes varied and imperious, ſometimes ſmooth and tranquil in its inflections. Thence the muſician regulates the choice of keys which he uſes in his melody, and the different places in which he employs voice, keeping it down with ſmall intervals to expreſs the languor of ſorrow and dejection; and ſtraining it with acute ſounds in paſſion and grief; driving it rapidly through all the intervals of the diapaſon in the agitation of deſpair, or the turbulence of diſtracted paſſions. Above all it muſt be remembered, that the charms of muſic conſiſt not only in imitation, but in an agreeable imitation; and that the declamation (or recitative) itſelf to have its full effect, ſhould be ſubordinate to melody; ſo that there is no painting ſentiment without giving it this ſecret charm inſeparable from it, nor touch the heart without pleaſing the ear. And this is ſtill very conformable to nature, which gives to the tone of voice of perſons of ſenſibility, certain touching and delicious inflections, which thoſe who feel nothing never poſſeſſed. Never, therefore, miſtake rough and coarſe for expreſſive, nor harſhneſs for energy. Give not a hideous picture of the paſſion which you wiſh to paint, nor imitate the performers at the French opera, where the voice of paſſion reſembles a complaint of the colic, more than tranſports of love.

The natural pleaſure which reſults from harmony, augments in its turn the moral pleaſure of imitation, in uniting the agreeable ſenſations of chords to the expreſſion of the melody, upon the ſame principle as that juſt mentioned. But harmony does ſtill more; it enforces even the expreſſion in giving more truth and preciſion to melodious intervals; it animates their character, and exactly marks their place in the order of the modulation; it calls back the preceding, announces that which ought to follow, and thus connects the phraſes in the melody, as ideas are linked together by grammar in a diſcourſe. Harmony, regarded in this light, furniſhes the compoſer with powerful means of expreſſion, which eſcape him when he ſeeks expreſſion in harmony alone; for then, inſtead of animating the accent, he extinguiſhes it by his chords, and all the intervals, confounded in a continued crowd of combined ſounds, offer to the ear only a ſeries of fundamental chords, which have nothing touching or agreeable in their effect, and often not only ſuffocates the melody, but the ſenſe of the words. What then muſt the harmoniſt do to fortify the expreſſion of the melody, and give it more effect? He will carefully avoid covering the principal ſound in the combination of chords; he will render all the notes of the accompaniment ſubordinate to the vocal part; he will give relief and energy to it by the concurrence of other parts; he will enforce the effect of certain paſſages, by the chord of the ſharp 7th; he will diſguiſe others by ſuppoſition or ſuſpenſion, in making no proviſion for them in the baſe; he will gain ſtrong expreſſions by major diſcords, he will reſerve the minor, for tender ſentiments; ſometimes he will unite all his parts by ſmooth and flowing notes; ſometimes he will contraſt them with the melody by pointed notes; ſometimes he will fill the ear with full harmony, and ſometimes enforce the accent by the choice of a ſingle interval. He will render preſent and ſenſible the chain of modulation throughout, and will make the baſe and its harmony ſerve to determine the place of each paſſage in the key, in order that no interval or trait of melody ſhall be heard, without feeling at the ſame time its relation with the whole.

With reſpect to rhythm, formerly ſo powerful as to give force, variety, and ornament to poetical harmony; if modern languages leſs accentuated and leſs proſodic have loſt this charm, our muſic can ſubſtitute another more independent of ſpeech in the preciſion of meaſure, and in the combination of its proportions, whether moving together or ſeparately in each part.

Quantity in language is almoſt wholly loſt in notes of muſic; and the muſic, inſtead of ſpeaking with words, borrows, in ſome ſort, from the meaſure a language apart.

The force of the expreſſion conſiſts in this particular, in the uniting theſe two languages as much as poſſible together, in ſuch ſort, that if the meaſure and the rhythm ſpeak not in the ſame manner, they will at leaſt ſay the ſame things.

Chearfulneſs, which gives vivacity to all our movements, ought to do the ſame in muſical meaſures. Melancholy locks up the heart, relaxes all our motions, and the ſame languor is felt in the melodies which it dictates; but when grief is poignant, or great conflicts are paſſing in the mind, ſpeech is unequal; it moves alternately with the ſlowneſs of the ſpondee and the rapidity of the Pyrrhic, and ſometimes ſuddenly ſtops ſhort, as in accompanied recitative; it is on this account, that the moſt expreſſive muſic, or at leaſt the moſt paſſionate, is commonly that in which the times or portions of each bar, though equal in themſelves, are the moſt unequally divided; whereas the image of ſleep, of repoſe, of peace of mind, require ſmall exertion of voice, and are naturally painted with notes of equal length, which move neither quick nor ſlow.

There is one obſervation which the compoſer ought not to neglect, and which is, that the more ſtudied and extraneous is the harmony, the ſlower ſhould be the movement, in order that the mind may have leiſure to diſentangle the diſcords, and follow the rapid chain of modulation. Nothing but the laſt degree of fury can permit the union of rapid meaſures and harſh chords. When the head is diſtracted, and the actor, by violent agitation, ſeems not to know what he ſays, this energetic and terrible confuſion may be communicated to the mind of the ſpectator, and, in like manner, make him loſe his reaſon. But if the compoſer is not inflamed and ſublime, he will only be coarſe and cold; if he does not throw the audience into a delirium, he runs a great riſk of a failure: for he who loſes his reaſon is only mad in the eyes of thoſe who preſerve it, and inſanity is no longer intereſting.

Though the greateſt force of expreſſion is derived from the combination of ſounds, the quality of their tone is not indifferent in the effect. There are voices ſo ſtrong and ſonorous as to impoſe by their force; others thin, flexible, and fit for execution; others again ſo touching and delicate as to penetrate the heart by ſoothing and pathetic ſtrains. In general, treble voices and acute are fitteſt to expreſs tenderneſs and affection; baſes and baritones for intemperate paſſion and choler; but the Italians have baniſhed baſes from their ſerious operas, as a part, of which the melody is too rude and boiſterous for the heroic ſtyle, and have ſubſtituted in their ſtead tenors, of which the melody has the ſame character, with a more agreeable effect. They employ baſe voices in the groteſque and ridiculous parts of their comic operas with more propriety.

Inſtruments have alſo their peculiar expreſſions, proportioned to their quality of tone, force, and compaſs. The flute is tender, the hautbois cheerful, the trumpet military, the horn ſonorous, majeſtic, and proper for grand expreſſions. But there is no inſtrument of more varied expreſſion, and more univerſally uſeful, than the violin. This admirable inſtrument is the foundation of every orcheſtra, and can furniſh a great compoſer with all the effects which mean muſicians vainly ſeek in a multitude of different inſtruments. The compoſer ought to be acquainted with the finger-board of the violin, to conſider the ſhifts, and know how to write arpeggios, by diſtinguiſhing the open from the ſtopped ſtrings, and to chooſe and make uſe of keys according to the different characters they have upon that inſtrument.

It is in vain for the compoſer to attempt to animate his orcheſtra, if the ardour which ought to reign in it does not inflame the performers. The ſinger who only ſees notes in his part, is not qualified to ſeize the expreſſion of the compoſer, nor to give one of his own to what he ſings, if he has not well comprehended the ſenſe. He muſt underſtand what he reads before he can make it comprehended by others; and it is not enough to be poſſeſſed of general ſenſibility, if not particularly energetic in the language we ſpeak. Let him begin therefore by thoroughly underſtanding the character of the melody which he has to execute, its expreſſion of the words, the diſtinction of its phraſes, the accent which it has in itſelf, that which it requires in the voice of the ſinger, the energy which the compoſer has given to the poet, and that which in his turn he can give to the compoſer. Let him reſign his whole powers, then, to all the enthuſiaſm which theſe conſiderations ſhall have inſpired; he ſhould expreſs every thing as completely as if he were at once the poet, compoſer, actor, and ſinger, and he will then have all the animation which it is poſſible for him to give to the work which he has to execute.

In this manner he will naturally embelliſh with taſte and delicacy airs that are only elegant and graceful; with ſpirit and fire, ſuch as are animated and gay; with ſighs, the tender and pathetic; and with all the agitation of forte and piano, ſuch as are expreſſive of rage and fury. Whenever the muſical and oratorical accents are united (as in arie parlanti), wherever the time ſhall be ſtrongly marked, and ſerve as a guide to the accents of the melody; wherever the accompaniment and the voice ſhall ſo agree in their effects as to form only one melody, and the hearer, deceived, wholly attributes to the voice the paſſages which the orcheſtra embelliſhes ; and, finally, wherever ſober ornaments, judiciouſly applied, manifeſt the abilities and facility of the ſinger, without diſguiſing and injuring the melody, the expreſſion will be ſweet, agreeable, and animated ; the ear will be delighted, and the heart affected ; nature and art will at once concur in pleaſing the hearer, and there will reign ſuch a coincidence between the words and the muſic, that the whole will ſeem to proceed from one delicious language, which can ſay every thing, and always pleaſe.

This is more a diſſertation than an article of a dictionary, but theſe are the ſentiments of the citizen of Geneva, to moſt of which in muſic we readily ſubſcribe, as he is ever more reaſonable and conſiſtent in ſpeaking of that art than on any other ſubject. His views concerning dramatic muſic are always ſo ingenious, elevated, and refined, that we cannot reſiſt tranſlating him. Though we fear that the French, with all their preſent rage for Italian muſic and Italian expreſſion, will not adopt them ; and the Italians themſelves, in their moſt happy moments of conception, have been ſucceſsful from inſtinct and enthuſiaſm, more than precepts or reflection.

Expression, in *Oratory*, denotes the manner of delivering or conveying one man's ideas to another. Accordingly it denotes that felicity of diſcriminative energy in the reader, ſpeaker, or reciter, by which the characteriſtic beauties or peculiarities, whether of language, ſentiment, or paſſion, in a compoſition or oration, are forcibly and happily illuſtrated, and the various ſhades and tranſitions of ſtyle, ſignification, feeling, and alluſion, in ſuch compoſition or oration, are diſtinctly and intereſtingly marked. Expreſſion in this, as in every other art, is one of the chief conſtituents of excellence ; and contradiſtinguiſhes the elocutioniſt of taſte and genius, from the mere mechanical reader or declaimer. It depends chiefly upon that quickneſs and vitality of perception which may be regarded, in ſome degree, as an original gift of nature, and on that prompt and perfect ſympathy between the perceptive faculty and the executive organs, which it is the higheſt glory of art and practical exerciſe to produce.

Expression is more particularly uſed for the elocution, diction, and choice of words in a diſcourſe. See Elocution.

It is not enough that a poet or orator have fine thoughts, he muſt likewiſe have a happy expreſſion. Defects in the expreſſion ordinarily ariſe from defects in the imagination : abundance of the beauties of the ancient writers are annexed either to expreſſions which are peculiar to their language, or to relations, which, not being ſo familiar to us as to them, do not give us the ſame pleaſure.

Expression, *diverſifying of*, in *Rhetoric*. See Diversifying.

Expression, in *Painting*, principally conſiſts in the repreſentation of thoſe attitudes of the body, and variations of the countenance of men, which always accompany and denote the immediate influence of the paſſions of their minds. Beſides this more important uſe of the word, it is uſed in painting to ſignify the repreſentation of any object by a mode of execution agreeable to its nature, its character, and the ſituation it holds in the work. When wrought with juſt ſenſe and propriety in theſe reſpects, it is ſaid to be *well expreſſed*. We will firſt conſider it in the former and more uſeful ſenſe.

The paſſions which influence the conduct of men have each a general character of expreſſion, by look or geſture, attached to them in the whole race of mankind ; and they are alſo marked in individuals by peculiarities, ariſing from the temperament and conſtitutional habits with which each of them is endowed by nature.

To ſeize and repreſent with energy theſe characteriſtics of the paſſions of the mind, and accompany their repreſentation without diminiſhing its force, with the varieties appropriate to the individual perſonages introduced into a picture, is the eſſence, the ſoul of art. The ſlighteſt ſketch poſſeſſing this quality, acquires an intereſt uninſpired by, and far above, that excited by the moſt highly and excellently wrought pictures which are void of it.

Very few painters, amongſt the immenſe numbers of thoſe who lay claim to the name, have been happy enough to obtain a ſuper-eminent degree of expreſſion in their works; indeed it is a taſk of extreme difficulty to overcome, requiring the ſoundeſt ſenſe to ſelect the knowledge of it, and the greateſt ability in art to repreſent it when underſtood. The man who aims at it, beſides being an ever active obſerver, ſhould poſſeſs great ſuſceptibility of mind to enter into the feelings of others, and thus draw, as it were, from himſelf: yet that ſuſceptibility ſhould be under the regulation of ſound diſcernment, and cool diſpaſſionate judgment, to enable him to diſcriminate the fictitious repreſentations of paſſion, from thoſe natural unartificial actions, and looks, dictated by, and ariſing from, genuine feeling: and in his continued obſervations upon the actions and aſpects of men under their influence, he ſhould be careful to ſeparate thoſe points which identify a peculiar paſſion, and diſtinguiſh it from others that are nearly allied to it.

Artiſts endowed with very conſiderable talents have failed in two different ways in their endeavours to embelliſh their works with this valuable quality. Some, by an over-anxious deſire to give ſtrength and energy to their expreſſions, have carried them into artifice and bombaſt: others, on the contrary, wiſhing to unite the beautiful with the pathetic, have only rendered their works inſipid and unintereſting in expreſſion; and it appears that he who is obliged to labour to produce it, who does not work from a clear comprehenſion of the characteriſtic lines of an expreſſion in its ſimpleſt and moſt undiſguiſed ſhape, can never effect the repreſentation of it to any degree of perfection, and the beholder of his works will ſtill leave them unimpreſſed with any portion of the ſenſation the real paſſion is calculated to produce; the only true teſt of the value of works of art, as far as relates to expreſſion.

> " By tedious toil no paſſions are expreſt,
> He who conceives them ſtrongeſt paints them beſt."

The power of rendering, or producing expreſſion in painting, is, next to grace and elegance, the leaſt communicable talent of thoſe requiſite to form a perfect painter. He who attempts to obtain it, if not originally gifted by the great Author of nature with a peculiar propenſity to obſerve and imbibe the leading features which conſtitute its excellencies, follows a phantom that will for ever elude his graſp. If, however, he happily poſſeſſes that inclination, he may obtain ſome aſſiſtance in his purſuit of it from the works of others, which will ſhorten his labour, but will not lead him to the ultimate point of his deſire; to that, the ſtudy of nature can alone effectively induce.

We allude to ſome general rules given by artiſts who have communicated the reſult of obſervations made in their endeavours to obtain an underſtanding of the expreſſion of the paſſions of the mind, in the countenances and actions of men; and they are by ſome, whoſe names authorize reliance upon their obſervations, particularly Lionardo da Vinci, Trattata de la Pittura, and Le Brun's Paſſions. They have pointed out and illuſtrated thoſe actions of the countenance and figure which moſt ſtrongly deſignate the reigning influence of particular paſſions.

Theſe rules, however, go only a ſhort way in a general view of the ſubject; much leſs do they comprize what is requiſite, when the multitudinous varieties of expreſſion in the almoſt infinitely varying countenances and habits of men of all degrees are taken into conſideration. How, indeed, can it be poſſible to direct the means of obtaining with certainty that which is in itſelf ſo infinitely diviſible, as the courſe of the feelings and dictates of the ungovernable heart of man, and his correſponding actions and turns of feature?

It is in having aſcertained and eſtabliſhed the features of the more ſtrong and leading paſſions, that theſe general rules are found uſeful. We learn from them, that the influence of exceſſive joy or laughter draws all the features of the face upwards; that grief reverſes that order, and draws them downwards. Violent anger diſtorts them, and enlarges their appearance, particularly the eyes and noſtrils; and the action of the body is violent, with quick and ſhort motions. Deſire enforces an eager advancing action towards its object, and the eyes and mouth are ſomewhat expanded. Acute pain is generally expreſſed by a mouth ſomewhat opened and drawn back, the eyes raiſed, and partly covered by the upper eye-lid; and the eye-brows drawn cloſely together, wrinkling the forehead. Fear is denoted by expanded eyes and mouth, the eye fixed upon the exciting cauſe, the hair elevated and thickened, the colour livid, and the figure drawn back as if attempting to retire from the object which cauſes the alarm. The effects of the ſenſation of ſcorn or hatred on the figure and countenance are marked by the mouth being cloſed firmly, and the lips drawn down at the corners; whilſt the elevation of the noſtril cauſes the middle of the upper lip to riſe; the forehead is ſtrongly preſſed, and the brow falls over the eyes, which expreſs the paſſion beſt when they are turned ſideways, towards the object, with the body inverted from it. Awe, or veneration, produces a general inclination of the body, and the head ſtill more ſo, towards the object exciting it.

Under one or other of theſe paſſions and expreſſions all the feelings of our minds are more or leſs ranged; and of courſe will participate more or leſs of the indications of them, according to the excitation they meet with: therefore, ſo far the general rules will be of uſe in their repreſentation. But mankind, from their various modes of education, their habits, and manners, accompany theſe ſenſations, when excited in them, by peculiarities which it is of the utmoſt importance to the painter juſtly to diſcriminate, and be careful not to give that action to one, which, in propriety, belongs to another; not to attach the vulgar action of an uncultivated clown, to the dignified character of a man of rank and liberal education.

Beſides remarking the expreſſive characters of the ſtronger paſſions, great attention is requiſite to be paid to the phyſiognomical expreſſion of the countenance, and of the figure (if one may ſo ſpeak); the influence of which is daily felt and acknowledged. Though our information upon that ſubject is much thwarted by the effect of education and reflection, yet its baſis is juſt and firmly fixed, as every day's experience proves. Perſons whoſe features and general forms correſpond, are found to be correſpondent alſo in character; that is, in their natural propenſities: one of two, thus ſimilarly formed, may have cultivated his mind more than the other, and education and ſociety may have taught him to maſk or diſguiſe his inclinations; but nature is ſtill true to herſelf, and the ſame general diſpoſition remains. Nay, it goes ſtill further; young perſons not naturally addicted to vice, being drawn by accident or early aſſociation to continue in the practice of indulgence, acquire, in proceſs of time, a change of feature and expreſſion, in great meaſure ſimilar to that form uſually indicative of the vice or paſſion indulged in, where it is implanted by nature.

In this, therefore, we have a ground of expreſſion which is well worthy, indeed very neceſſary, to be carefully attended to by thoſe who aim at perfection in the art of painting. They ought to make themſelves acquainted with the forms that belong to the peculiar inclinations and different degrees of capacity of mind in the perſons they chuſe to bring forward in their works, of whatever claſs they may be. They ſhould not put into the face of a man of mild character any of the features indicative of warm paſſions; in ſuch an one the eye ſhould not have an eager look; the noſtrils ſhould not be large, or inflated; all the lines ſhould be ſmooth, and have little variation of form. And, on the contrary, when the figure of one whoſe diſpoſition is naturally hot and impetuous is introduced, he ſhould not have a ſmooth ſtraight forehead; which is indicative of mildneſs and ſuavity; his noſe ſhould not be ſtraight; nor his mouth gently undulating, of a mild pleaſing character: though he may not be in the act of exerting his natural impetuoſity of character, yet he ſhould have the appearance of one who would be eaſily rouſed to that feeling and expreſſion. A man of great ſenſe and intellect ſhould not be repreſented with the features that characterize imbecility; nor the weak, and undecided character, have the forms denoting ſenſe and intellectual power; and it ſhould be conſtantly remembered, that though every paſſion, every ſentiment of the mind, has its peculiar expreſſion; every particular perſon has his peculiar mode of expreſſing it.

In repreſentations of the paſſions, 'tis not form alone which is required to perfect the work: though that indeed yields a very ſtrong impreſſion of it, yet its effect is greatly heightened when a proper tone of colour is ſuperadded. By colour we judge of health or ſickneſs, of youth and age, as well as by form. The ſallow hue of melancholy is proverbial. It is well known how anger affects the hue of the countenance; in ſome it produces a violent fluſh of blood, and conſequent redneſs of colour, even almoſt to blackneſs: in others a pallid hue denotes it, or a change from one to the other rapidly ſucceeding. The malignant paſſions are generally accompanied in their expreſſions by a pallid tone of colour: and the more noble ſentiments by the reverſe. A man performing a benevolent action feels a degree of ſatisfaction which affects his countenance; his eyes exhibit his ſentiments by their livelineſs, and his mouth by its gentle curves at the corners, whilſt his cheeks bear (what is perfectly underſtood ſo as to be admitted a common phraſe) the cheerful glow of humanity ſtampt on them. Clearneſs of complexion, and colour in the cheeks, indicate youth and health; ſallowneſs, and the loſs of the ruddy hue of colour, ſickneſs and age. The inhabitants of the town, and of the country, exhibit the ſame diſtinctions; as alſo the ſtudious man and the ſportſman. Independent of the individual hue of the character repreſented, one general tone over the whole picture ſhould prevail, correſpondent to the ſubject. Thus, if it be one of a grave caſt, the tone of colours ſhould be low, yet rich; and though harmonious not monotonous. If, on the contrary, the ſubject is gay, the hues of the colouring ſhould be bright and cheerful, and greatly diverſified; and every part of the picture ſhould aſſiſt in expreſſing the nature of the ſubject choſen for repreſentation.

It is attention to this point which gives to painting its real value, its intrinſic worth; and ſeparates it from the

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more vulgar or merely mechanical arts. Hence it becomes of moral utility, and its power is not ſurpaſſed by the poetic, or other effuſions of the pen, in the force and vivacity of the impreſſions it is calculated to produce. Of this there are many notices given to us in hiſtory. Alexander is ſaid to have trembled and grown pale on ſeeing a picture of Palamedes betrayed to death by his friends: it bringing to mind the remembrance of his treachery to Ariſtonicus. It is alſo related of an Athenian courtezan, that in the midſt of a riotous banquet, caſting her eye on the portrait of a philoſopher marked with the happy character of virtue and temperance; ſhe was ſtruck with ſo lively an image of her own unworthineſs, that ſhe inſtantly went home and became an example of temperance. In both theſe caſes, to the truth of the expreſſion muſt be aſcribed the force with which the pictures wrought upon the obſervers; and produced the powerful impulſe related.

It appears, indeed, to have been the principal object of attention with the ancient Greeks, and very naturally ſo; for in the beginning of an art, before any rules for regulating its efforts were adopted the artiſt's attention muſt of courſe have been ſolely directed to relating his ſtory; and whatever aſſiſted in effecting that, was preſſed into the ſervice. Firſt of all, we are told, the efforts were ſo rude it was neceſſary to explain them: afterwards labels were placed as iſſuing from the mouths of figures; and other means of giving the ideas, ſuppoſed to occupy their minds, were adopted, till at laſt the artiſts arrived at the perfection of imitations of nature; and by giving their figures the actions and expreſſions appropriate to their ſituations, cauſed them to tell their own ſtory, and impreſs all its intereſt on the beholders, without any extraneous aid. Unhappily, excepting the few pictures found at Herculaneum, and thoſe are of a trivial kind, we have none of their works in this art to judge of the degree of perfection they arrived at in this moſt important point of it; but we have the teſtimony of many authors, ſome of whom ſpeak as eye-witneſſes, by whom we are led to believe, on convincing grounds, that their beſt pictures were full fraught with this beſt of good qualities; and there is no reaſon to doubt the truth of the report, when we ſee the ſculpture of the ſame period which remains to us, ſo rich in poſſeſſion of it.

In their ſtatues, which were principally of gods, a great degree of minutiæ of expreſſion does not appear to have been the object of their attention, as far as relates to the paſſions, the repreſentation of which they ſeem properly to have regarded as degrading to the dignity of a divinity. A calm unruffled ſtate of mind appears in their countenances, and governs their looks and actions, but each has its appropriate character. What can be more dignified and majeſtic than the countenance of the Jupiter? Yet the line which its air, partaking ſomewhat of ſeverity, inſpires, is ſo blended with mildneſs, that it produces implicit confidence and veneration. The Apollo Belvedere has alſo the dignity of the godhead ſhining in it; but leſs impoſing and overpowering, of a milder character, and the expreſſion of his figure and action is perfect; no one doubts the intent of it for an inſtant; and this juſt diſcernment, and impreſs of character, run through the whole claſs of ſtatues of the primary deities of the Greeks. The Venus, the Bacchus, the Hercules, &c. have each their diſtinctive line of character without paſſion, whoſe influence they are ſuppoſed to be exalted above, whilſt in the lower orders, the fauns and nymphs, and rural deities, are no leſs properly marked with characteriſtic features and actions. In the figure of Laocoon deſtroyed with his ſons by ſerpents, the authors (who were three) have exhibited a moſt powerful extent of feeling and power in expreſſion, remaining almoſt unrivalled in ſubſequent productions; the agony of pain and diſtreſs of mind are ſpread over the whole work which chills the beholder with horror.

Correſpondent with this powerful effect is that related of and attributed to their pictures. Pliny ſays of Ariſtides, "that he infuſed into his pictures all the paſſions of the ſoul." It is ſaid, "that Parrhaſius, in his picture of Philoctetes, had renewed the pains of the hero, as ſeen in his parched deep ſunk eyes, and the tears which flowed from them;" (Anthol. lib. 4.) and the epigrammatiſt concludes with a handſome compliment to the painter, blaming him "for not allowing the ſufferings of Philoctetes to end with his life." Philoſtratus, Vita Apollonii. cap. 10. ſays, ſpeaking of the Ajax of Timotheus, "we cannot do juſtice to the picture where Ajax is repreſented diſtracted, unleſs we previouſly form in our minds the image of his condition. The picture of "Medea contemplating the Murder of her Children," by the ſame painter, was the ſubject of numerous epigrams (Anthologia); ſo that it muſt have been very powerful to excite ſo much emulation among the wits to celebrate it. It was ſaid to repreſent in her face, fury mixed with pity of the innocence of her children, who were repreſented ſmiling at the dagger in her hand. Ovid ſays, "her crime was confeſſed in her eyes." Plutarch ſays of Lyſippus the painter, that he was ingenious as well as ſublime; that from the ſlight inclination of the neck natural to Alexander, he invented a ſublime expreſſion; making him look up to the heavens with manly boldneſs, and commanding majeſty. The ſame author (in Timoleon) praiſes the paintings of Nicomachus "for their juſt expreſſion," comparing them "to the poetry of Homer in grace and facility:" and Apelles in this point affirmed himſelf ſuperior to other painters, though inferior in ſome others of leſs importance. It is needleſs to repeat the well known ſtory of Timanthe's picture of the Sacrifice of Iphigenia, and of his artifice in hiding the face of the father, having exhauſted the force of expreſſion in the beholders; commendations and imitations of it are met with every where; and of his ingenious contrivance to convey an idea of the immenſe ſize of a Cyclops, by drawing ſome Satyrs meaſuring his figure with a thyrſus; and Pliny remarks of him on this occaſion, that "in all his works there is more underſtood than is marked, and though his execution be maſterly, yet his ideas exceed it."

Whatever allowance be made for the zeal and ſtrength of terms with which perſons at all times deſcribe thoſe things, than which they are unacquainted with any thing better, and which muſt have been the caſe in the early periods of art, the writers not being ſo learned in it as the painters who made it their continual ſtudy; yet we cannot refuſe belief to a wonderful extent of power in rendering expreſſion among the Greek painters, accompanied, as (it has been before obſerved) theſe deſcriptions of it are, by the actual effect in ſculpture. It is more aſtoniſhing that it ſhould ever have been loſt ſight of; yet that was the caſe, and on the revival of the art of painting the old original futile means of labels, &c. were had recourſe to, till the gradual advance of learning and propriety of ſentiment again reſtored it in the 15th century to the juſt imitation of the impreſſions of nature. Maſſaccio was among the firſt who thus advanced it, but it was Lionardo da Vinci who firſt perfected its claim to intereſt over the mind, though, perhaps, in none of his works ſo completely as in his repreſentation of the Laſt Supper, painted on the walls of the refectory of the Dominican convent at Milan, where it ſhone for a period, unrivalled in truth and vigour of expreſſion.

It repreſents the moment wherein our Saviour has juſt ſaid to his diſciples "One of you ſhall betray me." Each figure has intelligence beaming from it; each individual exhibits a full report of what paſſes within his boſom. How tranquilly, yet how fully does our Lord diſcloſe this forerunner of his approaching miſeries, that one of thoſe whom he had loved and cheriſhed ſhould become treacherous, and turn his bounty to his ruin; and with what propriety is he thus repreſented tranquil, yet dignified! ſo conſiſtent with his high character and office! With what eagerneſs does the impetuous Peter apply to the well deſignated meek and humble John, to learn the name of the culprit that would betray ſo good a maſter! while that conſcious culprit, hearing the requeſt, ſtarts backward with alarm, fearing the conſequences of ſuch a diſcloſure. Theſe are repreſentations ſo powerful, that it needs but the regard of a moment to comprehend all ſaid, and to be ſaid, to complete the whole intereſt of the ſtory. The timid heſitating Thomas, at a ſmall diſtance from Peter, preſſes his hand on the other's ſhoulder, to urge him to make the requeſt his own timidity prevents him from doing himſelf. The next of the apoſtles, whoſe peculiarities hiſtory hath not ſo fully recorded, are repreſented in great variety of actions and expreſſions correſponding with, and juſtly originating in, the incredible circumſtance juſt announced to them. One, with his hands preſſed on his boſom, riſing, aſſerts his innocence; another ſtarts with ſurpriſe, and, in the pious conſciouſneſs of ſinful weakneſs, ſeems to demand "Lord, is it I?" One calmly, yet earneſtly, liſtens to the reſult of the queſtion urged by Peter: others, in contraſt with him, ſeem to argue together if it be poſſible ſuch iniquity could dwell with man, and in ſo doing declare their own innocence. Anxiety is depicted as diſturbing every breaſt, yet the peculiarities of each are preſerved with the moſt juſt diſcrimination; and all appear ſo impreſſed with nature, that while it is recognized as the offspring of that great man's genius, the mere imagination of his mind, it has the appearance of a portrait of the actual ſcene. It is now unfortunately much injured by time and cleaning, being painted in oil, and not, therefore, adhering to the wall ſo perfectly as freſco.

To become able to produce a work of this ſurpriſing power in expreſſion, Lionardo ſays of himſelf, that he loſt no opportunity which the occaſions of life afforded him, of ſtoring up remarks upon the nature of its action in men. He paid much attention to anatomy, and is ſaid to have attended executions, not only to watch the looks and actions of the ſufferers, but alſo to obſerve how the different perſons compoſing the crouds of ſpectators were affected. The common occurrences of life are every day affording the attentive and ingenious artiſt leſſons on this head; and he will ſucceed, accordingly as he is intelligent and active in obſervation of them; or if he neglects to improve his mind by them, is inattentive and unfeeling to them, he can never become equal to the taſk of repreſenting them.

Michael Angelo was alſo a powerful promoter of this high quality in works of art, but his expreſſion is of a grand and more myſtic nature than Lionardo's, and it is Raffaelle alone that has approached in his own way the ſuperior excellencies of the work we have above deſcribed. "We ſtand in awe of Michael Angelo," ſays M. Fuſeli, "while we embrace Raffaelle, and follow him wherever he leads us." He has not ſucceeded well where he has attempted the ſublime. His gods are not even heroes, and his heroes are common vulgar men, except in a few inſtances; but where tenderneſs, and the amiable qualities of human nature have been his ſubject, he is not behind his great forerunner. Nor in the relation of his ſtory is he ever deficient; ſometimes, indeed, as has been obſerved on the Cartoon of Ananias ſtruck dead, under the word ENERGY, in *Painting*, he combines the paſt events on which it depends, and the future, to which it leads. His Cartoons of "St. Paul preaching at Athens;" the "Healing the Lame Man at Lyſtra;" "Elymas ſtruck blind," are inſtinct with feeling and expreſſion: they are but ſlightly finiſhed, and lack the extreme perfection of Lionardo's work; however, from the high degree of character to which Raffaelle has carried ſome of his heads, in his picture of the "Transfiguration," 'tis fair to ſuppoſe he could have perfected theſe, if the nature of the works (being only examples for tapeſtry) had required it. In comparing the reputation of Raffaelle to Lionardo da Vinci in this reſpect, it ſhould not be forgot that he was only 36 years old when he died, and the latter was 49 or 50 when he painted the aſtoniſhing work of the "Laſt Supper." Had Raffaelle lived to an advanced age, it is probable he would have ſurpaſſed even him. The ſimplicity and fullneſs with which he deſcribes, or effects, the relation of his ſubject, is beautifully inſtanced in the Cartoons of "St. Paul and Barnabas healing the lame Man at Lyſtra," and the conſequent adoration paid to them. The apoſtles are raiſed upon ſome ſteps above the croud, and thus diſtinguiſhed, as well as by the attention of all being directed to them. The reſtored cripple is known from the reſt, by his eager demonſtrations of gratitude and adoration; by his united and uplifted hands and animated looks, addreſſed to his reſtorers, and by the crutches now become uſeleſs, and fallen at his feet to the ground. An aged man bending forwards, lifts with one hand the garments of the healed man, to view the limb now become perfect, and ſimply by the uplifting of the other, expreſſes his admiration of the cure ſo miraculouſly effected. It is the ſimplicity of the means Raffaelle uſes, which gives ſo much the appearance of nature to his expreſſions: no one, on ſeeing the works, doubts but that he ſhould have employed the ſame means; the art is loſt ſight of. The effect of the pictures of Raffaelle, in point of expreſſion, on the artiſt who obſerves them, is much the ſame as Garrick's acting the character of a clown is ſaid to have had upon a countryman, who completely loſt ſight of the actor, and criticiſed only the ſentiments, in which, by the by, he complimented the author alſo, by ſtating that he ſhould have done the ſame himſelf. Yet it is a fact, that no point in art is ſo difficult to attain as this true ſimplicity of character with effect. Perhaps the moſt beautiful piece of expreſſion in painting known to the world, is Raffaelle's head of the Madonna della Sedia, now in Paris. The ſweetneſs of ſentiment conveyed by the mouth is completely undeſcribable: no picture has been ſo frequently copied, none ſo rarely imitated.

Titian has frequently ſucceeded in rendering expreſſion in his works, though it is not his general characteriſtic. His picture of St. Peter Martyr, before alluded to, (ſee EXECUTION, in *Painting*,) is almoſt perfect in this, as well as in moſt other points. Indeed, when taken in the whole, we cannot help conſidering this as the moſt perfect picture in the world; poſſeſſing more of every good quality than any other we are acquainted with. It has ſtrongly the character of expreſſion, both in form, and correſpondent tone of colour. No man of feeling regards it, but with an inſtantaneous ſentiment of ſeriouſneſs; ſomewhat, indeed, of horror is inſpired by the firſt view of it; particularly by the figure of the monk who is running away, and who eyes the proffered palm of martyrdom itſelf with horror. In direct oppoſition to him is the figure of the ſaint; who, ſuffering under the power of the aſſaſſin, (in whoſe perſon nought but the ſentiment of brutality prevails,) turns his eyes towards the angels deſcending with the palm and crown, and hails the viſion of future glory. The hue of the picture, we have ſaid, is ſerious, and it is alſo rich and deep in colour; 'tis the effect of that hue which prevails at twilight, and is moſt judiciouſly choſen as ſuitable to the affecting nature of the ſubject. Raffaelle has employed it in his portrait of Leo X. with the cardinals Roſſi and Medici attending him. Here the ſubject was grand, and its effect is increaſed by the deep and ſerious tone of the colouring.

Pouſſin has, in ſeveral inſtances, been very happy in the expreſſion of his ſubject. One of his pictures we will mention as a very excellent model of it; 'tis the Judgment of Solomon, a picture bad in its colour, in its compoſition, and execution, but fraught with the quality we are now conſidering. The king is ſeated upon his throne, ſurrounded by his attendants, and has juſt given the command to divide the living child. A ſoldier is proceeding to execute the order, and this gives occaſion to the admirable diſplay of diverſity of feeling in the by-ſtanders. An old man ſeems coolly to reaſon with himſelf if the king can intend the performance of ſo cruel a ſentence. Another looks earneſtly forward with the vacuity of aſpect ſo commonly produced by ſurpriſe. A woman turns away her head to avoid the ſight, and her child clings to her ſide alarmed. A ſoldier regards the ſcene with a countenance fraught with pity, another turns from it with diſguſt. Whilſt the wicked, abandoned woman, who had ſlain her own child, ſeeks the deſtruction of her neighbour's alſo; the real mother implores, with an earneſtneſs never to be too much admired, the preſervation of her child; rather willing to diſown, than to ſee it deſtroyed. The expreſſion of the action of the king is completely that of conviction to whom the child belongs; he almoſt ſeems to exclaim, now I ſee the right, now I know to whom to give the award. Pouſſin has alſo in this inſtance added another uſeful indication of character in the attire of the woman, no leſs different in mind, than in habit. He has given to the vicious creature that negligence in dreſs which is too often indicative of a general habit of idleneſs and neglect; whilſt he has dreſſed the other with decent care, and propriety.

This great painter has in another picture exhibited the force of colour in rendering expreſſion, almoſt independent of form: 'tis in his picture of the deluge; one of a ſeries of four pictures meant to repreſent the four ſeaſons of the year. It is almoſt entirely of one hue. The compoſition conſiſts of little more than a large portion of ſky and water; the latter in the lower part of the picture falling in a cataract. In the diſtance is the ark, ſcarcely diſcernible through the thickneſs or dullneſs of vapour, through which the ſun is with difficulty alſo ſeen, of a reddiſh hue. In the loweſt corner of the picture is a family, conſiſting of a man, his wife, and child, endeavouring to climb from a boat upon a rock, on which a ſerpent glides along; and a little farther towards the centre are ſeen the heads of a man and horſe juſt ſinking in the water. With theſe ſlight materials has Pouſſin wrought a picture which is completely overpowering in its melancholy effect. It is ſaid that Rouſſeau would ſit enwrapt in ſilence over it for hours, gratified with the ſenſations it inſpired.

Another maſter, whoſe attempts to render expreſſions have been ſometimes very ſucceſsful, is Guido Rheni; but he ſeldom goes farther than the characters of ſaints in pious ejaculations, Magdalens in the moment of contrition, and Ecce Homos. Of the latter, there is one of ſuper-excellent perfection, in the poſſeſſion of B. Weſt, eſq. a head only, but full of feeling; ſurely "never was ſorrow like unto his ſorrow," may be as juſtly applied to the painting, as to the ſufferings of the divine original. There is an ancient painting of a Satyr's head, now in the Barberini palace at Rome, which is eminently diſtinguiſhed by expreſſion of character.

There are but few among the large maſs of the Italian and French painters who have ſucceeded in their efforts (to any pre-eminent degree) in giving expreſſion to their works in its more exalted ſenſe. Ludovico Carrache, and Domenichino have ſometimes effected it, but rarely, and Annibal Carrache ſtill leſs frequently, notwithſtanding his immenſe power in execution. Among the Flemings, Jan Stein, and Oſtade, hold the principal places. The former particularly is exceedingly happy in characterizing the aſpects and manners of that claſs of men he undertook to paint, and he does it with great freedom and eaſe. Oſtade is more laboured in his manner, but perfect in his finiſh in the confined ſcale in which he exerted himſelf. Rubens has ſometimes ſucceeded to a high degree in this quality, but, in general, the expreſſions of his figures in ſerious ſubjects are too violent, and outſtep the modeſty of nature. In the gayer ſcenes, where nymphs and fawns are fancifully indulging their humours, his power is complete; they live and breathe with all their native gaiety and animation; and in expreſſing the characters of beaſts, either calm or enraged, not even Snyder has ſurpaſſed him. Vandyke rarely appears to have felt it in his hiſtorical pictures; but in ſome of his portraits he is extremely happy. His Cardinal Bentivoglio is a perfect inſtance of expreſſion in this branch of art. His picture of lord Strafford and his ſecretary at Wentworth-houſe, Yorkſhire, is another; but the idea is taken from Titian; whoſe portraits are maſter-pieces of identical character and expreſſion, and the prototype of Vandyke's excellence. In this reſpect, ſir Joſhua Reynolds is no leſs happy than either of them: prints from whoſe pictures are in ſo many hands, and ſo generally known, that it is needleſs to exemplify the aſſertion by further remark, yet we cannot decline mentioning the picture of Mrs. Siddons in the character of the Tragic Muſe, as a very happy inſtance of his power.

Rembrandt, though ſeldom happy in repreſenting the purity of expreſſion in his figures, yet ſometimes effects it; but his great characteriſtic is the truth with which he gives expreſſion in the ſecondary ſenſe we have affixed to it, as regarding painting. To imitate the peculiarities of nature was his delight. He ſeized and expreſſed, with the greateſt truth, the moſt extraordinary effects of the illumination of objects, and gave it its greateſt poſſible brilliancy and force. In a different line, Netſcher and Metzu were highly ſkilful in the exact expreſſion of the nature of the objects they choſe to repreſent. Silks, furs, carpets, metals, &c. all are expreſſed by them with the greateſt truth, and in a free, broad ſtyle of execution, particularly by the former. Teniers, and in ſhort almoſt all the painters of the Dutch and Flemiſh ſchools, have exhibited great ability in expreſſing the character of natural objects. But to this ſtudy they ſacrificed attention to expreſſion in its more elevated and uſeful province.

Not ſo our inimitable Hogarth. Though he took the common ſcenes of nature as his field of action; and was not unſkilful in imitating the natural effect of objects; yet with him this meaner talent was of ſecondary conſideration. By his pencil he inculcates leſſons of morality, and no lectures from the pulpit are more effectually ſtrong and convincing, than thoſe conveyed by his pictures. Witneſs the Rake's, and the Harlot's Progreſs; where the evils attendant on vice, and the bleſſings which a courſe of virtue is calculated to produce, are ſo powerfully exemplified. With what force has he ſatirized pride and luxury in his Marriage-a-la-Mode; bigotry, ſuperſtition, and folly, in many of his other works!

and no one has ever expreſſed identical character more ſtrongly than he has. The figure of the exhauſted rake in the breakfaſt-ſcene of the Marriage a-la-Mode, has never been ſurpaſſed in truth and force. We could enlarge with pleaſure upon his value in this point of view, but content ourſelves with recommending his works with the excellent comments upon them by Mr. J. Ireland, to the peruſal and obſervation of our readers; and are proud to have ſo excellent an exemplar of the value of expreſſion in painting as Hogarth, whoſe talents were native, unindebted to foreign ſchools, in praiſe of whom to conclude our obſervations on this very important point.

EXPROBATION, Exprobatio, in *Rhetoric*, is the reproaching a perſon with ingratitude, and unmindfulneſs of ſome particular benefit conferred upon him.

EXPUGNATION, in *Military Language*, the taking of any place by aſſault.

EXPULSION, the act of driving a man by force out of a city, community, or the like.

Expulsion is alſo uſed for the act of driving out a foreign body with violence from the place it was in.

The uterus has the chief office in the expulſion of the fœtus; if the expulſion of the fœtus happen very ſoon after conception, it is called a *falſe birth*. See Delivery, Foetus, and Labour.

EXPURGATION, in *Aſtronomy*, is uſed by ſome authors for that ſtate or action of the ſun, wherein, after having been eclipſed and hid by the interpoſition of the moon, it begins to appear again.

Later aſtronomers call this emerſion, not expurgation.

EXQUIMA, in *Zoology*, the name of a ſpecies of monkey common on the coaſt of Guinea, of which Ray enumerates two or three varieties. See Simia.

EXSIBIDANTES, in *Antiquity*, a kind of hiſſers, who, in the theatre, and other public auditories, uſed to make a noiſe with their feet, and even ſometimes beat the ſeats with battons.

EXSICCATION, formed of *ex* and *ſiccus*, *dry*, in *Chemiſtry*, *Pharmacy*, &c. the act of drying up or evaporating the moiſture of a thing. For this purpoſe two methods are uſually employed: in one of which the humidity is evaporated by heat, and in the other it is imbibed or abſorbed by ſubſtances adapted to the purpoſe. Bodies combined with, or diſſolved in a fluid, require the firſt mode, and to ſuch as are only ſuperficially blended with it, the ſecond mode is applicable. Vegetables are commonly exſiccated by the natural warmth of the air, though the aſſiſtance of artificial heat is often very uſeful. By a moderate fire the more tender flowers may be ſoon dried without any conſiderable loſs, either of their odour or lively colour, which would be injured, if not deſtroyed, by a more ſlow exſiccation in the air. Some plants, particularly thoſe of the more acrid kind, loſe their virtues by this proceſs.

EXSORS Particula. See Particula.

EXSUCCATIO, a word uſed by ſome *Chirurgical Writers*, to expreſs an enchymoſis, or ſuggillation.

EXSUFFLATION, a ceremony obſerved in baptiſm, by which the candidate was ſuppoſed to renounce the devil. See Baptism.

EXTACY, Εξϛασις, a rapture, or removal of the mind out of its natural ſtate and ſituation; or a tranſport, whereby a perſon is hurried out of himſelf, and the office of his ſenſes is ſuſpended. See Enthusiasm.

Extacy, in *Medicine*. See Ecstasis.

EXTANT, ſomething that ſtill ſubſiſts, or is in being.

It is but part of the hiſtory of Livy, of the writings of Cicero, Cæſar, &c. that are extant, the reſt are loſt. We have nothing extant of Socrates, though he wrote a great deal.

EXTEMPORANEOUS Prescription. See Prescription.

Extemporaneous *Playing*, flights in *Muſic*, on a harpſichord, or piano forte, have many appellations; as toccata, toccatina, *Ital.* prelude, capriccio. On the organ it is called a voluntary.

There have been organiſts, whoſe abilities in unſtudied effuſions on their inſtruments have almoſt amounted to inſpiration, ſuch as Sebaſtian Bach, Handel, Marchand, Couperin, Kelway, Stanley, Worgan, and Keeble, ſeveral of whom played better muſic extempore, than they could write with meditation.

EXTEND, in the *Manege*. To extend a horſe, is an expreſſion uſed by ſome to import the ſame with making a horſe go large. See Large.

Extend, in *Military Language*. When the files of a line, or the diviſions of a column, are to occupy a greater ſpace of ground, they are ſaid to extend their front or line.

Extend, in *Law*. See Extending.

EXTENDENDA Terra. See Terra.

EXTENDI Facias, in *Law*, a writ of extent, whereby the value of lands is commanded to be made and levied, &c. Reg. Orig. See Extent.

EXTENDING, in a *Legal Senſe*, ſignifies the valuing of lands and tenements of one bound by ſtatute, &c. and who hath forfeited his bond at ſuch an indifferent rate, as that by the yearly rent the obligator may in time be fully paid his debt. See Extent.

EXTENSION, in *Philoſophy*, is one of the general and eſſential properties of matter; the extenſion of a body being the quantity of ſpace which the body occupies, the extremities of which limit, or circumſcribe, the matter of that body. It is otherwiſe called the *magnitude*, or *ſize*, or *bulk* of a body.

A quantity of matter may be very ſmall, or ſo as to elude the perception of our ſenſes, ſuch as a particle of air, a particle of water, &c.; yet ſome extenſion it muſt have, and it is by the compariſon of this extenſion, that one body is ſaid to be larger than, equal to, or ſmaller than, another body. The meaſurement of a body conſiſts in the compariſon of the extenſion of that body with ſome determinate extenſion, which is aſſumed as a ſtandard, ſuch as an inch, a foot, a yard, a mile; hence it is ſaid, that a body is a foot long, or three inches long, &c.

The extenſion of a body is meaſured three different ways; or a body is ſaid to have length, breadth, and thickneſs. Thus an ordinary ſheet of writing paper is about 16 inches long, about 14 inches broad, and nearly one hundredth part of an inch thick. Either of theſe dimenſions might be called the length, or the breadth, or the thickneſs; but, by general cuſtom, the greateſt extenſion is called the length, the next is called the breadth, and the ſhorteſt is called the thickneſs. The outſide of a body, its boundary, or that which lies contiguous to other bodies that are next to it, is called the *ſurface* of that body, and this ſurface has two dimenſions only, *viz.* length and breadth; but it has no thickneſs, for if it had, it would not be the outſide of the body; yet a ſurface by itſelf cannot exiſt. In mathematics, however, ſurfaces are mentioned, and are reaſoned upon, abſtractly from matter. But in theſe caſes the ſurfaces exiſt in the imagination only, and even then our ideas have a reference to body, for our ſenſes cannot perceive a ſurface without a body.

As a ſurface is the outſide or boundary of a body, ſo a *line* is the boundary of a finite ſurface. Suppoſe, for inſtance, that a ſurface is divided into two parts, the common boundary of the two parts is called a line; and this has one extenſion only, *viz.* it has length.

The beginning, or the end of a line, or the interſection of two lines which croſs each other, is called a *point*, and this has no dimenſions; or, according to the mathematical definition, a point is that which has no parts or magnitude. Thus, if you divide a line into two parts, the diviſion or boundary between the two parts is a point.

Our ſenſes are only capable of perceiving bodies which have three dimenſions; or rather the ſurfaces of bodies, which ſurfaces have two dimenſions, but a ſurface cannot be repreſented nor perceived without a body, and of courſe neither a line nor a point can be perceived without a body. In the ſtudy of geometry, and in a variety of other branches, ſurfaces, lines, and points are repreſented upon paper, or upon ſomething elſe; but in thoſe caſes, the paper or that ſomething elſe is the body whoſe ſurface we perceive, and the ſurface of a particular figure is circumſcribed, not by real lines, but by a narrow ſlip of ſurface, which is ſufficient to direct our reaſoning with reſpect to the geometrical properties of lines and ſurfaces. Thus alſo when points are repreſented by themſelves, the marks are not real points, but very ſmall portions of the ſurface of a body.

There is a caſe in which extenſion is often ſaid to be perceived without the exiſtence of a body, and this is the extenſion between two bodies. But, upon conſideration, it will eaſily be comprehended, that we may perceive the two bodies, and that they are ſeparate from each other; but we cannot perceive any thing poſitive between them. So that in this caſe the word extenſion is uſed in a figurative manner, as if ſome other body exiſted between the two bodies.

The particular extenſion, whether under the name of inch, foot, yard, metre, league, &c. with which other extenſions are compared, or by which they are meaſured, are eſtabliſhed only by the common conſent or agreement of perſons of a certain nation, or profeſſion, and are uſed as ſtandard meaſures by them only. Hence, the meaſures of different nations, though ſometimes they have the ſame name, do, however, differ conſiderably from each other. Great endeavours have been made by divers ingenious perſons, at different times, for the purpoſe of determining an unalterable univerſal ſtandard of meaſures; but thoſe endeavours, and the ſucceſſes with which they have been attended, will be found deſcribed under the article STANDARD *of Meaſures*.

Extenſion is uſually deſcribed as conſiſting in the ſituation of parts beyond parts, with which ſome authors cavil, maintaining, that we can conceive abſolute extenſion without any relation to parts.

If a man conſider the diſtance between two bodies abſtractedly, and without any regard to bodies which may fill that interval, it is called ſpace; and when he conſiders the diſtance between the extremes of a ſolid body, it is called extenſion.

Extenſion is frequently confounded with quantity and magnitude; and, for what we can perceive, without much harm, the thing ſignified by them all appearing to be the ſame; unleſs we admit a diſtinction made by ſome authors, that the extenſion of a body is ſomething more abſolute, and its quantity and magnitude more reſpective, or implying a nearer relation to much and little. See QUANTITY, MAGNITUDE, MASS, and MATTER.

The infinite diviſibility of extenſion has been a famous queſtion in all ages. It is not eaſy to reconcile the doctrine of mathematicians on this head with the tenets of ſome philoſophers. They who hold that all extenſion and magnitude are compounded of certain *minima ſenſibilia*; and that a line, for inſtance, cannot increaſe or decreaſe, but by certain indiviſible increments or decrements only, muſt, conſiſtently with themſelves, affirm, that all lines are commenſurable to each other, contrary to the tenth book of Euclid, who demonſtrates that the diagonal of a ſquare is incommenſurable to its ſide. But if all lines were compoſed of certain indiviſible elements, it is plain one of thoſe elements muſt be the common meaſure of the diagonal and the ſide. This is a gordian knot which none of the philoſophers have yet thought fit to untie.

Biſhop Berkeley obſerves, that the infinite diviſibility of finite extenſion, though it is not expreſsly laid down either as an axiom or theorem in the elements of geometry, yet is throughout the ſame every where ſuppoſed, and thought to have ſo inſeparable and eſſential a connection with the principles and demonſtrations in geometry, that mathematicians never admit it into doubt, or make the leaſt queſtion of it. (See DIVISIBILITY.) And as this notion is the ſource from whence do ſpring all thoſe amuſing geometrical paradoxes, which have ſuch a direct repugnancy to the plain common ſenſe of mankind, and are admitted with ſo much reluctance into a mind not yet debauched by learning; ſo is it the principal occaſion of all that nice and extreme ſubtility which renders the ſtudy of mathematics ſo difficult and tedious. Hence, ſays he, if we can make it appear, that no finite extenſion contains innumerable parts, or is infinitely diviſible, it follows, that we ſhall at once clear the ſcience of geometry from a great number of difficulties and contradictions which have ever been eſteemed a reproach to human reaſon, and withal make the attainment thereof a buſineſs of much leſs time and pains than it hitherto hath been.

Every particular finite extenſion, which may poſſibly be the object of our thought, is an idea exiſting only in the mind, and conſequently each part thereof muſt be perceived. If therefore, ſays this author, I cannot perceive innumerable parts in any infinite extenſion that I conſider, it is certain they are not contained in it; but it is evident, that I cannot diſtinguiſh innumerable parts in any particular line, ſurface or ſolid, which I either perceive by ſenſe, or figure to myſelf in my mind; wherefore, I conclude they are not contained in it. Nothing can be plainer to me than that the extenſions I have in view are no other than my own ideas; and it is no leſs plain, that I cannot reſolve any one of my ideas into an infinite number of other ideas; that is, that they are not infinitely diviſible. If by an infinite extenſion be meant ſomething diſtinct from a finite idea, I declare I do not know what that is, and ſo cannot affirm or deny any thing of it. But if the terms extenſion, parts, and the like, are taken in any ſenſe conceivable; that is, for ideas; then to ſay a finite quantity or extenſion conſiſts of parts infinite in number, is ſo manifeſt a contradiction, that every one at firſt ſight acknowledges it to be ſo. New Theory of Viſion, § 54, 55. Analyſt. § 31.

On the other hand, it is obſerved by an eminent mathematician, that geometricians are under no neceſſity of ſuppoſing that a finite quantity or extenſion conſiſts of parts infinite in number, or that there are any more parts in a given magnitude than they can conceive or expreſs: it is ſufficient that it may be conceived to be divided into a number of parts equal to any given or propoſed number; and this is all that is ſuppoſed in ſtrict geometry concerning the diviſibility of magnitude. It is true, that the number of parts into which a given magnitude may be conceived to be divided, is not to be fixed or limited, becauſe no given number is ſo great but a greater than it may be conceived and aſſigned: but there is not therefore any neceſſity for ſuppoſing that number infinite; and if ſome may have drawn very abſtruſe conſequences from ſuch ſuppoſitions, they are not to be imputed to geometry. Geometricians are under no neceſſity of ſuppoſing a given magnitude to be divided into an infinite number of parts, or to be made up of infiniteſimals; nevertheleſs, they cannot ſo well avoid ſuppoſing it to be divided into a greater number of parts than may be diſtinguiſhed in it by ſenſe in any particular determinate circumſtance. But they find no difficulty in conceiving this; and ſuch a ſuppoſition does not appear to be repugnant to the common ſenſe of mankind, but on the contrary to be moſt agreeable to it, and to be illuſtrated by common obſervation. It would ſeem very unaccountable not to allow them to conceive a given line, of an inch in length for example, viewed at the diſtance of 10 feet, to be divided into more parts than are diſcerned in it at that diſtance; ſince by bringing it nearer, a greater number of parts is actually perceived in it. Nor is it eaſy to limit the number of parts that may be perceived in it when it is brought near to the eye, and is ſeen through a little hole in a thin plate? or, when by any other contrivance it is rendered diſtinct at ſmall diſtances from the eye. If we conceive a given line that is the object of ſight to be divided into more parts than we perceive in it, it would ſeem that no good reaſon can be aſſigned why we may not conceive tangible magnitude to be divided into more parts than are perceived in it by the touch; or a line of any kind to be divided into any given number of parts, whether ſo many parts be actually diſtinguiſhed by ſenſe, or not. In applying the reaſonings and demonſtrations of geometricians on this ſubject, it ought to be remembered, that a ſurface is not conſidered by them as a body of the leaſt ſenſible magnitude, but as the termination or boundary of a body; a line is not conſidered as a ſurface of the leaſt ſenſible breadth, but as the termination or limit of a ſurface; nor is a point conſidered as the leaſt ſenſible line, or a moment as the leaſt perceptible time; but a point as a termination of a line, and a moment as a termination of a limit of time. In this ſenſe they conceive clearly what a ſurface, line, point, and a moment of time is; and the poſtulata of Euclid being allowed and applied in this ſenſe, the proofs by which it is ſhewn, that a given magnitude may be conceived to be divided into any given number of parts, appear ſatisfactory; and if we avoid ſuppoſing the parts of a given magnitude to be infinitely ſmall, or to be infinite in number, this ſeems to be all that the moſt ſcrupulous can require. See Maclaurin's Treatiſe of Fluxions, art, 290, 291.

Dr. Reid, in his "Inquiry into the Human Mind, on the Principles of Common Senſe," endeavours to obviate the difficulties ſuggeſted by Berkeley, by overturning the ſyſtem of ideas eſtabliſhed by Mr. Locke. According to his theory, it is abſurd to deduce from ſenſation the firſt origin of our notions of external exiſtence, of ſpace, motion, and extenſion, and all the primary qualities of bodies; they have, he ſays, no reſemblance to any ſenſation, or to any operation of our minds, and therefore they cannot be ideas either of ſenſation or reflection; nor can he conceive how extenſion, or any image of extenſion, can be in an unextended and indiviſible ſubject like the human mind.

Extension, in the *Ancient Muſic*, according to Ariſtoxenus, was one of the four parts of the melopœia, which conſiſted in ſuſtaining certain ſounds longer than their quantity ſtrictly required. We call theſe binding-notes, and ſometimes perhaps tempo rubato. See Compass.

Extension *of Fractured Limbs.* See Fracture.

EXTENSOR, in *Anatomy*, a name given to thoſe muſcles which have the uſe of extending or making ſtraight thoſe parts to which they are attached.

Extensor *brevis digitorum pedis*; calcaneo-ſus-phalangettien commun, is a thin and flat muſcle, placed on the ſuperior or convex ſurface of the foot. Poſſeſſing a ſomewhat quadrilateral figure behind, it divides into four flat tendons in front. It ariſes from the upper and front part of the os calcis, and from the ligament which connects that bone to the aſtragalus. Thence its fibres are continued obliquely forwards and inwards, and divide into four ſecondary faſciculi, (of which the two innermoſt are the largeſt,) giving origin to the ſame number of tendons; which, in paſſing over the metatarſus, croſs thoſe of the extenſor longus, and terminate in the toes. The firſt, on the inſide, is attached to the upper ſurface of the metatarſal extremity of the firſt phalanx of the great toe; the three ſucceeding tendons become intimately attached to the external edge of the correſponding tendons of the extenſor longus, and are connected at the firſt joints of the toes, as well as thoſe of the latter muſcle, with the tendons of the lumbricales and interoſſei. They extend over the ſecond phalanges, and are inſerted in the third.

Covered on its external ſurface by the tendons of the extenſor longus and peroneus tertius, and by the aponeuroſis of the back of the foot, this muſcle lies upon the anterior phalanx of the tarſus, upon the metatarſus, and the phalanges.

It extends and elevates all the phalanges of the toes, at the ſame time turning them rather outwards.

Extensores *carpi radiales.* See Carpi.

Extensor *carpi ulnaris.* See Carpi.

Extensor *communis digitorum manus*; epicondylo-ſus-phalangettien commun; extenſive digital; a muſcle belonging to the fingers, ſituated on the poſterior or dorſal ſurface of the fore-arm, hand, and fingers; elongated, ſomewhat rounded and fleſhy above, and divided into four tendons below.

It ariſes above, by means of a tendon common to it with the ſurrounding muſcles, from the external condyle of the humerus; is connected internally to a tendinous partition, which ſeparates it from the extenſor of the little finger, externally to a ſhorter ſeptum placed between it and the extenſor carpi radialis brevior, and poſteriorly to the faſcia of the fore-arm. The fibres, uniting together obliquely from theſe origins, form a muſcle, at firſt thin, and afterwards more conſiderable, which is divided, towards the middle of the fore-arm, into four portions, united at firſt by cellular ſubſtance, then ſeparating, and giving origin to the ſame number of tendons. Theſe at firſt are connected by a looſe cellular ſubſtance, paſs together with the tendon of the indicator under the annular ligament at the back of the wriſt, and in a ſuperficial groove of the radius, ſurrounded by a burſa mucoſa, then diverge towards the fore fingers, and become completely flattened. They are often ſplit longitudinally, and are united to each other, at the back of the hand, by croſs ſlips of tendon and their aponeuroſes. At the firſt joints of the fingers the broad thin tendons of the extenſor communis are joined, on either ſide by the tendinous expanſions of the lumbricales and interoſſei, and completely cover the articulation. They divide, at their extremities, into three portions, the middle of which are inſerted in the ſecond phalanges of the fore-fingers; while the lateral diviſions, running along the ſides of theſe phalanges, are inſerted cloſe together into the third.

This muſcle is covered by the aponeuroſis of the fore-arm, the annular ligament and ſkin. It covers the ſupinator radii brevis, the extenſors of the thumb and fore-finger, the carpus, metacarpus, interoſſei muſcles, and poſterior ſurface of the phalanges.

The annular ligament at the back of the fore-arm conſiſts of a broad, thin, and flat, but ſtrong fibrous expanſion, extended from the outer part of the carpal extremity of the radius, over all the extenſor tendons at the back of the wriſt, and connected to the end of the ulna, and to the os piſiforme. It confines the tendons to the ſurface of the bones. Thoſe of the common extenſor are ſurrounded, as they paſs under it, by a ſynovial membrane, in which we may diſtinguiſh a cavity containing the membranes completely iſolated, and a ſuperior and inferior cul de ſac, where the membrane is reflected over the tendons. The ſynovial membranes of the firſt joints of the fingers are cloſely connected to the tendons of the extenſor communis, where they paſs over thoſe joints.

This muſcle extends the different joints of the fingers; and afterwards, or if the fingers are bent by their flexors, it extends the wriſt upon the fore-arm.

Extensor *indicis*. See Indicator.

Extensor *longus digitorum pedis*; peroneo-tibi-ſus-phalangettien commun; grand extenſeur; is a long, thin muſcle, flattened laterally, and placed at the outer and anterior part of the leg, and upper part of the foot. It ariſes above from the external tuberoſity of the tibia, from a ſmall aponeurotic ſeptum which ſeparates it from the tibialis anticus, and from the anterior ligaments of the peroneo-tibial articulation; behind from five or ſix inches of the upper and anterior part of the fibula; before, at its upper part, from the aponeuroſis of the leg; and externally, from a broad aponeurotic ſeptum, which ſeparates it from the two peronei. The ſuperior fibres deſcend perpendicularly, the inferior ones more and more obliquely, to end in a common tendon at firſt concealed in the ſubſtance, but, from the middle of the leg, occupying the anterior edge of the muſcle. It divides into three or four portions, which paſs together behind the annular ligament: below which part we always ſee four ſeparate tendons diverging over the convexity of the foot, aſſuming a broad and flattened form, and croſſing the direction of the tendons of the extenſor brevis, in their paſſage to the four ſmaller toes. At the firſt joints of the toes theſe tendons are connected to thoſe of the extenſor brevis, and of the lumbricales and interoſſei, as in the hand, and they have ſimilar inſertions to thoſe of the extenſor communis digitorum, which ſee.

In the leg, this muſcle, on its inner ſurface, is ſeparated above by the anterior tibial veſſels from the tibialis anticus; lower down it is contiguous, on the ſame aſpect, with the extenſor proprius hallucis: externally it is in contact with the peronei; and the aponeuroſis of the leg covers it on the front. At the ankle it runs in a peculiar cavity of the ſtrong tranſverſe annular ligament, which binds it firmly down in its place. Here the tendons are ſurrounded by a ſynovial membrane. In the foot it is covered by the ſkin, and covers the extenſor brevis and phalanges.

This muſcle extends the toes, and afterwards bends the ankle joint. If the foot be fixed to the ground, it may either maintain the leg erect upon the foot, or carry it forwards.

Extensor *longus pollicis pedis*; or *proprius*; peroneo-ſus-phalanginien du pouce; thin, elongated and flattened in its form, it lies on the inſide of the preceding muſcle. It ariſes from the inner and anterior part of the fibula, and neighbouring portion of the interoſſeous ligament, for a ſpace of five or ſix inches, beginning about two inches below the upper end of the fibula. Its fibres paſs obliquely downwards and forwards, parallel to each other, and joining a tendon which runs along their anterior edge, conſtitute a ſingle penniform muſcle. The tendon goes behind the annular ligament, in a peculiar burſa mucoſa, runs along the inner edge of the metatarſus, and paſſing over the firſt, terminates in the ſecond phalanx of the great toe. Sometimes a ſmall portion of its tendon is inſerted in the firſt phalanx.

This muſcle is placed between the tibialis anticus, the anterior tibial veſſels and nerves being however interpoſed, and the extenſor longus digitorum. On the front it is covered by the aponeuroſis of the leg, the annular ligament, and the integuments. Its tendons lie on the lower end of the tibia, the tarſus, metatarſus, and phalanges of the great toe, and is cloſely connected to the ſynovial membrane of the firſt joint of that toe.

It extends the two joints of the great toe, and acts upon the foot in the ſame manner as the preceding muſcle.

Extensor *major pollicis*. See Extensores *pollicis*.

Extensor *minor pollicis*. See Extensores *pollicis*.

Extensor *oſſis metacarpi pollicis*. See Extensores *pollicis*.

Extensores *pollicis*; are three muſcles belonging to the three bones of the thumb.

Extensor *primi internodii*; extenſor oſſis metacarpi pollicis; abductor pollicis longus of Albinus; cubito-radi-ſus-metacarpien du pouce; grand abducteur du pouce; is a muſcle of an elongated, thin, and flattened form, ſituated obliquely on the back of the fore-arm. It ariſes above from the ulna, below the ſupinator radii brevis; from the interoſſeous ligament; and from the radius juſt below the inſertion of the ſupinator brevis. The fleſhy fibres unite together from theſe origins to form a flattened faſciculus at firſt ſmall, but afterwards larger, which croſſes the fore-arm obliquely from above downwards, and from the radial towards the ulnar ſide. Towards the lower extremity of the radius it terminates in a tendon, which runs in a ſmall groove on the outer ſide of the carpal extremity of the bone. Here it is ſurrounded by a hollow burſa, common to it with the tendon of the next muſcle. It is inſerted, generally by means of ſeveral more or leſs diſtinct portions, into the radial ſide of the carpal end of the firſt phalanx of the thumb. One of theſe portions is often connected with the abductor pollicis.

It is covered, in its fleſhy portion, by the extenſor carpi ulnaris, extenſor ſecundi internodii, extenſor proprius auricularis, and communis digitorum; and it covers the radius, ulna and interoſſeous ligament. Its tendon is covered by the aponeuroſis of the fore-arm, and covers the extenſores carpi, the radius, radial artery, and joint of the wriſt.

It extends the firſt bone of the thumb, when that has been bent towards the palm of the hand. It carries the thumb away from the other fingers; and it may move the whole hand towards the radius.

Extensor *ſecundi internodii*; extenſor minor pollicis; cubito-ſus-phalangien du pouce; is an elongated and ſlender muſcle, ſituated cloſe to the former, and lying on its ulnar edge. Ariſing from the interoſſeous ligament and radius, it croſſes the direction of the fore-arm, like the former, and forms a ſlender tendon, which cloſely accompanies that of the preceding muſcle. It paſſes along the firſt, and is inſerted in the ſecond phalanx of the thumb. It is covered by the extenſor tertii internodii, proprius auricularis, and digitorum communis, by the aponeuroſis of the fore-arm, and the integuments. It lies upon the bones of the fore-arm and the interoſſeous ligaments, the extenſores carpi radiales, the joint of the wriſt, and the firſt bone of the thumb. It extends the firſt and ſecond joints of the thumb, and carries it into the ſtate of abduction. It may draw the whole hand towards the radius.

Extensor *tertii internodii*; extenſor major pollicis; cubito-ſus-phalangettien du pouce; is an elongated and ſlender muſcle, placed cloſe on the ulnar edge of the former, and following the ſame general direction. It ariſes from the middle third of the poſterior ſurface of the ulna, and a very little from the interoſſeous ligament; and croſſes the fore-arm obliquely towards the thumb. Surrounded by a hollow burſa, it runs along a peculiar groove of the radius, being placed about an inch on the ulnar ſide of the preceding tendons. It paſſes along the ulnar ſide of the firſt phalanx of the thumb; is connected with the inſertion of the preceding tendon in the ſecond phalanx, and terminates in the third. Situated at its origin between the bones of the fore-arm and interoſſeous ligament, and the extenſor communis, proprius auricularis, and carpi ulnaris, it afterwards runs in its peculiar groove: it is then ſub-cutaneous, and lies on the extenſores carpi, joint of the wriſt, and bones of the thumb. It extends all the joints of the thumb, and at the ſame time rather carries it towards the fingers. It will alſo act as an extenſor of the wriſt.

Extensor *proprius auricularis*, or digiti minimi; epicondylo-ſus-phalangettien du petit doigt; is a thin, ſlender, and elongated muſcle, ſituated in the firſt or ſuperficial layer of the back of the fore-arm, and placed cloſe along the ulnar ſide of the extenſor digitorum communis. It ariſes above by means of the common tendon, from the external condyle of the humerus; on the outſide, from a ſeptum, which ſeparates it from the extenſor communis; on the inſide, from one interpoſed between it and the flexor carpi ulnaris; and behind, from the aponeuroſis of the fore-arm. It gives origin to a ſlender tendon, which paſſes in a ſeparate canal of the annular ligament, and forming the tendon which the little finger receives from the extenſor communis, is inſerted together with it into that finger. On the fore-arm, this muſcle is covered by the faſcia, and covers the ſupinator brevis, the extenſors of the thumb, and the indicator. The extenſor communis lies on its outſide, and the extenſor carpi ulnaris on the inſide. Its tendon is ſurrounded by a tendinous ſheath, lined with a ſynovial membrane, at the wriſt; and afterwards is covered by the integuments lying on the laſt metacarpal bone, and on the phalanges of the little finger. It extends the little finger, and afterwards moves the wriſt in the ſame direction; it will carry the little finger rather in the direction of abduction.

Extensor *proprius pollicis pedis*. See Extensor *longus pollicis pedis*.

Extensor *tarſi minor*, a name given by Douglas to the plantaris, which ſee.

Extensor *tarſi ſuralis*, or magnus; a name under which Douglas claſſes the gaſtrocnemius and ſoleus. See thoſe words

EXTENT, or Extendi Facias, in *Law*, ſometimes denotes a writ or commiſſion to the ſheriff for the valuing of lands and tenements; ſometimes the act of the ſheriff or other commiſſioner upon this writ; and ſometimes the eſtimate or valuation of lands, *per proprios viros*; which, when taken at the utmoſt value or extent, furniſh our extended, or rack-rents. Fleta. lib. ii.

This is a ſpecies of *execution* (which ſee) upon ſome proſecutions given by ſtatute; as in the caſe of recognizances or debts acknowledged on ſtatutes-merchant, or ſtatutes-ſtaple; upon forfeiture of which, the body, lands, and goods may be all taken at once, to compel the payment of the debt. And by ſtatute 33 Hen. VIII. c. 39. all obligations made to the king ſhall have the ſame force, and of conſequence the ſame remedy to recover them, as a ſtatute-ſtaple; though, indeed, before this ſtatute, the king was entitled to ſue out execution againſt the body, lands, and goods of his accountant or debtor. (3 Rep. 12.) And his debt ſhall, in ſuing out execution, be preferred to that of every other creditor, who hath not obtained judgment before the king commenced his ſuit. The king's judgment alſo affects all lands, which the king's debtor hath at or after the time of contracting his debt, or which any of his officers, mentioned in the ſtatute 13 Eliz. c. 4. hath at or after the time of his entering on the office; ſo that, if ſuch officer of the crown alienes for a valuable conſideration, the land ſhall be liable to the king's debt, even in the hands of a *boná fide* purchaſer; though the debt due to the king was contracted by the vendor many years after the alienation. (10 Rep. 55, 56.) Whereas judgments between ſubject and ſubject reverted, even at common law, no farther back than the firſt day of the term in which they were recovered, in reſpect of the lands of the debtor; and did not bind his goods and chattels, but from the date of the writ of the execution: and now, by the ſtatute of frauds, 29 Car. II. c. 3. the judgment ſhall not bind the land in the hands of a *boná fide* purchaſer, but only from the day of actually ſigning the ſame; which is directed by the ſtatute to be punctually entered on the record; nor ſhall the writ of execution bind the goods in the hand of a ſtranger, or a purchaſer (Skin. 257.); but only from the actual delivery of the writ to the ſheriff or other officer, who is therefore ordered to endorſe on the back of it the day of his receiving the ſame. Blackſt. Comm. book iii.

EXTENUATION, the act of diminiſhing or leſſening the bulk or ſubſtance of a thing, eſpecially of the human body. Fevers, agues, long abſtinences, &c. occaſion great extenuations or emaciations.

Extenuation is alſo a figure in *Rhetoric*, oppoſite to the hyperbole. The Greeks call it λιτότης.

EXTERIOR *Polygon*, *Talus*. See the ſubſtantives.

EXTERMINATION, formed of *ex* and *terminus*, *boundary*, the act of extirpating, or totally deſtroying a people, race, family, &c.

The Jews have been exterminated out of Portugal, the Moors out of Spain, the Albigenſes out of France, &c. Philip the Fair of France, to be revenged on the Knights Templars, took a reſolution, in 1307, to exterminate them.

Extermination, or *Exterminating*, in *Algebra*, is uſed for taking away. Thus algebraiſts ſpeak of exterminating ſurds, fractions, and unknown quantities out of equations. See Maclaur. Algebr. part i. chap. 12, where we have ſome general theorems for the exterminating unknown quantities in given equations. See Equation.

EXTERNAL, or Exterior, a term of relation applied to the ſurface or outſide of a body; or that part which appears or preſents itſelf to the eye, touch, &c. In which ſenſe it is oppoſed to *internal* or *interior*.

The ſenſes are divided into external, which are thoſe whereby we perceive ideas, or have the perception of external objects; as ſeeing, hearing, &c. and internal. See Sense.

External is alſo uſed to expreſs any thing that is without-outſide a man, or that is not within him, and particularly in his mind. In which ſenſe we ſay external objects, &c.

The exiſtence of an external world, *i. e.* of bodies and objects out of the mind, is a thing which has been greatly called in queſtion by Dr. Berkeley and others. See EXISTENCE, BODY, and QUALITY.

EXTERNAL *Angles*. See ANGLES, *external*.

EXTERNAL *Denomination, Ear, Modes, Place*. See the ſubſtantives.

EXTERNUS AURIS, in *Anatomy*. See EAR.

EXTERNUS *Cubitæus*. See CUBITÆUS.

EXTERNUS *Duverni*, a name given by Douglas to one of the muſcles of the ear, called by Cowper and others obliquus auris, and by Albinus externus mallei. See EAR.

EXTERNUS *Gaſtrocnemius, Iliacus*. See the ſubſtantives.

EXTERNUS *Mallei*. See EAR.

EXTERNUS *Orbiter, Pterigoideus, Vaſtus, Rectus Capitis*, See the ſeveral articles.

EXTINCTION, the act of extinguiſhing, that is, of putting out, or deſtroying, fire, flame, or light.

The Ariſtotelians account for the extinction of fire from the principle of contrariety; thus, ſay they, water puts out fire, becauſe the qualities of water are contrary to thoſe of fire, the one being cold and moiſt, and the other hot and dry. But how far this will go, may appear hence, that fire is extinguiſhed by hot water as readily as cold; nay, even by oil, earth, &c.

Some of the moderns offer two more plauſible cauſes of extinction; *viz.* diſſipation, as when the next immediate fuel of the flame is diſperſed and blown off by too forcible a wind; and ſuffocation, when it is ſo compreſſed, that its free motion cannot be maintained; as happens upon throwing water, &c. thereon. Various preparations and engines have been contrived for extinguiſhing accidental fires. See FIRE.

Boerhaave denies that there is properly any ſuch thing as extinguiſhing of fire; it is a body *ſui generis*, of an immutable nature, and we can no more extinguiſh or deſtroy it than we can create it.

EXTINCTION, in *Chemiſtry* and *Pharmacy*, is when a metal, mineral, or the like body, after having been heated red-hot in the fire, is plunged in ſome fluid, either to ſoften or temper its acrimony, as tutty in roſe-water; or to communicate its virtue to the liquor, as iron or ſteel to common water; or, laſtly, to give it a temper, as in the extinction of ſteel in water, or ſome other preparation.

EXTINGUISHER, SELF-ACTING, is a contrivance whereby a candle can be extinguiſhed at any given time after being lighted. There are ſeveral ways by which this can be effected. The moſt ſimple is placing the candle in a veſſel of water, with ſuch a length above the ſurface as will burn as long as a light is wanted; of courſe when the candle burns down to the water it will be extinguiſhed.

Figs. 10 and 11, *Plate* XII. *Miſcellany*, repreſent two neat mechanical contrivances for the above purpoſe; in *fig.* 10, *a a* is a braſs clip, formed of two pieces, and jointed together by the pin, *b*, by means of a ſliding ring, *d*; this clip can be cloſed round the candle ſo as to fix firmly thereto; the pin, *b*, has a joint in the upper end to receive a crooked lever, *e*, which has a conical extinguiſher faſtened at the other end of it. This extinguiſher is held up from falling upon the candle, by means of a ſmall wire, *f*, which is bent ſideways at the end, and thruſt into the candle, at the place where it is intended to be put out; as the tallow is conſumed, it becomes ſo ſoft as to be unable to ſuſtain the preſſure of the wire, *f*, which therefore flies forward, and the extinguiſher falls upon the candle. It muſt be obſerved that the wire, *f*, muſt only be put into the tallow, but not in the wick, as it might not then fall down quickly.

Fig. 11 is another extinguiſher, invented by Mr. J. J. Hawkins, and placed in his muſeum of mechanical inventions: *a a* is a pair of nippers, made of tinned iron plate, and jointed in the middle; between the outer ends a piece of watch-ſpring is fixed, which cauſes the ends, *b*, to cloſe upon the candle, and thus hold the extinguiſher on the candle. The centre-pin of the joint is long enough to ſerve for the centre of another clip, *b b*, which is exactly ſimilar to the lower one, except that inſtead of the bow to embrace the candle, two wires, *c*, *e*, are fixed to the ends, to ſhut the extinguiſher, which is compoſed of two flat plates, *f*, *f*, which open and ſhut upon the joint, *g*. The ſpring between the ends of the nippers, *b*, *b*, has a conſtant tendency to cloſe the extinguiſher, but is prevented from ſhutting by the candle. When the candle burns away, it becomes ſoft at the place where the extinguiſher bites the ſpring, then ſhuts it up, and puts out the light.

EXTINGUISHMENT, in *Law*, is uſed for a conſolidation. Thus, if a man, having a yearly rent due to him out of my lands, afterwards purchaſe the ſame lands; both the property and rent, becoming conſolidated, or united in one poſſeſſor, the rent is ſaid to be extinguiſhed.

So, where a man has a leaſe for years, and afterwards buys the property, there is a conſolidation of the property, and an extinguiſhment of the leaſe.

But if a man have an eſtate in land merely for life or years, and hath a higher eſtate in a fee-ſimple, in the rent, this rent is not extinguiſhed, but in ſuſpence for a time; for, after the term, the rent ſhall revive. (Terms de Ley.) See RELEASE.

So alſo, if there be lord meſne and tenant, and the lord purchaſe the tenancy, the meſnalty is extinct.

Likewiſe by purchaſing of lands wherein a perſon hath common appendant, the common is extinguiſhed. (Cro. El. 594.) A releaſe of common in one acre, is an extinguiſhment of the whole common. Shower's Rep. 350.

And where a perſon hath common of vicinage, if he incloſes any part of the land, all the common is extinct. (1 Brownl. 174.) If a man hath a highway appendant to land, and afterwards purchaſeth the land wherein the highway is, the way is extinct: though it is held, that a way of neceſſity to a market or church, or to arable land, is not ſo extinguiſhed. 11 Hen. VII. 25 Co. Litt. 155.

EXTINGUISHMENT *of a copyhold* takes place on any act of the copyholder's, which denotes his intention to hold no longer of his lord, and amounts to a determination of his will. (Hutt. 81. Cro. Eliz. 21. 1 Jon. 41.) As if a copyholder in fee accepts a leaſe for years of the ſame land from the lord, or accepts an aſſignment of a leaſe made to another from the leſſee, his copyhold is extinct. (Moor. 184. 2 Co. 166. Godb. 11. 101.) A copyhold eſtate is extinct whenever it becomes not demiſeable by copy. Coke's Copyholder, 62. See COPY-HOLD.

EXTINGUISHMENT *of debt* happens in a variety of caſes. Thus, if a creditor accepts a higher ſecurity than he had before, or accepts a bond for a legacy, the firſt debt or legacy is hereby extinguiſhed.

EXTINGUISHMENT *of liberties*. If liberties and franchiſes granted by the king, ſuch as felon's goods, waifs, ſtrays, wrecks, &c. (9 Rep. 25.) come again to the crown, they are extinct in the crown, and the king is ſeiſed of them *jure coronæ*: but if liberties of fairs, markets, or other franchiſes, and juriſdictions, be erected, and created by the king, they will not be extinguiſhed, nor their appendances ſevered from the poſſeſſion. 9 Rep. 25.

EXTINGUISHMENT *of ſervices*. If the lord purchaſes or, accepts any part of the tenancy, out of which an entire ſervice is to be paid or done, the ſervice becomes thereby extinct; unleſs it be for the public good, or homage and fealty, which are not ſubject to extinguiſhment. (6 Rep. 1. 105. Co. Litt. 149.) If the lord and another perſon do purchaſe the lands out of which he is to have ſervices, they are extinct; alſo by ſeverance of the ſervices a manor may be extinguiſhed. Co. Litt. 147. 1 And. 257. See Tenure.

Extinguishment *of ways*. See Extinguishment.

EXTIRPATION, formed of *ex* and *ſtirps*, *root*, the act of pulling up, or deſtroying, a thing to the very roots.

Among the prayers of the Romiſh Jubilee, there is one for the extirpation of hereſy.

Extirpation. This word, in *Surgery*, ſignifies the eradication of any diſeaſe, tumour, &c. by ſome manual operation, whether done with a cutting inſtrument, with cauſtic, with a ligature, or any other means.

Thus, the generality of tumours are extirpated with a knife; but ſome, which claſs as excreſcences, or warts, are frequently extirpated with cauſtic, or with the ligature. The extirpation of polypi in the noſe is, for the moſt part, accompliſhed with forceps, by which ſuch tumours are pulled, or rather twiſted off.

The art of extirpating encyſted tumours with adroitneſs conſiſts in diſſecting the parts, ſurrounding the tumour, without wounding the cyſt. If the latter accident occur, the contents frequently flow out, the cyſt collapſes, and the continuance of the diſſection is attended with more difficulty. It is a great point to remove every particle of the cyſt, and, hence, it is ſatisfactory to take it out entire, that is, without wounding it. When any portion remains behind, the wound will frequently not heal, in conſequence of fungous granulations, ariſing from the diſeaſed part. Unleſs the ſwelling be large, a ſingle inciſion through the ſkin is ſufficient; but, in other inſtances, it is advantageous to make two cuts in this manner ( ); firſt, becauſe it facilitates the removal of the tumour; ſecondly, becauſe it prevents a redundance of ſkin, which would take place, if none were removed, and would greatly retard the cicatrization of the wound.

After the operation, the edges of the wound are to be brought together with ſticking plaſter, and a compreſs and bandage are to be applied.

When the breaſt is affected with any diſeaſe of an incurable nature, the ſurgeon can ſometimes extirpate the malady by cutting away the whole of the diſeaſed parts.

If the diſeaſe be of a ſcirrhous or malignant nature, ſome particularity in the mode of operating is requiſite. The ſurgeon ought, in this caſe, not to be content with merely removing parts, which are palpably and viſibly diſeaſed, but he ſhould alſo endeavour to remove a certain quantity of the ſubſtance, which is in the immediate circumference of the diſeaſe. In ſcirrhus, every ſurgeon knows the propenſity of the ſkin to be affected, and the frequent extenſion of white morbid bands into the ſurrounding adipoſe ſubſtance. Theſe facts greatly confirm the propriety of making a free removal of the ſkin, whenever it is in the leaſt diſcoloured, puckered, adherent to the ſwelling beneath, or in any way altered; and of taking away a good deal of the fat, in which ſcirrhous tumours are ſometimes involved. When there are no reaſons for ſuppoſing the diſeaſe of the breaſt to be any thing elſe than a mere ſarcomatous enlargement, the removal of the ſkin muſt certainly be conſidered unneceſſary. When cancer recurs, the ſkin is the firſt part in which it uſually makes its appearance, and the ſkin of the nipple in particular. Hence, many ſurgeons always make it a rule to remove the latter part, when it is judged proper to take away any of the integuments.

The operation is uſually performed as the patient is in a ſitting poſture, well ſupported by pillows and aſſiſtants.

The pectoral muſcle is to be made tenſe by keeping the arm back, by means of a ſtick, placed tranſverſely behind the back, in front of the two arms.

If none of the integuments are to be removed, a ſtraight inciſion is to be made through them; the tumour is to be regularly diſſected all round from the circumjacent parts; and, laſtly, its baſe is to be detached from its connections, from above downward, till the whole is ſeparated.

This is the mode of removing all ſimple tumours, which are not of a malignant nature, and which are not of an immenſe ſize.

When the tumour is of a malignant nature, and adherent to the ſkin and pectoral muſcle beneath, the operator is to remove, at leaſt, an inch or two of the fat on every ſide of the diſeaſe. The portion of the ſkin intended to be taken away muſt be included in two ſemi-circular inciſions, which meet thus ( ) at their extremities; and when the baſe of the tumour is to be detached, the ſurface of the pectoral muſcle, wherever it is adherent to the tumour, is alſo to be removed.

It is ſufficiently obvious, that the advantage of making the inciſion in the above manner conſiſts in enabling the ſurgeon to bring the edges of the wound together after the operation, ſo as to form a ſtraight line, and unite by the firſt intention.

The mere magnitude of a tumour frequently renders it highly judicious to take away a portion of the ſkin in the above method. If ſome were not removed, the diſſection of the tumour would be exceedingly tedious; and, after the operation, the looſe undiſtended ſkin would lie in folds, and form, as it were, a large pouch for the lodgment of matter.

The tumour being removed, the ſurgeon ſhould examine the interior of the wound, in order to aſcertain that no indurated part is left behind. If any hardneſs ſhould be felt, it is proper to remove it. The ſurgeon ſhould alſo examine the ſurface of every ſcirrhous tumour, immediately after it is taken out, for the purpoſe of knowing whether any of the white bands, ſhooting into the ſurrounding fat, have been divided; for, in this caſe, ſome portions have been left behind, and ought to be taken away. Their ſituation may eaſily be known, by conſidering the poſition of the tumour before the operation.

When the diſſection of a ſwelling will occupy a conſiderable time, it is always judicious practice to tie every large artery as ſoon as it is divided. This remark is not meant to comprehend veſſels of ſuch a diameter, that though they bleed when firſt cut, they do not emit blood afterwards, ſo as to require a ligature. It was Default's invariable method, in cutting out tumours, to tie every large artery before he continued the diſſection.

When a tumour of the breaſt has been entirely detached, and the hemorrhage ſuppreſſed, the ſtick confining the arm backward is to be removed. Then if there are any diſeaſed glands in the axilla, it is a very excellent plan to tie the pedicles, by which they are attached on the ſide towards the axilla, before attempting to cut the tumours completely away. It would be extremely difficult, after taking off the gland, to tie the little ſhort artery which enters the ſwelling, almoſt immediately after it has quitted one of the thoracic arteries. The bleeding alſo, in conſequence of the ſhortneſs of the veſſel, and vicinity of its orifice to the thoracic arteries, would be exceedingly profuſe, ſeeming rather to ariſe from a wound of the latter veſſels than of a ſmall branch.

The celebrated Deſault uſed to purſue the practice above recommended ; and ſir Charles Blicke has long been in the habit of obſerving the ſame rule, in the numerous operations which he has performed with the utmoſt benefit to the afflicted, and well deſerved honour to himſelf.

When the operation is finiſhed, the ſkin of the wound is to be relaxed, and the edges of the inciſion brought together with ſtrips of adheſive plaſter. Proper compreſſes and bandages are next to be applied. Should the operation have been the removal of a diſeaſed breaſt, the neareſt arm ſhould be kept completely at reſt in a ſling, as whenever it moves, it occaſions a diſturbance of the pectoral muſcle, and, of courſe, of the wound. (Firſt lines of the "Practice of Surgery," by Samuel Cooper.)

For the mode of extirpating a diſeaſed teſtis, ſee CASTRATION.

The method of effecting the extirpation of polypi is to be deſcribed in the article POLYPUS.

Some obſervations are offered, under the head EXOSTOSIS, on the ſubject of extirpating tumours of the bones. The way in which a diſeaſed eye ought to be cut out, will be hereafter explained. See EYE, *Extirpation of*.

For an account of the plan of extirpating certain excreſcences, ſee EXCRESCENCE.

EXTIRPATIONE, in *Law*, a judicial writ, either before or after judgment, that lies againſt a perſon, who when a verdict is found againſt him for land, &c. doth maliciouſly overthrow any houſe, or extirpate any trees upon it. Reg. Jud. 13. 56.

EXTISPEX, formed of *exta*, and *ſpicere*, of *ſpicio*, or *inſpicere*, *I view*, *conſider*, in *Antiquity*, an officer who viewed and examined the intrails of victims ; in order to draw preſages from them as to futurity.

This kind of divination, called extiſpicium, was much in vogue throughout Greece, where there were two families, the Jamidæ and Clytidæ, conſecrated, or ſet apart, peculiarly for it.

It appears to have been very ancient, and was probably derived from the ancients. Vitruvius, cap. 4. lib. i. gives the following plauſible account of its origin. He ſays that the ancients inſpected the livers of thoſe animals which frequented the places where they intended to build or encamp ; and if they commonly found that the liver, to which they attributed ſanguification, was injured, they concluded that the waters and nouriſhment collected near ſuch places were not wholeſome.

In Italy, the firſt extiſpices were the Etrurians or Tuſcans ; among whom, likewiſe, the art was in great repute. Lucan gives us a fine deſcription of one of theſe operations in his firſt book.

EXTORTION, in *Law*, denotes generally any oppreſſion under colour of right ; and it is uſually applied to ſignify an illegal manner of wreſting any thing from a man, either by force, menace, or authority : *e. g.* if an officer, by terrifying another on pretence of his office, or "by colour of his office," takes more than his ordinary fees or dues, he commits, and is indictable for, extortion.

So the exacting of unlawful uſury, winning by unlawful game, and, in fine, all taking of more than is juſtly due, by colour or pretence of right, as exceſſive tolls in millers, exceſſive prices of ale, bread, victuals, wares, &c. come under extortion.

Crompton ſays, that wrong done by any man is properly a treſpaſs, but exceſſive wrong is extortion ; which is moſt properly applicable to ſheriffs, mayors, bailiffs, and other officers, who, by colour of their office, greatly oppreſs and wrong the king's ſubjects, by taking exceſſive reward, or fees, for executing their office : and extortion has been deemed more odious than robbery, becauſe it carries an appearance of truth ; and is often accompanied with perjury in officers, &c. by violating their oaths of office. The diſtinction between bribery and extortion ſeems to be this : the former offence conſiſts in the *offering* a preſent, or receiving one if offered ; the latter, in *demanding* a fee, or preſent, by colour of office. Extortion by the common law is ſeverely puniſhed, on indictment, by fine and impriſonment, and removal of officers from the offices in which the crime was committed. By the ſtat. 3 Edw. I. inferior officers of juſtice, &c. guilty of extortion, are to render by c. 26. double, and by c. 30. treble, value ; and there are divers other ſtatutes for puniſhing extortions of ſheriffs, bailiffs, gaolers, clerks of the aſſiſe, and of the peace, attornies and ſolicitors, &c. ſtats. 23 H. VI. c. 7 & 9. 33 H. VIII. c. 24. 29 Eliz. c. 4. 1 Jac. I. c. 10. 9 & 10 W. III. c. 41. 10 & 11 W. III. c. 23. 3 Geo. I. c. 15. 17 Geo. III. c. 26. § 6. In caſes of extortion, there muſt be a poſitive charge, that the charged perſon did it *extorſivé*, or *colore officii*. The place where it was committed muſt be ſet down in the declaration ; the ſum extorted particularly ſpecified, and the indictment or information muſt ſtate the full particulars by ſpecifying the time, &c. Againſt attornies for extortion, action may be brought, and the party aggrieved ſhall have treble damages and coſts ; but information will not lie on the ſtat. 3 Jac. I. c. 7. Sid. 434. 4 Nelſ. 822.

EXTRA-*Conſtellary Stars*. See SPORADES.

EXTRA-*judicial*, ſomething done out of the proper court, or the ordinary courſe of law. As when judgment is given in a cauſe, or caſe, not depending in that court where ſuch judgment is given, or wherein the judge has no juriſdiction.

EXTRA-*mundane ſpace*, is the infinite empty void ſpace, which is by ſome ſuppoſed to be extended beyond the bounds of the univerſe, and conſequently in which there is really nothing at all.

EXTRA-*parochial*, a place out of the bounds of any pariſh ; or privileged and freed from the duties of a pariſh.

EXTRACT, in *Chemiſtry*. The term extract, as uſed in chemical nomenclature, has been borrowed from the pharmaceutical diſpenſatories, where it has long been applied to a great variety of ſubſtances which have little other agreement than in the mode of preparation, which conſiſts in extracting by water, or any other menſtruum, the ſoluble part of certain parts of vegetables, and inſpiſſating this ſolution by heat to a thick conſiſtence, or ſometimes to entire ſolidity.

The term extract, therefore, in its original and pharmaceutical ſenſe, only refers to the mode of preparation, and not to the nature of the ſubſtance prepared ; and hence much confuſion and uncertainty have prevailed in the attempts of chemiſts to define the nature of the ſubſtance to which this term ſhould in ſtrictneſs be limited.

All the pharmaceutical extracts are extremely compounded, for being prepared either by water or alcohol, of courſe every thing ſoluble in theſe liquids would be confounded in the general maſs. Hence we find in one or other, and ſometimes in a ſingle extract, mucilage, ſugar, tannin, gallic acid, reſin, gluten, ſeveral neutral ſalts, and other ingredients. But along with theſe there always is found a conſiderable quantity of a brown tenacious ſubſtance, often with a bitter taſte, and poſſeſſing a number of chemical properties, which entitle it to be conſidered as a peculiar ſubſtance, and to which the term extract, or extractive principle, has been given.

The diſtinguiſhing properties of this ſubſtance have been laid down with much ability by Vauquelin, in his memoir on the extractive principle (Journal de Pharmacie, p. 132.) and in his reſearches on the ſap and native juices of trees (An. Chem. tom. 31.) and alſo by Fourcroy in an elaborate and excellent analyſis of the cinchona of St. Domingo. An. Chem. tom. 8 & 9.

We ſhall firſt notice the experiments of Vauquelin, which being made on the native juices of plants, the extract already in ſolution, and unaltered by the heat requiſite in artificial decoction, is probably in a purer ſtate.

When the ſap of any tree is firſt drawn it is always colourleſs, or nearly ſo, but when inſpiſſated by heat, however moderate, it always aſſumes a brown colour, and in the proceſs of evaporation a certain though ſmall quantity of pulverulent brown inſoluble matter falls down. If this is collected ſeparately before the juice is entirely inſpiſſated, and treated with muriatic acid, one portion diſſolves with effervеſcence, and is found to be chiefly carbonat of lime, and an inſoluble part remains, which is conſidered by this excellent chemiſt as extract altered and oxygenated during the evaporation. If the concentrated ſap is now ſlowly evaporated to dryneſs, it yields a brown extract, ſtrongly deliqueſcent, and of a pungent ſaline taſte. This entire extract is always extremely compounded, containing in fact all the ſoluble ingredients of the original juice. Gallic acid, when preſent, is detected by a ſolution of iron; tannin, by a ſolution of iſinglaſs; ſalts of lime, by oxalic acid; ſugar, by the taſte, and by its ſoon acquiring the vinous fermentation. The entire extract alſo always contains acetous acid, partly in exceſs and partly united both to lime, potaſh, and ammonia, and hence when a few drops of ſtrong ſulphuric acid are poured upon any extract, copious vapours of pungent acetic acid are given out; and if this is done with large quantities, and in cloſe veſſels, acetic acid may be obtained pure. It is probably owing to the preſence of theſe neutral acetites, that all the inſpiſſated native juices attract moiſture ſtrongly from the air, and hence too their great diſpoſition, to mould and change by keeping.

Ammonia alſo is detected in moſt inſpiſſated juices of plants by the pungent vapours of this alkali, that are perceived on the addition of quick-lime, but in the natural ſtate the ammonia is more than neutralized by the acetous acid, as all the ſoft extracts redden betimes.

Extractive matter (meaning by this term the pure extract) appears to form a great portion of the colouring matter of vegetables. If to any liquid containing extract a ſolution of alum be added, a copious coloured inſoluble precipitate is produced, conſiſting chiefly of alumine in intimate combination with extractive matter, and the ſupernatant liquor remains clear and nearly colourleſs. The ſame proceſs takes place in dyeing, the alum being firſt fixed on the cloth as a *mordant*, as it is called. The ſolutions of tin poſſeſs this power of precipitating coloured extract as an inſoluble powder in a ſtill more ſtriking manner. That of the other metallic ſalts produce a ſimilar precipitate of extract, combined with the metallic oxyd.

The experiments of Fourcroy on the cinchona have been detailed at length under that article, to which we refer our readers. It may be obſerved in this place, that the facts relative to the ſubject of extract were, ſhortly, that the decoction of cinchona during evaporation depoſited a quantity of black matter, inſoluble in cold water, but which moſtly was diſſolved in alcohol, leaving however a portion of a red powder of a peculiar nature, which the author of the experiments conſiders as extractive matter, changed by union with oxygen, and thereby rendered inſoluble in water or alcohol. The appearance of this powder, and its inſolubility in water, might at firſt lead to the ſuppoſition that it was reſin, but its equal inſolubility in alcohol refutes this idea.

The preciſe nature of this inſoluble matter, which is depoſited on the evaporation of all vegetable infuſions or decoctions, is hitherto not known, and ſeveral objections to the opinion of its being merely *oxygenated extract* may be adduced, which we have already detailed under the article Cinchona.

On the whole, however, we may ſafely admit, that there is a peculiar ſubſtance found in almoſt all ſoluble matter of vegetables, and particularly in the common circulating juices, to which the term extract, or pure extractive principle, has been given, and which has the following diſtinguiſhing properties.

In its natural ſtate in the ſap of trees it is colourleſs, or nearly ſo; but when the ſolution is heated and inſpiſſated, it always acquires a deep colour, which is generally brown or fawn, with various ſhades, and by the ſame proceſs its ſolubility in cold water is diminiſhed.

It is in its natural ſtate equally ſoluble in alcohol as in water, by which circumſtance it is diſtinguiſhed both from pure mucilage and reſin.

It is inſoluble in ether.

It has a very ſtrong affinity with alumine, and with metallic oxyds, and when combined with ether it becomes inſoluble in water, alcohol, and many other menſtrua. By deſtructive diſtillation it is reſolvable into carbon, oxygen, and hydrogen, and a ſmall proportion of azot.

Much variety is found in the properties of ſmell, taſte, and colour, in the various extracts, and we are ſtill totally ignorant how far theſe varieties may depend on other admixtures, or whether there are different ſpecies of extract; and in general we may add that this ſubſtance appears to be one which moſt eaſily enters into intimate combination with all the other ſoluble vegetable principles, and, conſequently, can hardly by any known means be obtained pure, as it exiſts in the vegetable itſelf, and unchanged by the proceſſes of analyſis.

Extract, in *Pharmacy*. The greater number of pharmaceutical extracts are made by boiling the ſubſtance (in coarſe powder) in water, ſtraining the decoction, boiling it down till it is conſiderably concentrated, then gently drying the reſidue in a ſtove, or ſlow oven, to the requiſite conſiſtence.

A few of the extracts are made with alcohol inſtead of water, or with a mixture of the two; the ſubſtance being firſt digeſted with the alcohol, and the tincture, thus prepared, ſtrained off; the reſidue then boiled with water, and the decoction poured off, and both the decoction and tincture mixed, and evaporated ſlowly.

The purely ſpirituous extracts are alſo called reſins, and are always evaporated to dryneſs, when they remain hard brittle maſſes, with a vitreous fracture, reſoluble in alcohol, and in all eſſential characters reſembling the natural reſins.

In preparing the extracts by water the decoctions are uſually directed to be ſet aſide for ſome hours, that any ſediment may be depoſited, which laſt is to be rejected. But this is obviouſly a bad practice, as in many caſes much of the medicinal property of the plant reſides in this reſidue which ſubſides from the hot decoction on cooling.

Another ſpecies of extracts is the inſpiſſated juices of plants. Several powerfully medicinal plants, ſuch as the hemlock, are ſucculent vegetables, which, when ſtrongly expreſſed, yield a large quantity of a green turbid juice, which (after ſeparating the mere fragments of the plant) only requires to be inſpiſſated by a very gentle heat, to form the extract in the form in which it is uſed.

All the extracts, except thoſe made by alcohol, are liable to ſpoil by keeping. This is particularly the caſe with the inſpiſſated juice of the ſucculent plants, being compoſed of materials all extremely liable to fermentation, and being kept in a conſtant tendency to deliqueſcence by the neutral acetites which they contain. Therefore they muſt be kept in cloſe veſſels, but with every care the moſt important of them loſe their medicinal quality in no great length of time.

Extract, in *Matters of Literature*, denotes a ſhort abridgment of a book or paper, or of ſome of the matters thereof. The journals, nouvelles, bibliotheques, memoires, and other monthly reviews, or quarterly accounts of the affairs of learning, conſiſt principally of extracts of the moſt material paſſages, doctrines, &c. found in the ſeveral books publiſhed in that time.

Extract *ab Eccleſia*. See Restitutione *Extracti*.

EXTRACTA Curiæ, in our *Old Writers*, the iſſues or profits of holding a court, ariſing from the cuſtomary fees, &c.

EXTRACTION, in *Pharmacy* and *Chemiſtry*, an operation, whereby eſſences, tinctures, &c. are drawn from natural bodies. See Extract.

Extraction, in *Surgery*, is the drawing from, or out of the body, any thing fixed in it, as a thorn, or bullet, in the fleſh, a tooth from the jaw, &c. Surgeons ſpeak alſo of the extraction of a ſtone from the bladder, a cataract from the eye, foreign bodies from the œſophagus, extraneous ſubſtances from wounds, &c. For a deſcription of the methods of extracting a ſtone from the bladder, ſee Lithotomy.

The operation of extracting the cataract is explained in the article Cataract.

Extraction, or *Deſcent*, in *Genealogy*, denotes the ſtock, or family, which a perſon is deſcended from.

In ſome military orders, chapters, &c. a candidate muſt make proof of the nobility of his extraction before he is admitted.

Extraction *of Roots*, the method of finding the roots of given numbers, or quantities. See Root.

The ſquare, cube, and other powers of a number, or root, are formed by multiplying the given number into itſelf a greater or leſs number of times, as the power required is higher or lower. See Power.

This multiplication compounds the powers; and the extraction of the roots decompounds them again, or reduces them to their principles or roots. So that the extraction of the root is to the multiplication of the power, what the analyſis is to the ſyntheſis.

Thus, 4, multiplied by 4, produces 16; which is the ſquare of 4, or the factum of 4, by itſelf; and 16 multiplied by 4, makes 64, which is the cube of 4, or the factum of 4 by its ſquare. Such is the compoſition of powers.

Again, the ſquare root of 16 is 4, becauſe 4 is the quotient of 16 divided by 4; and the cube root of 64 is likewiſe 4, as 4 is the quotient of 64 divided by the ſquare of 4. Such is the extraction of roots.

Hence to extract the root out of a given power, is the ſame thing as to find a number, *e.gr.* 4, which being multiplied a certain number of times into itſelf, produces the given power, *e.gr.* 16 or 64.

For the extraction of ſquare and cube roots, it is neceſſary to have the ſquares and cubes of all the digits in readineſs; as exhibited in the following table.

Roots	1	2	3	4	5	6	7	8	9
Square	1	4	9	16	25	36	49	64	81
Cube	1	8	27	64	125	216	343	512	729

To extract the ſquare root out of a given number.—1. Divide the given number into claſſes, of two figures a-piece; and include each claſs between two dots, commencing with the place of units, and proceeding to the left in integers, and to the right in decimals; the root will conſiſt of ſo many parts or figures as you have claſſes. By the way obſerve, it may happen, that for the laſt claſs on the left hand there ſhall be only one figure left.

2. Then the left-hand claſs being the ſquare of the firſt figure of the root ſought, look in the table of roots for the ſquare root anſwering to that number; or, if that ſquare number be not preciſely there, to the next leſſer number: this root write down for the firſt figure of the quotient; and ſubtract its ſquare from the left-hand claſs. To the remainder bring down the next claſs toward the right.

3. Write down the double of the quotient figure under the left-hand figure of the ſecond claſs; and ſeek how oft this duple is contained in the figure over it: the quotient gives the ſecond figure of the root.

4. Write the ſame quotient under the right-hand figure of the ſame claſs, and ſubtract the product of the whole number underwritten, multiplied by the ſecond figure of the root, from the number over it, as in diviſion.

5. The operation being repeated according to the third and fourth ſteps, *i. e.* the remainder being ſtill divided by the double of the root as far as extracted; and from the remainder ſubtract the product of the laſt diviſor, having the laſt found figure of the quotient added to it, multiplied by this figure, you will have the root required.

E. gr. To extract the root of 99856, point it after the following manner, $\dot{9}9\dot{8}5\dot{6}$: then ſeek a number, whoſe ſquare ſhall equal the firſt figure 9, *viz.* 3, and write it in the quotient; then having ſubtracted from 9, 3 × 3, or 9, there will remain 0; to which ſet down the figures as far as the next point, *viz.* 98, for the following operation. Then, taking no notice of the laſt figure 8, ſay, How many times is the double of 3, or 6, contained in the firſt figure 9? Anſwer, 1. Wherefore, having written 1 in the quotient, ſubtract the product, of 1 × 61, or 61 from 98, and there will remain 37, to which connect the laſt figures 56, and you will have the number 3756, in which the work is next to be carried on. Wherefore, alſo neglecting the laſt figure of this, *viz.* 6, ſay, How many times is the double of 31, or 62, contained in 375 (which may be gueſſed at from the initial figure 6 and 37, by taking notice how many times 6 is contained in 37)? Anſwer 6; and writing 6 in the quotient, ſubtract 6 × 626, or 3756, and there will remain 0; whence it appears, that the buſineſs is done, the root coming out 316.

```
.  .  .
99856 ( 316
9
-----
098
 61
-----
3756
3756
-----
   0
```

Otherwiſe, with the diviſors ſet down, it will ſtand thus;

```
 .  .  .
99856 (316
9
------
6) 98
    61
    -------
62) 3756
    3756
    -------
       0      And ſo in others.
```

Again, if you were to extract the ſquare root out of 22178791:

```
 .  .  .  .
22178791 ( 4709, 43637, &c.
16
---
 617
 609
 ------
  88791
  84681
  -------
   411000
   376736
   --------
    3426400
    2825649
    --------
     60075100
     56513196
     ---------
      356190400
      282566169
      ----------
       73624231
       ----------
```

Firſt having pointed it, ſeek a number, whoſe ſquare (if it cannot be exactly equalled) ſhall be the next leſs ſquare (or neareſt) to 22, the figures to the firſt point, and you will find it to be 4. For 5 × 5, or 25, is greater than 22; and 4 × 4, or 16, is leſs; wherefore 4 will be the firſt figure of the root. This, therefore, being writ in the quotient, from 22 take the ſquare 4 × 4, or 16; and to the remainder 6, adjoin the next figures 17, and you will have 617; from whoſe diviſion, by the double of 4, you are to obtain the ſecond figure of the root, *viz.* neglecting the laſt figure 7, ſay, how many times is 8 contained in 61? Anſwer, 7; wherefore write 7 in the quotient, and from 617 take the product of 7 into 87, or 609, and there will remain 8, to which join the two next figures 87, and you will have 887; by the diviſion whereof by the double of 47, or 94, you are to obtain the third figure; in order to which ſay, how many times is 94 contained in 88? Anſwer, 0; wherefore write 0 in the quotient, and adjoin the two laſt figures 91, and you will have 88791, by whoſe diviſion by the double of 470, or 940, you are to obtain the laſt figure; *viz.* ſay, how many times 940 in 8879? Anſwer, 9; wherefore write 9 in the quotient, and you will have the root 4709. But ſince the product 9 × 9409, or 84681, ſubtracted from 88791, leaves 4110, the number 4709 is not the root of the number 22178791 preciſely, but a little leſs.

If then it be required to have the root approach nearer, carry on the operation in decimals, by adding to the remainder two cyphers in each operation. Thus, the remainder 4110, having two cyphers added to it, becomes 411000; the diviſion whereof, by the double of 4709, or 9418, will give the firſt decimal figure 4. Then having writ 4 in the quotient, ſubtract 4 × 94184, or 376736, from 411000, and there will remain 34264. And ſo having added two more cyphers, the work may be carried on at pleaſure, the root at length coming out 4709, 43637, &c.

But when the root is carried on half way or above, the reſt of the figures may be obtained by diviſion alone: as in this example, if you have a mind to extract the root to nine figures, after the five former 4709,4 are extracted, the four latter may be had, by dividing the remainder by the double of 4709,4.

Thus if the root of 32976 were to be extracted to five places, in numbers; after the figures are pointed, write 1 in the quotient, as being the figure of whoſe ſquare 1 × 1, or 1, is the greateſt that is contained in 3, the figure to the firſt point; and having taken the ſquare of 1 from 3, there will remain 2; then having ſet the two next figures, *viz.* 29, to it (*viz.* to 2,) ſeek how many times the double of 1, *viz.* 2, is contained in 22, and you will find indeed that it is contained more than ten times; but you are never to take your diviſor 10 times, nor even 9 times in this caſe; becauſe the product of 9 × 29, or 261, is greater than 229, from which it would be to be taken, or ſubtracted; wherefore write only 8. And then having written 8 in the quotient, and ſubtracted 8 × 28, or 224, there will remain 5; and having ſet down to this the figures 76, ſeek how many times the double of 18, or 36, is contained in 57, and you will find one, and ſo write 1 in the quotient; and having ſubtracted 1 × 361, or 361, from 576, there will remain 215. Laſtly, to obtain the remaining figures, divide this number 215, by the double of 181, *viz.* 362, and you will have the figures, 59 which, being writ in the quotient, give the root 181,59. After the ſame manner are roots extracted out of decimal numbers. Thus the root of 329,76 is 18,159; and the root of 3,2976 is 1,8159, and the root of 0,032976, is 0,18159, and ſo on. But the root of 3297,6 is 57,4247; and the root of 32,976 is 5,74247. And thus the root of 9,9856 is 3,16.

```
 .  .  .
32976 (  181,59
---
1
-----
  2)229
     224
     -----
36)   576
      361
    -------
362)  215(59, &c.
    ---------
```

To extract the other, or higher root, out of a given number.—The extraction of the cubic root, and all other roots, may be comprehended under one general rule; *viz.* every third figure, beginning from unity, is firſt to be pointed, if the root to be extracted be a cubic one; or every fifth, if it be a quadrato-cubic (or of the fifth power;) and then ſuch a figure is to be writ in the quotient, whoſe greateſt power (that is, whoſe cube, if it be a cubic power, or whoſe quadrato-cube, if it be the fifth power, &c.) ſhall either be equal to the figure, or figures, before the firſt point, or next leſs under them; and then having ſubtracted that power, the next figure will be found by dividing the remainder augmented by the next figure of the reſolvend, by the next leaſt power of the quotient multiplied by the index of the power to be extracted, that is, by the triple ſquare, if the root be a cubic one; or by the quintuple biquadrate, (that is, five times the biquadrate,) if the root be of the fifth power, &c. And having again ſubtracted the power of the whole quotient from the firſt reſolvend, the third figure will be found by dividing that remainder, augmented by the next figure of the reſolvend, by the next leſſer power of the whole quotient, multiplied by the index of the power to be extracted.

Thus, to extract the cube root of 13312053, the number is firſt to be pointed after this manner, *viz.* 13312053 then you are to write the figure 2, whoſe cube is 8, in the firſt place of the quotient, as that which is the next leſſer cube to the figure 13, (which is not a perfect cube number) or as far as the firſt point; and having ſubtracted that cube, there will remain 5; which being augmented by the next figure of the reſolvend 3, and divided by the triple ſquare of the quotient 2, by ſeeking how many times 3 × 4, or 12, is contained in 53, gives 4, or the ſecond figure of the quotient. But ſince the cube of the quotient 24, *viz.* 13824, would come out too great to be ſubtracted from the figures 13312, that precede the ſecond point, there muſt only 3 be writ in the quotient; then the quotient 23 being in a ſeparate place multiplied by 23, gives the ſquare 529, which again multiplied by 23, gives the cube 12167; and this taken from 13312, will leave 1145, which augmented by the next figure of the reſolvend 0, and divided by the triple ſquare of the quotient 23, *viz.* by ſeeking how many times 3 × 529, or 1587, is contained in 11450, gives 7, for the third figure of the quotient. Then the quotient 237, multiplied by 237, gives the ſquare 56169, which again multiplied by 237, gives the cube 13312053; and this taken from the reſolvend, leaves 0. Whence it is evident, that the root ſought is 237.

```
                    13312053 (237
Sub. the cube 8
              ——
      12) rem. : 53 4 or 3
      ————————————————
Subtract cube   12167
    1587) rem. : 11450 ( 7
    ——————————————————
                    13312053
            Remains        0
                    ————————
```

So alſo, to extract the quadrato-cubical root of 36430820, it muſt be pointed over every fifth figure; and the figure 3, whoſe quadrato-cube, or fifth power 243, is the next leſſer to 364, *viz.* to the firſt point, muſt be writ in the quotient. Then the quadrato-cube 243 being ſubtracted from 364, there remains 121, which augmented by the next figure of the reſolvend, *viz.* 3, and divided by five times the biquadrate of the quotient, *viz.* by ſeeking how many times 5 × 81, or 405, is contained in 1213, gives two for the ſecond figure. That quotient 32 being thrice multiplied by itſelf, makes the biquadrate 1048576; and this again, multiplied by 32, makes the quadrato-cube 33554432, which, being ſubtracted from the reſolvend, leaves 2876388. Therefore 32 is the integral part of the root but not the true root; wherefore, if you have a mind to proſecute the work in decimals, the remainder, augmented by a cypher, muſt be divided by five times the aforeſaid biquadrate of the quotient, by ſeeking how many times 5 × 1048576, or 5242880, is contained in 2876388,0, and there will come out the third figure, or the firſt decimal 5. And ſo by ſubtracting the quadrato-cube of the quotient 32,5, from the reſolvend, and dividing the remainder by five times its biquadrate, the fourth figure may be obtained. And ſo on *in infinitum.*

```
           .  .
           36430820(32,5,
           ————
           245
       405)1213(2
           ———
           33554432
  5242880) 2876388,0(5
```

In ſome caſes it is convenient only to indicate the extraction of a root, eſpecially where it cannot be had exactly. Now, the ſign or character whereby roots are denoted, is $\surd$; to which is added, the exponent of the power, if it be above a ſquare, and even ſometimes if it be not. *E. gr.* $\sqrt[2]{}$ denotes the ſquare root; $\sqrt[3]{}$ the cube root, &c. See Root.

When a biquadratic root is to be extracted, you may extract twice the ſquare root, becauſe $\sqrt[4]{}$ is as much as $\surd \times \surd$. And when the cubo-cubic root is to be extracted, you may firſt extract the cube root, and then the ſquare root of that cube root, becauſe the $\sqrt[6]{}$ is the ſame as $\sqrt[2]{} \times \sqrt[3]{}$; whence ſome have called theſe roots, not cubo-cubic ones but quadrato-cubes. And the ſame is to be obſerved in other roots, whoſe indices are not prime numbers.

To prove the extraction of roots.—1. For a *ſquare root*; multiply the root found by itſelf, and to the product add the remainder, if there were any: if the ſum be equal to the number given, the operation is juſt.

2. For a *cube root.* Multiply the root found by itſelf, and the product, again, by the ſame root. To the laſt product, add the remainder, if there were any. If the ſum come out the number firſt given, the work is juſt.

After the like manner may the extraction of the other roots be proved.

To extract the roots of equations, or algebraic quantities.—The extraction of roots out of ſimple algebraic quantities, is evident, even from the nature, or marks of notation itſelf; as that $\sqrt{aa}$ is a, and that $\sqrt{aacc}$ is ac, and that $\sqrt{9aacc}$ is 3ac; and that $\sqrt{49a^4xx}$ is 7aax. And alſo that $\sqrt{\frac{a^4}{cc}}$, or $\frac{\sqrt{a^4}}{\sqrt{cc}}$ is $\frac{aa}{c}$, and that $\sqrt{\frac{a^4bb}{cc}}$ is $\frac{aab}{c}$, and that $\sqrt{\frac{9aazz}{25bb}}$ is $\frac{3az}{5b}$, and that $\sqrt{\frac{4}{9}}$ is $\frac{2}{3}$, and that $\sqrt[3]{\frac{8b^6}{27a^3}}$ is $\frac{2bb}{3a}$, and that $\sqrt[4]{aabb}$ is $\sqrt{ab}$; moreover, that $b\sqrt{aacc}$, or b into $\sqrt{aacc}$, is equivalent to b into ac, or abc: and that $3c\sqrt{\frac{9aazz}{25bb}}$ is equivalent to $3c \times \frac{3az}{5b}$, or $\frac{9acz}{5b}$. And that $\frac{a+3x}{c}\sqrt{\frac{4bbx^4}{81aa}}$ is equivalent to $\frac{a+3x}{c} \times \frac{2bxx}{9a}$, or to $\frac{2abxx+6bx^3}{9ac}$ I ſay all theſe are evident, becauſe it will appear at firſt ſight, that the propoſed quantities are produced, by multiplying the roots into themſelves (as aa from a into a; aacc from ac into ac; 9aacc from 3ac into 3ac, &c.) The rule is to extract the required root of the numeral coefficient, if there be any, and to divide the exponents of the literal or algebraic quantities by the number that denominates the root required. It is evident from the application of this rule, that any power which has a poſitive ſign may have either a poſitive or negative root, if the root is denominated by an even number, becauſe + or −, multiplied into themſelves an even number of times will give +. Alſo, that if a power have a negative ſign, no root of it denominated by an even number can be aſſigned. But if the root to be extracted is denominated by an odd number, the ſign of the root will be the ſame as the ſign of the given quantity whoſe root is required. However, it will often happen, that the number, denominating the required root, will not exactly divide the exponent of the given power, in which caſe the required root will have a fractional exponent, thus, $\sqrt[3]{8a}$ is $= 2a\frac{1}{3}$. But when quantities conſiſt of ſeveral terms, the buſineſs is performed as in numbers.

Thus, to extract the ſquare root out of aa + 2ab + bb; in the firſt place, write the root of the firſt term aa, *viz.* a, in the quotient; and having ſubtracted its ſquare a × a, there will remain 2ab + bb to find the remainder of the root by. Say, therefore, how many times is the double of the quotient, or 2a, contained in the firſt term of the remainder 2ab? I anſwer, b [times]: therefore write b in the quotient, and having ſubtracted the product of b into 2a + b, or 2ab + bb, there

```
aa + 2ab + bb (a + b
aa
—
 0 + 2ab + bb
   + 2ab + bb
 ——————————————
    0     0
```

there will remain nothing; which ſhews that the work is finiſhed, the root coming out $a + b$.

And thus to extract the ſquare root out of $a^4 + 6a^3b + 5aabb - 12ab^3 + 4b^4$, firſt ſet in the quotient the root of the firſt term a^4, *viz.* aa, and having ſubtracted its ſquare $aa \times aa$, or a^4, there will remain $6a^3b + 5aabb - 12ab^3 + 4b^4$ to find the remainder of the root. Say, therefore, how many times is $2aa$ contained in $6a^3b$? Anſwer, $3ab$; wherefore write $3ab$ in the quotient; and having ſubtracted the product of $3ab$, into $2aa + 3ab$, or $6a^3b + 9aabb$, there will yet remain $-4aabb - 12ab^3 + 4b^4$, to carry on the work. Therefore, ſay again, how many times is the double of the quotient, *viz.* $2aa + 6ab$, contained in $-4aabb - 12ab^3$? or, which is the ſame thing, ſay, how many times is the double of the firſt term of the quotient, or $2aa$, contained in the firſt term of the remainder $-4aabb$? Anſwer, $-2bb$. Therefore having writ $-2bb$ in the quotient, and ſubtracted the product $-2bb$ into $2aa + 6ab - 2bb$, or $-4aabb - 12ab^3 + 4b^4$, there will remain nothing.

Whence it follows, that the root is $aa + 3ab - 2bb$.

$$\begin{array}{l}
a^4 + 6a^3b + 5aabb - 12ab^3 + 4b^4 \;(aa + 3ab - 2bb \\
a^4 \\
\overline{\quad} 6a^3b + 5aabb - 12ab^3 + 4b^4 \\
0 + 6a^3b + 9aabb \\
\hline
\quad 0 - 4aabb - 12ab^3 + 4b^4 \\
\quad\;\; - 4aabb - 12ab^3 + 4b^4 \\
\hline
\qquad\quad 0 \qquad\quad 0 \qquad\quad 0
\end{array}$$

And thus the ſquare root of the quantity $xx - ax + \frac{1}{4}aa$ is $x - \frac{1}{2}a$, and the ſquare root of the quantity $16a^4 - 24aaxx + 9x^4 + 12bbxx - 16aabb + 4b^4$ is $3xx - 4aa + 2bb$, and the ſquare root of the quantity $y^4 + 4y^3 + 8y^2 + 8y + 4$ is $yy + 2y + 2$; as may appear underneath.

1.
$$\begin{array}{l}
xx - ax + \frac{1}{4}aa \;(x - \frac{1}{2}a \\
xx \\
\hline
0 - ax + \frac{1}{4}aa \\
\hline
\qquad 0 \quad 0
\end{array}$$

2.
$$\begin{array}{l}
9x^4 \begin{array}{l} -24aa \\ +12bb \end{array} x^2 \begin{array}{l} +16a^4 \\ -16aabb \\ +4b^4 \end{array} \quad \left(3x^2 \begin{array}{l} -4aa \\ +2bb \end{array}\right. \\
9x^4 \\
\hline
0 \quad \begin{array}{l} -24aa \\ +12bb \end{array} x^2 \begin{array}{l} +16a^4 \\ -16a^2b^2 \\ +4b^4 \end{array} \\
\hline
\quad 0 \qquad 0
\end{array}$$

3
$$\begin{array}{l}
y^4 + 4y^3 + 8y^2 + 8y + 4 \;(yy + 2y + 2 \\
y^4 \\
\hline
0 \\
4y^3 + 8yy \\
\hline
\quad 0 + 4yy + 8y + 4 \\
\quad\;\; + 4yy + 8y + 4 \\
\hline
\qquad\quad 0 \qquad 0 \qquad 0
\end{array}$$

If you would extract the cube root out of $a^3 + 3aab + 3abb + b^3$, the operation is performed thus:

$$\begin{array}{l}
\quad a^3 + 3aab + 3abb + b^3 \;(a + b \\
\quad a^3 \\
3aa)\; 0 + 3aab \;(b \\
\hline
\quad a^3 + 3aab + 3abb + b^3 \\
\hline
\qquad\quad 0 \qquad\quad 0 \qquad\quad 0
\end{array}$$

Extract firſt the cube root of the firſt term a^3, *viz.* a, and ſet it down in the quotient: then ſubtracting its cube a^3; ſay, how many times is its treble ſquare, or $3aa$, contained in the next term of the remainder $3aab$; and there comes out b; wherefore write b in the quotient, and ſubtracting the cube of the quotient $a+b$, there will remain 0; therefore $a + b$ is the root. After the ſame manner, if the cube root is to be extracted out of $z^6 + 6z^5 - 40z^3 + 96z - 64$, it will come out $zz + 2z - 4$. And ſo likewiſe in higher roots.

The general rule for extracting any root out of any given quantity, is as follows. Having ranged the quantity according to the dimenſions of its letters, extract the ſaid root out of the firſt term, and that ſhall be the firſt member of the root required; then raiſe this root to a dimenſion lower by unit than the number that denominates the root required; and multiply the power that ariſes by that number itſelf; divide the ſecond term of the given quantity by the product, and the quotient ſhall give the ſecond member of the root required. The other members of the root, if there be more than two, are found after the ſame manner. In ſome caſes the exact root cannot be found in finite terms: thus, the ſquare root of $a^2 + x^2$ is found to be $a + \frac{x^2}{2a} - \frac{x^4}{8a^3} + \frac{x^6}{16a^5} - \frac{5x^8}{128a^7}$, &c.

The operation is thus:

$$\begin{array}{l}
\qquad\qquad a^2 + x^2 \;\left(a + \frac{x^2}{2a} - \frac{x^4}{8a^3} + \frac{x^6}{16a^5}\right., \text{&c.} \\
\qquad\qquad a^2 \\
2a + \left.\frac{x^2}{2a}\right) * + x^2 \\
\quad \times \left.\frac{x^2}{2a}\right) = x^2 + \frac{x^4}{4a^2} \\
\hline
2a + \frac{x^2}{a} - \left.\frac{x^4}{8a^3}\right) - \frac{x^4}{4a^2} \\
\quad \times -\left.\frac{x^4}{8a^3}\right) = -\frac{x^4}{4a^2} - \frac{x^6}{8a^4} + \frac{x^8}{64a^6} \\
\hline
\qquad\qquad + \frac{x^6}{8a^4} - \frac{x^8}{64a^6}, \text{&c.}
\end{array}$$

In the ſame manner the cube root of $a^3 + x^3$ will be found to be $a + \frac{x^3}{3a^2} - \frac{x^6}{9a^5} + \frac{5x^9}{81a^7} - \frac{10x^{12}}{243a^{11}}$, &c. Thus,

$$\begin{array}{l}
\quad a^3 + x^3 \left(a + \frac{x^3}{3a^2}\right. \\
\quad a^3 \\
3a^2)\; * x^3.
\end{array}$$

Then cube $a + \frac{x^3}{3a^2}$, and we ſhall have $a^3 + x^3 + \frac{x^6}{3a^3} + \frac{x^9}{27a^3}$, which ſubtracted from the given quantity $a^3 + x^3$, leaves $-\frac{x^6}{3a^3} - \frac{x^9}{27a}$ for the next reſolvend; and this divided by $3a^2$ will give $-\frac{x^6}{9a^5}$ for the next term of the quotient, &c. But the roots of quantities of this kind are much more expeditiouſly obtained by means of the binomial theorem. For the ſquare root of $a^2 + x^2 = \overline{a^2+x^2}^{\frac{1}{2}}$; and $\overline{a^2+x^2}^{\frac{1}{2}} = \overline{a^2}^{\frac{1}{2}} + \frac{1}{2} \times \overline{a^2}^{\frac{1}{2}-1} \times x^2 + \frac{1}{2} \times \frac{\frac{1}{2}-1}{2} \times \overline{a^2}^{\frac{1}{2}-2} \times \overline{x^2}^2 + \frac{1}{2} \times \frac{\frac{1}{2}-1}{2} \times \frac{\frac{1}{2}-2}{3} \times \overline{a^2}^{\frac{1}{2}-3} \times \overline{x^2}^3$, &c. $= \overline{a^2}^{\frac{1}{2}} + \frac{1}{2} \times \overline{a^2}^{-\frac{1}{2}} x^2 + \frac{1}{2} \times -\frac{1}{4} \times \overline{a^2}^{-\frac{3}{2}} x^4 + \frac{1}{2} \times -\frac{1}{4} \times -\frac{1}{2} \times \overline{a^2}^{-\frac{5}{2}} x^6$, &c. $= a + \frac{1}{2} \times a^{-1} x^2 - \frac{1}{8} \times a^{-3} x^4 + \frac{1}{16} \times a^{-5} x^6$, &c. = (bringing the powers of a from the numerators to the denominators, by changing the ſigns of their exponents) $a + \frac{x^2}{2a} - \frac{x^4}{8a^3} + \frac{x^6}{16a^3}$, &c.

Thus alſo the cube root of $a^3 + x^3 = \overline{a^3+x^3}^{\frac{1}{3}}$; and $\overline{a^3+x^3}^{\frac{1}{3}} = \overline{a^3}^{\frac{1}{3}} + \frac{1}{3} \times \overline{a^3}^{\frac{1}{3}-1} \times x^3 + \frac{1}{3} \times \frac{\frac{1}{3}-1}{2} \times \overline{a^3}^{\frac{1}{3}-2} \times \overline{x^3}^2 + \frac{1}{3} \times \frac{\frac{1}{3}-1}{2} \times \frac{\frac{1}{3}-2}{3} \times \overline{a^3}^{\frac{1}{3}-3} \times \overline{x^3}^3$, &c. $= \overline{a^3}^{\frac{1}{3}} + \frac{1}{3} \times \overline{a^3}^{-\frac{2}{3}} x^3 + \frac{1}{3} \times -\frac{1}{3} \times \overline{a^3}^{-\frac{5}{3}} x^6 + \frac{1}{3} \times -\frac{1}{3} \times -\frac{5}{9} \times \overline{a^3}^{-\frac{8}{3}} x^9$, &c. $= a + \frac{1}{3} \times a^{-2} x^3 - \frac{1}{9} \times a^5 \times x^6 + \frac{5}{81} a^{-8} x^9$, &c. $= a + \frac{x^3}{3a^2} - \frac{x^6}{9a^5} + \frac{5x^9}{81a^8}$, &c. See Maclaurin's Algebra, part i. ch. viii. p. 50, 51. See ROOT.

EXTRACTOR, in *Midwifery*, an inſtrument contrived to extract children in caſes of difficult births. We have the deſcription of a forceps for extracting children by the head when lodged low in the pelvis of the mother, in the Medic. Eſſ. Edinb. vol. iii. art. 20. See alſo the abridgment of this book, vol. ii. p. 438, where ſome alteration is mentioned of this inſtrument from Giffard's Midwifery, and an improvement of it by Mr. Freke. See FORCEPS.

EXTRACTUM CATHARTICUM, a form of medicine in the London Diſpenſatory, intended as an equivalent for the *extractum Rudii*, commonly called Rudius's pill, and which is for many reaſons a better compoſition than that pill. It is now called "extractum colocynthidis compoſitum." See COLOCYNTHIS.

EXTRADOS, the outſide of a vault.

EXTRANEOUS FOSSILS, in *Geology*. Adventitious, ſecondary, or figured foſſils, have among them (ſee FOSSILS, *Extraneous*) thoſe remains and exuvia of organized beings, which are found imbedded in the ſtrata of the earth. Since the diſcovery of Mr. William Smith, that each particular ſhell, and other organic remain, has its proper and appropriate place in the lamina of ſome particular ſtratum, and of which it is often a perfect, and, perhaps, the moſt unerring teſt of identity, in moſt inſtances, the knowledge and exact diſcrimination of theſe numerous animal and vegetable remains has appeared a matter of the firſt importance to geologiſts, eſpecially ſince it has been further aſcertained, as it now is, that moſt, if not every one, of the organic remains, differ eſſentially from any recent ſpecies of the animals and plants, to which former, and too curſory, obſervations had referred them; while many of them differ altogether and entirely from any thing now living or growing: which two points aſcertained, have tended irreſiſtibly to ſhew that theſe organic remains were not entombed by the Moſaic deluge, as moſt writers had ſuppoſed, becauſe they differ entirely from the antediluvian race, of which the preſent living ones are the deſcendants and exact repreſentatives, as the Moſaic account informs us, and are not of ſubſequent creation. Another reſult of the former of theſe facts has been to ſhew, that the ſeveral animals and plants whoſe foſſil remains we meet with in the ſtrata, lived and died on the ſtratum in which we find them, prior to the depoſition, and, perhaps, prior alſo to the creation of the matter of the lamina which covers them; and that the period of the exiſtence of particular ſpecies was in moſt, if not every inſtance, limited to that took up in the depoſition of the particular ſtratum in which they are found imbedded, ſeeming to ſuggeſt, that they were *created* at the period of the ſtratification, which anſwers to the loweſt lamina in which they are found, and ceaſed to exiſt altogether at the period anſwering to the higheſt lamina in which they are found; a ſuppoſition in no ways inconſiſtent with the Moſaic account of creation, if the whole of the foſſil race be different from the preſent race of organized beings, and of a period of time antecedent to the events deſcribed by the ſacred hiſtorian, except in his introductory words, "In the beginning God created the heavens and the earth." It may, poſſibly, be urged, againſt the idea of a temporary duration of the primitive animals and plants, and their becoming after that *extinct*, that the ſame kind of organic remains are found again, after large ſucceſſions of depoſitions with remains of different beings, in aſcending the ſeries of ſtrata, or in very diſtant parts of the globe; to which it may be anſwered, that where ſufficient diſcrimination has been made in the ſpecific differences of organic remains reſembling each other, but found imbedded in a ſtrata ſeparated by thoſe of a different kind, and with different kinds of organic beings in them, it has generally, if not always, turned out, that the remains reſembling each other, and hitherto ſuppoſed identic, are in reality not ſo, but of perfectly diſtinct ſpecies; their *varieties*, as ſome might be diſpoſed to call them, in conformity to the language of the naturaliſts reſpecting accidental deviations in ſome recent ſpecies, being *conſtant*, and ſuch as properly conſtituted diſtinct ſpecies in the great families of the primitive creation. Reſpecting organic ſubſtances found at very diſtant places on the globe, which, on being brought together and thoroughly examined, appear to be identic; before any argument is drawn therefrom, againſt the temporary exiſtence and extinction of their originals in the primitive race which inhabited the waters of this globe, it ſhould be diſtinctly aſcertained that the ſeries of ſtrata and organic remains above and below the two places in the ſeries whence the ſpecimens were brought are really different; or, in other words, that the identic ſpecies really do belong to different parts of the ſeries of ſtrata: for if, on the contrary, they belong to the *ſame ſtratum*, however its obvious mineralogical character may appear changed, it is to be expected that the organic remains will be identic, ſince Mr. Smith has, on tracing the ending or actual out-crop of a ſtratum for ſeveral hundred miles, always found the organic remains the ſame; as the numerous ſpecimens in his collection, marked and brought from the extreme and intermediate points of ſuch examination, do teſtify.

It is alſo to be taken into conſideration, that the diſcoveries of Mr. Farey, relative to denudated tracts on our globe, ſhew the poſſibility, and, perhaps, the frequent occurrence of ſuch deep excavations being left in the ſtrata of the earth, as to exhibit the edges, and indeed conſiderable tracts of the planes of ſtrata, at immenſe depths in the ſeries, below thoſe proper to the general ſtrata on the ſurface, and having their regular baſſet, or ending, on the ſurface, at great diſtances from ſuch denudated expoſures of them. The immenſe denudation, for inſtance, which has laid bare the fourth or loweſt limeſtone rock of Derbyſhire and Staffordſhire, and the excavation of Dove-dale and other vallies therein, appears to have expoſed ſtrata to view, which are from 1½ to 2 miles in perpendicular depth beneath the red earth, or gypſeous tract, which ſurrounds them on all ſides! (except, perhaps, a narrow ſtrip on the north, along the grand ridge, or waterſhead of the iſland,) which lower expoſed parts of the fourth lime rock do not, perhaps, anywhere baſſet, or come regularly to the ſurface, within 90 or 100 miles of Dove-dale and other vallies, where the denudation has expoſed them. The continents ſeem, from the relations of travellers, likely to furniſh numerous inſtances of denudations in the mountain chains, which will be found to expoſe ſtrata that lie very low indeed in the general ſeries, and at very great diſtances from the regular or continued line of ending or outcrop of thoſe particular ſtrata; and, without adverting to which circumſtances, the exact identity of organic remains from diſtant places ſo circumſtanced, might ſeem to contradict our ideas of their being peculiar to peculiar ſtrata. But after all, ſhould identically the ſame ſpecies of organic remains be found in diſtant parts of the ſeries of terreſtrial ſtrata, what have we to limit the architect of "heaven and earth," from having re-created ſimilar animals or plants during the countleſs periods of the primitive creation and exiſtence? Analogy ſurely cannot be ſaid to do this, when the animals and plants created ſince he ſaid "Let the waters be gathered together, and let the *dry land* appear," and which ſtill continue to exiſt, have ſo many points of reſemblance to ſome of the primitive and extinct ones, both in forms and habits, that they have for ages paſſed as identic therewith. Mr. James Parkinſon and Mr. W. Martin, having engaged in works intended to collect information on, and more accurately to diſcriminate, extraneous or organic foſſil remains, which works are ſtill in progreſs, and the reſults of Mr. W. Smith's labours and thoſe of his pupils being yet in a great meaſure unpubliſhed, we ſhall defer what we have further to add on theſe highly intereſting and curious relics to the article RELIQUIA, which ſeems, indeed, their more appropriate title. In the mean time, as the uſual names of the ſeveral foſſil animals and plants, &c. occur, we ſhall not fail to lay before our readers ſuch facts and particulars as we can collect, and with propriety communicate, concerning the objects of the unpubliſhed reſearches of the meritorious individuals alluded to; to whoſe credit it ought to be known, that extended and undiſguiſed communications have all along been made among the circle of their friends, and in conſequence of which a ſpirit of enquiry on the ſubject has been excited, in various diſtricts of the kingdom, from which the happieſt conſequences to ſcience may be expected ſhortly to ariſe.

EXTRANEONS, *Extraneus*, Lat. belonging to nothing, forcing. This word, during the laſt century, was admitted into the muſical technica, in ſpeaking of an unuſual and irregular change of key, which is called extraneous modulation, or modulating into an unrelative key, as in the key of C natural, D with a ſharp 3d, D♭, B♮, and B♭, which are unrelative keys, having no ſound in common with the chord of C natural. With reſpect to extraneous modulation, Rouſſeau ſays that no compoſers have frequent recourſe to ſudden and unuſual modulation, but thoſe who are ſteril in fancy and invention: and we ſhould believe the aſſertion well founded, if Eman. Bach, Haydn, and Mozart, were excepted, who cannot be accuſed of want of invention. It is to the clumſy imitators of theſe great maſters, who, in total want of melody, have recourſe to unexpected harmony, that Rouſſeau's accuſation ſeems to attach.

EXTRAORDINARII, in *Roman Antiquity*, a body of forces, conſiſting of a third part of the horſe, and a fifth part of the foot, which was ſeparated from the reſt, to prevent any deſign that might be formed againſt the natural forces. See ABLECTI.

EXTRAORDINARY, ſomething out of the common courſe.

EXTRAORDINARY *couriers*, are thoſe ſent expreſs on ſome urgent occaſion.

EXTRAORDINARY *embaſſador*, or *envoy*, is ſuch a one as is ſent to treat or negociate ſome ſpecial and important affair, as a marriage, a treaty, confederacy, &c. or even on occaſion of ſome ceremony, as condolence, congratulation, &c. See EMBASSADOR.

A gazette, journal, or other news-paper extraordinary, is that publiſhed after ſome great and notable event, containing the detail or particulars thereof, which are not found in the ordinary papers. Our news-writers generally uſe poſtſcripts, or ſupplements, inſtead of extraordinaries.

EXTRAORDINARY *culverin*. See CULVERIN.

EXTRAVAGANTES, a part of the canon law, containing divers conſtitutions of the popes, not included in the body of the canon-law; whence the denomination extravagantes: "quaſi extra corpus juris vagantes."

The extravagantes are divided into two parts: the firſt contains twenty conſtitutions of John XXII. and the ſecond other later conſtitutions of the ſaid John, and his ſucceſſors. See CANON-*Law*, and DECRETALS.

EXTRAVASATION, a term in *Surgery*, derived from *extra*, *out of*, and *vaſa*, *the veſſels*; it ſignifies an effuſion of any fluid from the veſſels, viſcus, or receptacle, in which ſuch fluid is naturally contained, and the paſſage of the ſame into another ſituation, which is very frequently the interſtices of the cellular membrane. In the head, blood is often extravaſated, under the cranium, upon the ſurface of the dura mater, in conſequence of the rupture of one of the arteries of this membrane from external violence. The ſame fluid is alſo frequently extravaſated on the pia mater, and in the convolutions of the cerebrum, or, more deeply in the ventricles, and very ſubſtance of the brain.

In caſes of wounds of the abdomen, large quantities of blood are occaſionally extravaſated in the cavity of the peritonæum, or the contents of the ſtomach, bowels, gall-bladder, or ſome other injured viſcus, may become effuſed. When the urinary bladder is wounded, or when a ſlough takes place in a certain part of it, from the diſtenſion occaſioned by a long protracted, and unrelieved retention of urine, the latter fluid may become extravaſated in the abdomen. In the example of ſtrictures, the urethra occaſionally ulcerates between the obſtruction, and the neck of the bladder, and the urine is conſequently extravaſated in the cellular membrane of the perinæum and ſcrotum. Sometimes, when a portion of the bowels mortifies, after being returned into the belly, in caſes of hernia, the inteſtinal matter eſcapes from the alimentary canal, through the breach occaſioned by the ſloughing.

In the thorax, ſurgeons ſometimes have opportunities of ſeeing caſes, in which conſiderable extravaſations of blood ariſe, in conſequence of ſtabs and gun-ſhot wounds.

In the limbs, and indeed, we might ſay, in every ſituation, practitioners frequently meet with extravaſations of blood, in caſes of wounded arteries, aneuriſms, and violent contuſions and blows, which rupture veſſels of important ſize. Bloody ſwellings, produced in the laſt-mentioned manner, are technically named ecchymoſes, and have already been treated of elſewhere. See Ecchymosis.

Our deſign, in the preſent place, is to conſider extravaſations in a ſurgical point of view, as they occur in the head, the cheſt, and the belly; taking occaſion, however, to refer the reader for certain parts of the ſubject to other places in this work.

Extravaſation of blood in the head, from external violence.—After explaining with equal perſpicuity and elegance, how the dura mater ſerves as a perioſteum to the internal ſurface of the bones of the cranium, in the ſame manner as the pericranium does to the external table, Mr. Pott notices, that by blows, falls, and other ſhocks, ſome of the larger of the veſſels, which carry on the communication between the dura mater and the ſkull, may be broken, and a quantity of blood ſhed upon the ſurface of that membrane. This, he obſerves, is one ſpecies of bloody extravaſation, and, indeed, the only one which can be formed between the ſkull and dura mater. If the broken veſſels be few, and the quantity of blood which is ſhed, be ſmall, the ſymptoms are generally ſlight, and, by proper treatment, diſappear: when they are large, or numerous, or the quantity of extravaſated fluid conſiderable, the ſymptoms are generally urgent in proportion; but, continues Mr. Pott, whether they be ſlight, or conſiderable, whether immediately alarming, or not, they are always, and uniformly, ſuch as indicate preſſure made on the brain and nerves, *viz.* ſtupidity, drowſineſs, diminution, or loſs of ſenſe, ſpeech, and voluntary motion.

The ſhock which the head ſometimes receives by falls from on high, or by ſtrokes from ponderous bodies, may likewiſe occaſion a breach in ſome of the veſſels, either of the pia mater, or brain, and thus produce an extravaſation of the fluid which ſhould circulate through them.

Mr. Pott remarks, that an extravaſation may be the only complaint cauſed by the accident; or it may be joined with, or added to, a fracture of the ſkull. But, this is not all; for it may be produced not only when the cranium is unhurt by the blow, but, even when no violence of any kind has been offered to, or received by the head.

Vertigo, vomiting, ſtupidity, hemorrhage, loſs of ſenſe and motion, either partial or total, are ſet down by this celebrated ſurgical author as the ſymptoms of an extravaſation within the cranium; ſometimes one or more occur in the ſame ſubject; ſometimes all of them. Theſe ſymptoms, which are all eaſily accountable for from extravaſation of fluid, and unnatural preſſure made on the brain and nerves, are, ſays Pott, frequently miſtaken as indications of a diſeaſe, which, conſidered abſtractedly, can never cauſe them; he means a ſimple undepreſſed fracture of the cranium, which may be accompanied by them, but cannot cauſe them.

The ſame writer repeats, that when a fluid is extravaſated in any conſiderable quantity within the cavity of the cranium, if any bad ſymptoms are produced by it at all, they are, and muſt be, ſuch as indicate preſſure made on the brain, and origin of the nerves, occaſioning thereby either diſturbance, or abolition of the offices of ſenſe and motion; and this in a different degree, according to the quantity, kind, and ſituation of the preſſing fluid.

Mr. Pott ſeems to have entertained the common notion of hemorrhage from the ears and noſe being alſo ſymptoms of an extravaſation. However, the leaſt reflection muſt ſoon make any body perceive, that a bleeding from thoſe parts is only indicative of their having ſuſtained a violent ſhock in common with the reſt of the head. Even the degree of violence is not at all denoted with any certainty by theſe circumſtances; for, with reſpect to the noſe, we know, that, in many perſons, the ſlighteſt cauſe will make it bleed.

When the above-mentioned ſymptoms exiſt, Mr. Pott was of opinion, that we might pronounce, in a poſitive manner, our judgment, that the brain ſuffers compreſſion; but, ſays he, to our very frequent mortification, we find theſe are the only circumſtances which, in ſuch caſe, we can depend upon; every thing elſe which relates, or belongs to them, being involved in a moſt perplexing obſcurity. We not only have no certain infallible rule whereby to diſtinguiſh what the preſſing fluid is, or where it is ſituated; but we are, in many inſtances, abſolutely incapable of knowing whether the ſymptoms be occaſioned by any fluid at all; for, a fragment of bone broken off from the internal table of the cranium, and making an equal degree of preſſure, will produce exactly the ſame complaints.

When a caſe, attended with the preceding ſymptoms, occurred, the old ſurgeons uſed in general to conclude, that the brain had ſuffered a concuſſion, to which all the conſequences were imputed.

Mr. Pott obſerves, that a concuſſion and an extravaſation are very diſtinct cauſes of miſchief, though not always very diſtinguiſhable. M. Le Dran, and others of the modern French writers, have made a very ſenſible and juſt diſtinction between that kind and degree of loſs of ſenſe, which ariſes from a mere commotion of the brain, and that which is cauſed by a mere extravaſation, in thoſe inſtances, in which the time of the attack or appearance of ſuch ſymptoms, is different, or diſtinct. The loſs of ſenſe, which immediately follows the violence, ſay they, is moſt probably owing to a commotion; but, that which comes on after an interval of time is paſt, is moſt probably cauſed by extravaſation.

Mr. Pott remarks, that this diſtinction is certainly juſt and good, as far as it will go. That degree of abolition, or diminution of ſenſe, which immediately attends, or follows the blow or fall, and goes off again, without the aſſiſtance of art, is in all probability occaſioned by the ſudden ſhake or temporary derangement of the contents of the head; and the ſame kind of ſymptoms recurring again ſome time after they had ceaſed, or not coming on until ſome time has paſſed from the receipt of the violence, do moſt probably proceed from the breach of a veſſel within, or upon the brain. But, unluckily, we have it not very often in our power to make this exact diſtinction. An extravaſation is often made ſo immediately, and ſo largely, at the inſtant of the accident, that all ſenſe and motion are inſtantaneouſly loſt, and never again return. And it alſo ſometimes happens (continues Mr. Pott), that, although an extravaſation may poſſibly not have been made at the moment of the accident, and the firſt complaints may have been owing to commotion merely, yet a quantity of fluid having been ſhed from its proper veſſels very ſoon after the accident, and producing its proper ſymptoms, before thoſe cauſed by the commotion have had time to go off, the ſimilarity of the effects of each of theſe different cauſes is ſuch, as to deprive us of all power of diſtinguiſhing between the one and the other, or of determining, with any tolerable preciſion, to which of them ſuch ſymptoms as remain are really owing.

Mr. Pott next obſerves, that the nature and degree of the ſymptoms, produced by the preſſure of an extravaſation, are various and different in different perſons, according to the kind, quantity, and ſituation of the preſſing fluid. Sometimes it is mere fluid blood; ſometimes blood in a ſtate of coagulation ; ſometimes it is a clear lymph ; and, at others, blood and water are found mixed together ; each of theſe is found either ſimple or mixed in different ſituations ; that is, between the ſkull and dura mater, between the dura and pia mater, or in the natural cavities of the brain, called its ventricles, and ſometimes, in caſes of great violence, they are found at the ſame time in all theſe different parts. Sometimes; a conſiderable quantity is ſhed inſtantly at the time of the accident ; and ſometimes the breach, by which the effuſion is made, is ſo circumſtanced, both as to nature and ſituation, that it is at firſt very ſmall, and increaſes by faſter or ſlower degrees. In the former (ſays Pott), the ſymptoms are generally immediate and urgent, and the extravaſation is of the bloody kind. In the latter, they are frequently ſlight at firſt, appear after ſome little interval of time, increaſe gradually, till they become urgent, or fatal, and are, in ſuch caſe, generally occaſioned by extravaſated lymph. So that although the immediate appearance of bad ſymptoms does moſt certainly imply miſchief of ſome kind or other, yet, on the other hand, no man ought to ſuppoſe his patient free from hazard, either becauſe ſuch ſymptoms do not ſhew themſelves at firſt, or becauſe they appear to be but ſlight ; thoſe which come on late, or, appearing ſlight at firſt, increaſe gradually, being full as much to be dreaded as to conſequence as the more immediately alarming ones ; with this material difference between them, that the one *may* be the conſequence of a mere concuſſion of the brain, and may by means of quietude and evacuation go quite off ; whereas, the other being moſt frequently owing to an extravaſation of lymph, (though ſometimes of blood alſo,) within the ſubſtance of the brain, are very ſeldom removed by art. (Pott's Works, vol. i.) It appears from ſome excellent obſervations publiſhed by Mr. Abernethy on the ſubject of injuries of the head, that a fracture of the ſkull is not likely to be followed by an equal degree of extravaſation in every part, as the veſſels, connecting the dura mater to the cranium, are in moſt parts of that membrane of a ſmall ſize. If theſe are accidentally ruptured, a ſlight hemorrhage enſues, which ſoon ſtops, and only a thin ſtratum of coagulated blood is found, if the bone be removed. But, ſays Mr. Abernethy, if the fracture happens in the track of the principal artery of the dura mater ; if the trunk, or even a conſiderable branch of that veſſel be torn, the hemorrhage will be profuſe, and the operation of the trephine becomes immediately neceſſary to preſerve the life of the patient.

When an interval of ſenſe occurs between the blow and the ſtupor occaſioned by the effuſed blood, the diſcrimination of the nature of the caſe is greatly facilitated by that circumſtance, as we have already related, becauſe it becomes manifeſt, that the bad ſymptoms, which now come on, are not owing to the firſt mere ſhock of the external violence on the brain. The patient was moſt probably ſtunned by the blow, at the very inſtant of its occurrence ; but he gradually regained his ſenſes, in proportion as the firſt effects of the ſhock on the brain ſubſided. However, as ſome veſſel was wounded by the ſame blow, an hemorrhage continues under the cranium, on, or within, the brain, and as ſoon as a certain quantity of blood is extravaſated, its preſſure produces a recurrence of ſtupefaction.

Unfortunately, great obſcurity attends numerous caſes, in conſequence of patients having no interval of ſenſe, and remaining in a ſtate of complete ſtupefaction ever after the accident. We know not, whether the brain is labouring under concuſſion, or compreſſion, or both ; and even when we do know that the bad ſymptoms ariſe from an extravaſation, we are frequently unable to ſay where the effuſed blood is ſituated. Now, ſince the operation of trepanning is not likely to afford aſſiſtance, unleſs the blood be upon the dura mater, ſo as to allow of being taken away, and ſince the operation itſelf is by no means free from danger, we ſhould be very reluctant to put it in practice without having good foundation for believing that there will be found immediately under the perforation, which we are about to make in the bone, the extravaſated blood, which gives riſe to the urgent complaints. Practitioners are highly indebted to Mr. Abernethy for a ſuggeſtion, which promiſes to be of exceedingly great aſſiſtance in directing whether the trephine ought to be uſed, or not, on a particular part of the head. "Unleſs one of the large arteries of the dura mater be wounded, (ſays this gentleman,) the quantity of blood poured out will be inconſiderable ; and the ſlight compreſſion of the brain, which this occaſions, may not be attended with any peculiar ſymptoms ; or, perhaps, it may occaſion ſome ſtupor, or excite an irritation diſpoſing the ſubjacent parts to become inflamed ; but both theſe effects will gradually abate, nor will any inflammation enſue, if proper means are taken to prevent it. It is indeed highly probable that in many caſes, which have done well without an operation, ſuch an extravaſation has exiſted. But, if there be ſo much blood on the dura mater as materially to derange the functions of the brain, the bone, to a certain extent, will no longer receive blood from within ; and by the operation performed for its expoſure, the pericranium muſt have been ſeparated from its outſide. I believe, that a bone ſo circumſtanced will not be found to bleed ; and I am certain it cannot with the ſame freedom and celerity, as it does when the dura mater remains connected with it internally."

In ſome caſes, related by Mr. Abernethy, there was not the leaſt hemorrhage, and this gentleman mentions his having twice been able, by attending to the want of hemorrhage from the outſide of the cranium, to aſcertain the extent to which the dura mater was detached within. Alſo, when ſymptoms ſeemed to require the perforation of the ſkull, Mr. Abernethy has frequently ſeen the operation contra-indicated by the hemorrhage from the bone, and rightly, as the event proved.

When the bone has been for ſome time bare, this criterion may not be ſo clear ; but Mr. Abernethy ſcraped the ſurface of a portion of the ſkull, which had remained ſome time in a denuded ſtate, and he found that it bled freely enough to denote that the dura mater was adherent to the inner table, and, conſequently, that making a perforation there could be of no ſervice. See Eſſay on Injuries of the Head, p. 32—34.

We ſhall next enumerate the ſymptoms of preſſure on the brain, and contraſt them with thoſe of concuſſion. It is to be underſtood, that the complaints produced are nearly the ſame, whether the preſſure is made by an extravaſation, or a fracture of the cranium with depreſſion.

Symptoms of Preſſure.

1. Patient at firſt ſtunned, with cold extremities.
2. Revives, and has an interval of ſenſe, in caſes of extravaſation, but not in thoſe of a depreſſed fracture.
3. The quantity of effuſed blood increaſing, he becomes drowſy and ſtupid.
4. Pulſe regular and ſlow.
5. Patient quite inſenſible.
6. Pupil dilated.
7. Stertorous reſpiration.

N.B. When the bleeding is very copious in the firſt inſtance,

ſtance, or when a violent concuſſion of the brain has alſo happened, the patient has no interval of ſenſe.

Symptoms of Concuſſion.

First ſtage.
- 1. Patient at firſt ſtunned.
- 2. Extremities cold; pulſe hardly perceptible.
- 3. When the violence has not exceeded a certain degree, the ſenſes return gradually.
- 4. The ſtomach rejects its contents; ſickneſs betrays irritability in the œſophagus and ſtomach, and cannot be expected, when the brain is labouring under much compreſſion, the great effect of which is to produce an univerſal inſenſibility, or palſy, throughout the body.
- 5. The pulſe is now ſlow, and intermits.

Second ſtage.
- 6. In proportion as the immediate effects of the ſhock of the brain ſubſide, ſymptoms of irritation and inflammation of that organ come on.
- 7. Symptomatic inflammatory fever begins.
- 8. Pupil of the eye contracted.
- 9. The veſſels of the eye become red and turgid.
- 10. Delirium.
- 11. Pulſe very frequent and ſmall.

We ſhall not expatiate on this ſubject; but refer to Compression, Concussion, Injuries *of the* Head, and Trepanning, for further information.

Extravaſation of blood in the thorax.—In caſes of wounds which penetrate the cavity of the cheſt, the intercoſtal arteries are liable to be injured, and if the blood cannot readily flow outward through the wound, it is apt to inſinuate itſelf between the pleura and lungs. An extravaſation of blood may alſo occur in the thorax, when ſome of the veſſels of the lungs, one of the coronary arteries of the heart, or the internal mammary artery, have been wounded. An effuſion of blood in the cheſt may likely obviouſly originate from a wound of the auricles, or ventricles of the heart, or of the thoracic aorta, and vena cava; but we need hardly obſerve, that in theſe and other inſtances, in which the bleeding would be in a moment exceſſively profuſe, the extravaſation proves inſtantly fatal. Smaller veſſels are frequently injured, and pour out a conſiderable quantity of blood in the cheſt; yet the records of ſurgery evince, that theſe accidents do not always have a fatal termination.

The ſymptoms commonly enumerated by ſurgical writers, as indicative of an extravaſation of blood in the thorax, are the following: the patient is greatly oppreſſed, and experiences a kind of uneaſineſs which will not let him remain for any length of time in the ſame poſture. He feels conſiderable difficulty in ſitting up in bed, except his body be bent a good way forward, in which poſition the diaphragm is relaxed, and not ſo much dragged by the weight of the extravaſated fluid. When the thighs are bent, the patient can lie with tolerable eaſe on his back, he is alſo not averſe to lying on the ſide on which the wound is ſituated; but he cannot place himſelf on the oppoſite one, without feeling very acute pain in the ſituation of the mediaſtinum.

His reſpiration is ſhort, frequent, and interrupted by ſighs; his veins become empty, a mortal paleneſs ſpreads over his countenance; his extremities become cold; a viſcid perſpiration covers his neck and temples; his teeth chatter, his pulſe grows weak, and if (as moſt frequently happens) the lungs are wounded, he coughs up frothy blood, and air iſſues from the wound.

The preceding claſs of ſymptoms, however, are not always attendant on every conſiderable effuſion of blood in the thorax. Wounded perſons have been known to die of ſuch an extravaſation, whoſe reſpiration was tolerably free, and who did not complain of ſuffering more inconvenience in one poſture than another. Sabatier ſtates, that ſeveral facts of this kind have fallen under his own obſervation. Other wounded perſons alſo, who have had moſt of the complaints, uſually imputed to extravaſations of blood in the thorax, have been cured by ordinary means.

The ſymptoms of an extravaſation of blood in the thorax are upon the whole very equivocal. Hence, ſeveral attentive practitioners have taken extraordinary pains to diſcover additional circumſtances, by which the nature of the caſe might be more infallibly aſcertained. Theſe endeavours, however, ſeem to have been attended with little ſucceſs. A ſurgeon of the name of Valentine aſſerted, that a ſort of ecchymoſis of the integuments, over the angles of the ribs, was an invariable ſymptom; but ſucceeding obſervers have not found the remark correct.

When there is no doubt in the practitioner's mind that blood is extravaſated in the cavity of the thorax, and that it is the occaſion of a dangerous oppreſſion of the lungs and diaphragm, the obvious indication is to endeavour to promote the eſcape of the effuſed fluid. However, before undertaking any operation, the revived ſtate of the pulſe, the return of warmth in the extremities, and the ceſſation of convulſions ought to denote, that the hemorrhage no longer continues from the wounded veſſels. If vent were given to the extravaſation before the bleeding had ceaſed, a freſh quantity of blood would ſoon be poured out in the cheſt, and the patient die exhauſted.

For another reaſon, alſo, prudence requires that the practitioner ſhould not precipitately have recourſe to an operation: *viz.* allowing a little while gives nature an opportunity of employing her own reſources, and any one who will be at the trouble of referring to books of ſurgical caſes, will ſoon meet with examples in which there is every reaſon to believe that there was more or leſs blood extravaſated in the cheſt, though the patients completely recovered without any operation.

There are five principal methods of diſcharging blood from the cavity of the cheſt. 1. By placing the patient in a poſture which favours the eſcape of the blood. 2. By introducing a ſyringe for the purpoſe of ſucking it out, or a mere cannula, through which it is to flow. 3. By enlarging the wound. 4. By employing injections, with which the clots of blood are to be waſhed away. 5. By making an opening into the thorax in a depending ſituation.

Having thus curſorily treated of extravaſations in the cheſt, we ſhall quit the ſubject for the preſent, intending to reſume the conſideration of it in ſpeaking of wounds of the thorax. See Wounds.

For an explanation of the method of making a depending opening into the cheſt, ſee Paracentesis.

Extravaſations in the Abdomen.—Various kinds of fluids may be extravaſated in the abdomen in caſes of wounds, ſloughing of the inteſtines, &c. Bile, chyle, urine, blood, feces, &c. are all apt to be effuſed under particular circumſtances. Surgeons uſed formerly to ſuppoſe, that whenever any fluid eſcaped from a veſſel, or bowel, into the general cavity of the peritonæum, it always became extenſively diffuſed among the convolutions of the inteſtines. The erroneous ſuppoſition ſeemed to be confirmed by facts, the moſt open to obſervation, and completely exempt from the poſſibility of miſtake. Practitioners ſaw that the water of dropſies, the pus of abſceſſes, which had burſt into the abdomen, as well as the chyle and feces, which had eſcaped through a wound, or other ſort of breach of an inteſtine, were invariably and univerſally diffuſed among the folds of the meſentery and bowels after death.

M. Petit (the ſon) firſt queſtioned the accuracy of the foregoing opinion, in relation to the patient while alive. He ſuggeſted that as in the living body the inteſtines were diſtended with feces, alimentary matter and air, while they were alſo mutually acting againſt each other, and in a continual ſtate of compreſſion from the alternate contraction of the diaphragm and abdominal muſcles, there might be a ſuperior reſiſtance made to the weight of the extravaſated fluid tending to ſeparate the viſcera to which we allude. On the contrary, ſays Petit, is it not poſſible that, as ſoon as the patient is dead, and the above kind of reſiſtance is taken away, the extravaſated fluid may inſinuate itſelf any where without difficulty? M. Petit remarks, that the truth of the preceding ſuggeſtion cannot be doubted, when we conſider, that certain caſes of hernia get well, notwithſtanding the burſting of the gangrenous part of the inteſtine, after its reduction into the abdomen. In ſuch inſtances, in fact, the contents of the bowels appear to eſcape outward through the wound entirely in conſequence of the reſiſtance made to their diffuſion among the convolutions of the inteſtines. However it might be objected, that, in caſes of hernia, ſince the bowel is almoſt always adherent to the edge of the abdominal ring, the iſſue of the inteſtinal matter through the wound is rather to be aſcribed to the eaſe with which this event may happen, than to any reſiſtance made internally by the ſurrounding viſcera. But M. Petit cites ſeveral caſes, which fully confirm, that there is a vaſt reſiſtance made to the lodgment of extravaſated fluids among the convolutions of the bowels, and folds of the meſentery.

After death, any fluid, extravaſated in the abdomen, may by its mere gravity inſinuate itſelf any where, and become diſperſed among the various parts, becauſe theſe parts being without action make no oppoſition. But in the living ſtate, all the abdominal viſcera reciprocally act upon each other, and forming, as it were, only one body, by reaſon of ſuch mutual ſupport, the reſiſtance which is made to any extravaſated matter will always keep it from becoming widely diffuſed, in the manner which many have imagined.

Let us next, with M. Petit, reflect upon the inferences to be drawn from ſuch reciprocal action of the abdominal viſcera.

The firſt conſequence is, that an extravaſated fluid can only inſinuate itſelf into the cavity of the abdomen, in the ſame way that a fluid becomes effuſed in an external part; that is to ſay, the extravaſation can only ſpread by degrees, and ſucceſſively, into ſuch places as offer the leaſt reſiſtance. Blood, when it inſinuates itſelf into the interſtices of the muſcles, can only get from one membranous cell into another, by the firſt one being ſo diſtended, that the fluid can more readily get into a ſecond cell, and from this into a third, than increaſe the diſtended ſtate of its firſt ſituation. Juſt ſo in the abdomen, the blood which eſcapes from a wounded veſſel, is firſt effuſed into a ſituation near the opening in the veſſel, either between the peritonæum and ſurface formed by the inteſtines, or more deeply among the convolutions of the bowels, or ſome of the folds of the meſentery. In the proportion as the bleeding continues, the blood forces its original boundary, and dilates the place which it occupies, in every direction, until it meets with leſs reſiſtance in making its way, either upward or downward, or to the right or left. The extravaſation continues to dilate the new ſpace, which it fills in the ſame way, until either the firſt limits are forced, or the effuſed fluid ſpreads in ſome other direction. The extravaſation will expand in this manner, till the reſiſtance, made by the viſcera, becomes equal to the impetus, with which the blood iſſues from the veſſel. M. Petit was of opinion, that it was this kind of reſiſtance which put a ſtop to the hemorrhage, even before any coagulum had been formed in the opening of the veſſel. That the blood, while flowing from the veſſel and in a fluid ſtate, ſhould only make one maſs and be contained in one cavity, till coagulation takes place, is a circumſtance which cannot rationally be imputed to any thing elſe, than the reſiſtance depending upon the mutual action of the viſcera in the living ſtate. It is alſo equally certain, that it is in conſequence of the ſudden ceſſation of ſuch reſiſtance, that extravaſated blood, which is fluid after death, becomes diſperſed among the different convolutions of the bowels, and forms numerous ſcattered collections.

The ſecond inference which M. Petit mentions, as deducible from the reſiſtance ariſing from the reciprocal preſſure of the abdominal viſcera, is that an extravaſation in the cavity of the abdomen cannot ſo eaſily happen, as ſome have fancied. It was once not an uncommon idea, that a breach in a very moderate veſſel could occaſion a conſiderable extravaſation, becauſe the orifice could not be compreſſed, like that of a veſſel in a more external ſituation. It is indeed true, that no compreſſion can be directly applied to the opening in an internal veſſel; but the reſiſtance which the ſurrounding viſcera make to the extravaſation, operates as a ſubſtitute. It is even probable, according to Petit, that when blood is effuſed in the abdomen, it has a greater reſiſtance to overcome, than when extravaſated in an external part. This author ſtates, that the reſiſtance of the cellular membrane, the common bond of connection between the muſcles, is undoubtedly leſs than that which depends on the reciprocal action of the inteſtines, and reſt of the viſcera. The inceſſant alternate motion of the abdomen and thorax is in favour of the preceding opinion. The facility alſo, with which abſceſſes ſituated in the abdomen are diſcharged, through a ſmall, and very frequently not a depending opening, is an additional fact, proving that the abdominal viſcera, by the manner in which they mutually preſs upon each other, make a greater reſiſtance to an extravaſation, than can be made by the cellular ſubſtance in other parts of the body.

Swords have often been thruſt completely through the body, without giving riſe to any dangerous ſymptoms, or only to ſuch as frequently attend wounds, which do reach into the cavity of the belly. We cannot imagine, contrary to all probability, that, in this caſe, the weapon has ſlipped over the inteſtines, through their interſtices, and by good luck has wounded none of the blood-veſſels. We muſt rather conclude, that an extravaſation does not always enſue from a wound of the viſcera or blood-veſſels, or at leaſt, that the extravaſation is not invariably attended with ſuch conſequences as former practitioners uſed to ſuppoſe.

For the purpoſe of rendering the foregoing remarks more intelligible, let us follow M. Petit in his obſervations, and take notice of the principle which he has laid down in his excellent memoir, *viz.* that without a particular action in the muſcular fibres of the inteſtine or artery, no extravaſation would occur in the abdomen, even were there a breach in ſuch bowel or veſſel. Suppoſing the blood veſſels deſtitute of action, and the place of the opening preſſed upon by a force equal to that, which operates upon the reſt of their extent, the fluid, which they contain, would never be effuſed in the abdomen, ſo as to form an extravaſation. Beſides its being evident, that this muſt be the fact, M. Petit mentions his having actually obſerved it in the body of a man, who died of gangrene in the abdomen, in conſequence of a hernia, which was attended for upwards of a fortnight with the moſt violent ſymptoms of ſtrangulation. Nearly the whole of the inteſtinal canal was equally affected with gangrenous miſchief, ſo that it was ſcarcely poſſible to handle any of the bowels without occaſioning a breach in them. However, although the inteſtines were filled with very fluid excrement, none of it was extravaſated in the abdomen. In ſeveral places, indeed, Petit diſcovered numerous little breaches of continuity, which had allowed a little of the excrement to eſcape, but only juſt enough to tinge the adjacent parts. Petit acknowledges, at the ſame time, that round where theſe holes were ſituated, ſome ſlight adheſions had taken place between the bowels, and theſe and other parts; but they were ſo weak, and eaſily broken, as to be quite incapable of hindering an extravaſation. Petit concludes, that in this inſtance no extravaſation happened, becauſe the inteſtinal canal was every where affected with gangrene in nearly the ſame degree, and the diſeaſe had deſtroyed the tone and action of the muſcular fibres of the inteſtines.

It is contended by Petit, that the foregoing caſe affords ſufficient proof, that, without a contractile power in the blood veſſels and inteſtines, no extravaſation of their contents could be produced in the abdomen, and that ſuch an event would certainly be oppoſed by the action of the abdominal muſcles and diaphragm, which make uniform and equal preſſure upon all the viſcera. If this ſtatement be correct, it is obvious, firſt, that the greater the action of the wounded veſſels is, in relation to the quantity of fluid which they have to propel, the greater will be an extravaſation from them: ſecondly, that no extravaſation can ariſe unleſs the action of the veſſels themſelves be capable of overcoming the reſiſtance depending upon the mutual action of the parts. Hence, only wounds of veſſels above a certain ſize can give riſe to extravaſations, at leaſt, to any of importance. The veins cannot occaſion ſo much extravaſation as the arteries: nor are wounds of the inteſtines ſo apt to be followed by an effuſion of the chyle and feces, as the ſame injuries of the blood veſſels are liable to be attended with an extravaſation of blood. Petit was alſo of opinion, that wounds of the ſtomach were not ſo often as thoſe of the bowels the cauſe of this kind of accident.

The feces cannot be ſo eaſily extravaſated as blood, not only becauſe the action of the inteſtines, particularly that of the ſmall ones, upon their contents, is weaker than that of the blood veſſels upon the blood, but, principally, becauſe, when there is a breach in one of the bowels, the contents will continue their courſe through the inteſtinal canal, without any need of there being a conſiderable obſtacle to the occurrence of an effuſion. However, Petit admoniſhes us not to conclude, from what has been ſaid, that the chyle and feces can never be extravaſated in the abdomen. There is no doubt whatever, he obſerves, that an extravaſation may take place, when the wound in the bowel is of ample ſize, the gut filled with chyle or excrement, and care is not taken to empty the large inteſtines very often with glyſters. The event may alſo happen, when pain and irritation render the muſcular action of the inteſtines violent, irregular, and convulſive, and when unequal preſſure is made upon the abdomen. Under ſuch circumſtances, the reſiſtance made to an extravaſation, by the reciprocal action of the viſcera, is overcome, and the contents of the bowels will continue to be effuſed, until the impulſe ariſing from the contractile power of theſe organs returns to a ſtate of equilibrium with the reſiſtance depending on the mutual action of all the viſcera.

The extravaſation of chyle and feces does not take place differently from that of blood; but in wounds of the bowels there is this advantage, that the ſame opening which has given paſſage to the extravaſated fluid, may alſo allow it to return and paſs off. Petit remarks that we need no further proof of what has been ſtated, than the great evacuations of blood, which ſome wounded perſons have had with their ſtools, without being afflicted with any of the ſymptoms of extravaſation. It is highly improbable, that ſuch bleeding could depend upon the injury of any of the veſſels ramifying upon the inteſtinal canal, ſince their ſize is too inconſiderable. We rather believe that, in theſe caſes, ſome veſſels, either of the meſentery, or ſome other part, have been wounded at the ſame time as the inteſtine, and that the blood has inſinuated itſelf into, and taken its courſe through the bowels, in conſequence of the reſiſtance made to its extravaſation among the viſcera.

The foregoing remarks, made by Petit (the ſon), clearly prove not only that an extravaſation of feces cannot ſo eaſily happen in the abdomen as has been imagined; but, alſo, that it is leſs dangerous than an effuſion of blood uſually is, and that it is accompanied by leſs violent ſymptoms. When the contents of the bowels are extravaſated, adheſions are likewiſe obſerved to form more readily, and to limit the effuſed matter ſooner, than when the extravaſation conſiſts of blood. After ſuch adheſions have once formed, it is probable that the extravaſated matter may be got rid of in the ſame favourable way, as certain abſceſſes, which have diſcharged themſelves into the inteſtinal canal. Blood, however, cannot inſinuate itſelf again into the canal of the veſſel, out of which it has eſcaped, becauſe a clot blocks up the opening. But a wound in an inteſtine remains continually open, till it is cloſed by the adheſions which the bowel contracts to the adjacent parts: adheſion, indeed, is the only means by which a wound of this deſcription can be healed.

M. Petit remarks, that among the numerous facts which might be adduced in proof of the difficulty with which a wound of the ſtomach permits the aliment to be extravaſated, the operation of an emetic in this caſe is a ſtriking one. Petit expreſſes his belief, that vomiting does not depend upon the action of the muſcular fibres of the ſtomach, but entirely upon the ſudden and violent contraction of the abdominal muſcles. This author conceives, that, if the particular action of the ſtomach itſelf had much concern in the production of vomiting, an extravaſation of the alimentary matter would neceſſarily happen in the abdomen when that viſcus is wounded. However, in the inſtances referred to by Petit, the occurrence did not take place, becauſe, notwithſtanding the violence with which the abdominal muſcles and diaphragm contracted, they made equal and uniform preſſure on all ſides of the ſtomach. The danger of an extravaſation is alſo leſs, inaſmuch as a wound of the ſtomach is always much ſmaller in relation to its cavity, than that of a bowel, in regard to the inteſtinal canal.

Circumſtances are very different, in reſpect to wounds of the gall and urinary bladders, eſpecially when theſe receptacles are full. An extravaſation is then an inevitable conſequence, both on account of the great fluidity of the bile and urine, and of the contractile power with which the parts are endued, and againſt which the action of the abdominal muſcles makes no ſort of reſiſtance. An extravaſation of theſe fluids is extremely dangerous, by reaſon of their irritating quality with reſpect to the viſcera. The co-lies and irregular contractions which ſuch ſtimulating fluids excite, cauſe the extravaſation to become more widely diffuſed. The eaſe alſo, with which the bile and urine mix with the ſerum, that naturally moiſtens the ſurfaces of all the viſcera, leads us to ſuſpect, that whenever thoſe fluids are extravaſated, they very ſoon become univerſally diſperſed among all the convolutions of the inteſtines.

Againſt theſe latter extravaſations little can be done, and unleſs they are in ſmall quantity, and their increaſe can be prevented, the patient's life hardly admits of being ſaved. Leaving a catheter in the bladder, indeed, is a ſure means of hindering the extravaſation of urine from augmenting; but not much confidence can be placed in the kind of outlet afforded by the duct of the gall-bladder.

When the extravaſated matter is completely encyſted and circumſcribed, it happens, that as ſuch matter had to overcome the reſiſtance of the parts before it could be effuſed, no ſooner is a paſſage afforded for its eſcape, than the reaction of the ſeparated parts neceſſarily forces out whatever fluid has inſinuated itſelf between them. This is a third conſequence, which is pointed out by Petit as reſulting from the reſiſtance, made by the reciprocal action of the abdominal viſcera, to extravaſations.

The foregoing obſervations tend to ſhew, that an extravaſation in the abdomen, and eſpecially one of blood, may be as completely diſcharged as a collection of fluid in the thorax. The evacuation, at leaſt, may always be eaſily effected, when the extravaſation is bounded at any part by the parietes of the abdomen: a circumſtance, which muſt invariably occur, whenever the extravaſation is conſiderable. Indeed Petit informs us, that it was always the caſe, as far as his experience went even when the effuſion was not very copious.

It is not enough to make ſurgeons underſtand, that fluids, extravaſated in the abdomen, admit of being diſcharged by an operation; we deem it alſo neceſſary to explain the ſymptoms denoting the caſes in which ſuch a proceeding is proper.

In order to underſtand this intereſting part of the ſubject, Petit, and moſt ſurgical writers after him, have adviſed us to draw a diſtinction between the conſecutive ſymptoms and the primary ones, or thoſe which attend the wound from the firſt, and are, ſtrictly ſpeaking, proper to it, becauſe they depend eſſentially upon the diviſion of the injured parts. Such breach of continuity occaſions, from the firſt, pain, irritation, tenſion, convulſions, and ſwelling and inflammation of the abdomen, affections naturally leading to other conſecutive ſymptoms, which vary according to the injured parts, and the degree of inflammation. Of the latter claſs are, hiccough, vomiting, conſtipation, ſuppreſſion, or retention of the bile and urine, a great deal of fever generally at firſt, and, after the inflammation has attained a certain pitch, a concentration and ſinking of the pulſe, conſiderable proſtration of ſtrength, and cold ſweats.

If when the firſt train of ſymptoms has been relieved, and after an interval of from four to eight days or more, the ſymptoms recur, or become exaſperated, without any apparent cauſe, we may infer that ſuch conſecutive complaints depend upon an extravaſation.

It may at firſt ſeem extraordinary, that the ſymptoms of an extravaſation of blood ſhould be conſecutive; for, as the effuſion takes place at the moment, when the wound firſt happens, why do not the ſymptoms commence at the ſame time?

Petit has referred the reaſon to the following circumſtances: blood, extravaſated in the abdomen, does not give riſe to any complaints, either by the preſſure which it makes, or by its quality; and whenever any ſymptoms are occaſioned on the firſt occurrence of the effuſion, they are thoſe of weakneſs, depending on the loſs of blood to the circulation. The extravaſation afterwards becomes entirely circumſcribed by the adheſions, which are produced by the inflammation around. An additional quantity of fluid continues to be ſecreted from the veſſels into the encyſted cavity of the effuſed blood, and conſequently pain, inflammation, &c. are occaſioned by the increaſing diſtention, now produced.

We ſhall not ſtop to enquire into the accuracy of the latter part of the foregoing ſtatement, as the fact, that the ſymptoms of an extravaſation are conſecutive, is a piece of information highly important to the practitioner, while the theory of the ſubject is a ſubordinate conſideration.

The remainder of the remarks, reſpecting extravaſations in the abdomen, and their treatment, will be found in the article WOUNDS. Some obſervations will alſo be offered, when we ſpeak of HERNIA.

EXTRAVASATION is a term ſometimes likewiſe uſed by the gardeners in ſpeaking of gums, juices, &c. which ouſe out of their trees either ſpontaneouſly, or at inciſions.

EXTREAM, or EXTREME, is applied to the laſt and outermoſt part of any thing; or that which finiſhes and terminates it on that ſide.

The extreams of a line are points. There is no paſſing out of one extream into the other, without going through the middle. Extream remedies muſt only be had recourſe to in extream neceſſity.

Some anatomiſts apply the denomination extremes, or extremities, to the arms and legs. See EXTREMITIES.

EXTREAMS, in *Logic*, denote the two extream terms of the concluſion of a ſyllogiſm, *viz.* the predicate and ſubject.

They are called extreams, from their relation to another term, which is a medium or mean between them.

The predicate, as being likewiſe had in the firſt propoſition, is called the *majus extremum*, greater extream; and the ſubject, as being put in the ſecond, or minor propoſition, is called the *minus extremum*, leſſer extream.

Thus, in the ſyllogiſm, man is an animal: Peter is a man, therefore Peter is an animal; the word animal is the greater extream, Peter the leſs extream, and the man the medium. See SYLLOGISM.

EXTREAM *and Mean Proportion*, in *Geometry*, is when a line is ſo divided, that the whole line is to the greater ſegment, as that ſegment is to the other.

Or, as Euclid expreſſeth it, when the line is ſo divided, that the rectangle under the whole line, and the leſſer ſegment, is equal to the ſquare of the greater ſegment.

The invention of this diviſion is thus: let the given line be $AB = a$ (*Plate* VII. *Geometry. fig.* 87.) and for the greater ſegment put x, the leſſer will be $a - x$. Then, by the hypotheſis, $a : x :: x : a - x$. Therefore, $aa - ax = xx$, conſequently $aa = ax + xx$. And, by adding $\frac{1}{4}aa$ on each ſide, to make $xx + ax + \frac{1}{4}aa$, a complete ſquare, the equation will ſtand thus, $\frac{5}{4}aa = xx + xa + \frac{1}{4}aa$.

Now, ſince the latter is exactly a ſquare, its root $x + \frac{1}{2}a = \sqrt{\frac{5}{4}aa}$, and by tranſpoſition it will be $\sqrt{\frac{5}{4}aa} - \frac{1}{2}a = x$; which laſt equation is a canon for finding x.

For at the foot of $AB = a$, ſet at right angles $CB = \frac{1}{2}a$; then draw CA, the ſquare of which is equal $ABq + CBq = \frac{5}{4}aa$. And therefore $AC = \sqrt{\frac{5}{4}aa}$; make $CD = CA$. From whence $CB = \frac{1}{2}a$ being taken as the caſe requires, there remains $BD = x$; which transferred into AB, ſhall give the point E, where AB is cut according to extream and mean proportion.

This cannot be exactly done in numbers; but if you would have it tolerably near, add together the ſquare of any number, and the ſquare of its half, and extract, as near as you can, the ſquare root of the ſum; from whence taking half, the remainder is the greater part.

Extreams, in right-angled ſpherical trigonometry. When one of the five circular parts of a right-angled ſpherical triangle, *viz.* the three ſides and two oblique angles, (for the right-angle is neglected) is pitched upon for the middle term, then the two circular parts lying immediately next to it are called extreams conjunct; and the two parts remote from the aſſumed middle part, or not immediately next it, extreams disjunct. See Circular *Parts*, Triangle, and Trigonometry.

Extream *Unction*, one of the ſacraments of the Romiſh church, the fifth in order, adminiſtered to people dangerouſly ſick, by anointing them with holy oils, and pronouncing ſeveral prayers over them.

It is called extream unction, as being only given to perſons in extremity. In the thirteenth century, it was called the "unction of the ſick," and not extream unction: for, in the earlier ages, it was given before the viaticum; which practice, according to F. Mabillon, was not changed till the thirteenth century.

The reaſons he aſſigns for the change are, that in that age there aroſe divers miſtaken opinions, ſeveral of which we find mentioned and condemned in the Engliſh councils; among the reſt, it was held, that ſuch as had received this ſacrament, in caſe they recovered, might not make uſe of their wives, nor eat meat, nor go barefooted; whence they choſe to forbear it till the laſt extremity, which practice prevailed. See the Councils of Worceſter and Exeter, in the year 1287; that of Wincheſter, in 1308; and F. Mabillon, Acta Sanct. Benedict. Sæc. iii. p. 1.

The form of extream unction is now deprecative, as the divines call it; formerly it was abſolute and indicative. This ſacrament is not only in uſe in the Latin, but alſo in the Greek church, and throughout the Eaſt, though under another name, and with ſome difference in the circumſtances; in that the orientals do not wait till their ſick are come to extremity, in order to anoint them; but the ſick generally go to church themſelves; and it is adminiſtered to them as often as they are indiſpoſed: the Greeks taking that direction of St. James, chap. v. ver. 14. which is the foundation of the practice, in a general ſenſe: "Is any ſick among you? let him call for the elders of the church, and let them pray over him, anointing him with oil." F. Dandini diſtinguiſhes two kinds of unction among the Maronites: the one called unction with the oil of the lamp; but this, he ſuggeſts, is not the ſacramental unction ordinarily adminiſtered to ſuch as are in extreme ſickneſs; becauſe the oil is only conſecrated by a prieſt, and it is given to all who are preſent; not to the ſick only, but alſo to the healthy; even the prieſt who officiates partakes of it. The other kind of unction, according to that father, is only for the ſick; this is performed with oil conſecrated by the biſhop alone, on Holy Thurſday; and this, it ſeems, is the ſacramental unction.

The unction with lamp-oil is in uſe, not only among the Maronites, but throughout all the Eaſtern church, who uſe it very religiouſly. The truth is, they do not ſeem to have any other ſacrament of extream unction beſide this. Yet F. Goar obſerves, though it be only a ceremony, with regard to thoſe in health, it is a real ſacrament to thoſe that are ſick.

In their great churches they have a lamp, wherein this oil for the ſick is preſerved; this lamp they call κανδηλα του ευχελαιου, that is, *the lamp of oil joined with prayer*; for what the Latins call extream unction, the Greeks call ευχελαιον, or αγιον ελαιον, that is, *oil with prayer*, or *holy oil*.

Extreme, in *Muſic*, is applied to ſuch intervals as deviate as much as poſſible from the true chord of the ſame name, without changing their names; generally when the term extreme is added to the prefix diminiſhed or ſuperfluous (which denote a minor ſemitone), its effect is to double that diminiſhing or ſuperfluous effect, or to make it $\frac{576}{625} = 72\Sigma + 2f + 6m$; but ſometimes we find Mr. Orwend applying a major comma and a minor ſemitone as the effect of his term extreme, or $\frac{128}{135} = 47\Sigma + f + 4m$, = the medius ſemitone: at other times we find extreme, when added to other prefixes, to have different effects, as extreme ſharp intervals, for inſtance, are ſometimes found a minor ſemitone above the intervals reſpectively, or $\frac{24}{25} = 36\Sigma + f + 3m$: but in other inſtances the ſame prefix ſignifies a major comma more, or $\frac{128}{135} = 47\Sigma + f + 4m =$ the medius ſemitone. It were much to be wiſhed that theſe various applications of terms, ſo perplexing to a reader, could be got rid of, and a conſiſtent nomenclature in harmonies adopted.

EXTREMITIES, in *Anatomy*, is a term applied to the limbs, as diſtinguiſhing them from the other diviſions of the animal body, the head, and trunk. They are immediately connected with the latter by one end, and totally free in all other parts. The numerous varieties of their form depend partly on the bones, which enter into their compoſition; but, in a material degree alſo, on the ſoft parts which ſurround theſe, and which give to the limbs that roundneſs and elegance of figure, in which beauty is united with activity and ſtrength. The extremities, being eſſentially concerned in all the functions of animal life, and conſtituting the great agents of locomotion, are compoſed of organs eſpecially deſtined for theſe purpoſes. Their volume is formed by bones and muſcles, ſupplied by numerous veſſels, and communicating with the common centre of ſenſation, the brain, by nerves diſtributed moſt extenſively; producing, in one part, the moſt important ſenſe of touch, and giving the ſpring in all to rapid and varied motions.

The extremities are four in number, divided in man into upper and lower; in other animals into anterior and poſterior. Each extremity is divided into four parts; the upper into the ſhoulder, the arm, the fore-arm, and the hand; the lower into the hip, the thigh, the leg, and the foot. In treating of theſe, both ſeparately and generally, we ſhall conſider only the bones, and the connections between them. On theſe depend all the motions of the limbs, the direction and extent of action of the muſcles being wholly dependent on the bony points to which they are attached, and on the form and mode of junction of the bones on which they exert their power. The influence of any muſcle will be conſidered in the detailed deſcription of each, and may be eaſily applied to the ſubject immediately before us.

Our preſent plan is to offer, firſt, ſome general obſervations on the external figure of the bones of the extremities, as far as it relates to their uſes; on their modes of articulation and their motions. We ſhall next examine ſeparately and in detail each diviſion of the bones of the upper extremity, the ligaments connecting them, the mechaniſm of their articulations, and their individual motions; afterwards the combined movements of the ſeveral parts, and the powers of the member, as reſulting from this conſtruction, both in the paſſive and active ſtate. A ſimilar mode will be purſued in conſidering the lower extremity. We ſhall conclude with a compariſon between the upper and lower limbs as to ſize, figure, direction, motions, and growth.

The bones determine eſſentially the ſize, figure, and direction of the extremities, forming, by their aſſemblage, ſolid and flexible columns, capable of motion in very varied directions. Some of theſe in each column differ very widely in form; while others partake of the figure of both oppoſite varieties. We deſcribe them under the different names of long, of broad or flat, and of ſhort bones.

In the limbs the bones diminiſh ſucceſſively in length and ſize, and increaſe in number, as we deſcend from the trunk to the oppoſite extremity, from the arm, or thigh, to the fingers or toes. In conſequence of this arrangement the upper part of the limb enjoys extenſive motions, whilſt the lower is characterized by multiplied, but confined movements. Theſe bones have every where an analogous ſtructure, being broad and voluminous at their *extremities*, contracted, and frequently rounded in their middle part, or *body*. The increaſed volume of the extremities poſſeſſes the double advantage of enlarging the articular ſurface, and thereby diminiſhing the chances of diſplacement, and of preſerving the ſymmetry of the limb. We perceive, for inſtance, that the bellies of the muſcles correſpond to the middle or ſmalleſt part of the bone, while the flat and contracted tendons are fixed near the protuberant extremities. The augmentation of ſize, in the ends of the long bones, is by no means ſudden; it commences inſenſibly from the body. We remark, on theſe extremities, various eminences, ſubſervient to the purpoſes of articulation, or giving an advantageous attachment to tendons. The middle part, or body, is generally ſmooth, offering prominent lines for muſcular or tendinous attachments. Theſe, where ſtrongly marked, deſtroy the cylindrical form of the bone: they are uſually three in number, longitudinal, ſeparated by plane ſurfaces, and give the bone a priſmatic figure, as may be obſerved in the arm, fore-arm, and leg. In theſe inſtances a ſection of the bone is manifeſtly triangular; yet its internal canal preſerves a circular form. We may obſerve alſo, that the body, in nearly all the long bones, appears as if twiſted on itſelf; ſo that the direction of the upper end differs more or leſs from that of the lower. This is rendered evident, by tracing the oblique courſe of the prominent lines between the two extremities; for example, in the bone of the arm.

The long bones are formed from three points of oſſification. The firſt of theſe is obſerved in the centre of the body, extending on each ſide to the extremities, at which the bony cylinder is arrived at the period of birth. Soon after this time, a point of bone is perceived in the centre of each cartilaginous extremity, which increaſes gradually, advancing towards the body, with which it at laſt unites. From this conſideration of the figure and formation of the long bones, we may naturally derive the arbitrary diviſion into a *body* and two *extremities;* which diviſion we ſhall adopt throughout. The body of the bone is the *diaphyſis* of ſome Latin writers; and the two ends being at firſt united to the body only by cartilage, are called *epiphyſes*.

The broad bones are not found ſo generally in the extremities as thoſe of the long form; we obſerve them only at the part immediately united with the trunk, where they offer an ample ſpace for the attachment of the powerful muſcles concerned in moving the limb. In our deſcription we obſerve two *ſurfaces* and a *circumference*. The former, if they give attachment to muſcles, are uſually unequal and rough; the latter is thicker than the middle of the bone, offering more points of origin to muſcular fibres, as we may obſerve in the margin of the hip bone.

The ſhort bones of the extremities are found in ſituations where it was requiſite to unite a certain degree of mobility with firmneſs, as, for inſtance, in the foot. They are collected in conſiderable number in the regions which they occupy; and have numerous eminences and depreſſions on their external ſurfaces, neceſſary for their reciprocal articulations and for the inſertion of the connecting ligaments. Nothing can be more irregular than their figure, which, in addition to their comparative ſmallneſs and number, has given riſe to much ambiguity of deſcription. By conſidering them under the ſame aſpects as the other bones, and by carefully noticing their relations to theſe, all confuſion may be avoided. The ſhort bones, in general, continue longer in a cartilaginous ſtate than the others, reſembling, in the phenomena of their oſſification, the epiphyſes, or extremities of the long bones.

There ſtill remain ſome ſmall bones, found only in the extremities, which can hardly be included in either of the above claſſes, and are diſtinguiſhed by the epithet of ſeſamoid. They poſſeſs this peculiarity, that they are formed, not in common cartilage, but in the middle of a tendon, or ligament, and that no trace of them can be obſerved in early life. Of their uſe we ſhall ſpeak hereafter.

There are ſome general characters belonging to all the above-mentioned claſſes of bones. We obſerve in all eminences and hollows, either giving attachment to muſcles, or ligaments, or forming ſurfaces for articulation. The eminences deſigned for the former purpoſe are very numerous in the bones of the extremities, and vary greatly in figure. They ſometimes appear only as aſperities impreſſed in the midſt of a ſmooth ſurface, giving origin to a number of diſtinct aponeurotic fibres; ſometimes as prominences or tubercles more or leſs elevated and rough, giving inſertion to one or more tendons; or, laſtly, as a continued raiſed line. In general theſe eminences are proportioned to the muſcles which are fixed to them; ſo that under which-ever form they appear, there is an equality of ſpace allowed for the tendinous inſertions of muſcles of equal bulk. They are in general leſs ſtrongly marked in the female than in the male; in the infant than in the adult; in feeble animals than in the carnivorous tribes, which live by preying on others. Their prominence is indicative of vigour and activity of motion; being more developed as the muſcles are more powerful. This is ſtrikingly exemplified by a compariſon of the bones of a well made and muſcular man, where the outline of each muſcle might be traced with energy and preciſion through the ſkin, with thoſe of a weak and ill proportioned male, whoſe rounded and faintly marked limbs, reſembling thoſe of the female, betray a total want of vigour or addreſs. The uſes of theſe eminences may be clearly traced to their removing the inſertions of muſcles farther from the centre, or axis of the bone, and conſequently increaſing their power of moving it. The eminences, which give attachment to ligaments, poſſeſs the advantage of removing the ligament farther from the joint, and thereby facilitating, and giving greater extent to its motions. Theſe eminences have received different names, according to their ſituation, their direction, or figure, as we ſhall ſee more particularly hereafter.

The hollows obſerved on the external ſurfaces of the bones, (with the exception of articular cavities, of which we ſhall ſpeak below,) are deſigned either for the attachments of muſcles, or for giving paſſage to their tendons. The firſt of theſe have the evident advantage of increaſing the ſurface, without augmenting the bulk of the bone;

the latter appear as gutters, or grooves more or leſs deep, lined by cartilage, and completed by very ſtrong ligamentous bands, through which the tendons glide in their way to their final attachments.

The connections between the bones of the extremities, whatever be their mode, are known by the general term of articulations. Their varieties have given riſe to numerous technical, and in ſome meaſure obſolete, names, for which we refer to the articles Joint and Diarthrosis. Some joints allow of motion in every direction; and we may trace a gradual decreaſe of mobility, through many intermediate ſteps, till we arrive at articulations which admit only of a gliding of the bones on each other. We have examples of the firſt in the joints of the ſhoulder and hip; where the extent of motion requires rounded articular ſurfaces, concave and convex in the oppoſite contiguous bones; conſtituting what is commonly termed the ball and ſocket joint. In man the moveable bone has the rounded head, the ſupporting bone the correſponding hollow. In ſome animals we have inſtances of a contrary diſpoſition, in which a concavity in the moveable bone moves in all directions on an oppoſite convex ſurface. This mode of connection is found only in the ſhoulder and hip; and one advantage reſulting from this ſtructure being found at the upper part of the limbs, is, that the whole member neceſſarily partakes of the ſame extenſive motions; while it allows of a greater firmneſs and ſolidity in the inferior articulations. The joints we have juſt mentioned are, in this ſenſe, the joints, not only of the bones of the arm and thigh, but of all the limb, the motions of which, conſidered as a whole, they eſſentially and principally influence. Hence, if their mobility is deſtroyed, either by accident or diſeaſe, the limb becomes uſeleſs: whilſt a ſimilar occurrence in the inferior joints produces a partial inconvenience only. By this arrangement alſo, the joint, which, from its want of firmneſs, is moſt liable to injury, is the furtheſt removed from the immediate action of external bodies.

The extent of motion decreaſes as we proceed towards the extremities of the limbs. We find no rounded head, whoſe axis makes an angle with that of the cylinder of the bone, but an articular ſurface placed directly at the top or bottom. Of this we have examples in the connection of the collar bone with the breaſt, of the fore-arm with the wriſt, &c. In theſe, all power of rolling the bone, which is enjoyed in a high degree by the thigh, and by the arm, is deficient. In the next ſtep, the motions are confined to flexion and extenſion, as in the elbow, the knee, and the middle of the fingers. In this diviſion the articular ſurfaces conſiſt of eminences and hollows adapted reciprocally to each other, allowing of motion in one direction only. They are remarkable alſo for their large extent, which imparts to them ſolidity; and for admitting a greater degree of motion in the direction of flexion, than in the oppoſite one of extenſion, as may be obſerved in the knee, elbow, and fingers. The degree of extenſion is always effectually limited, either by a projection of bone, as in the elbow; or by ſtrong ligaments, as in the knee, &c. In other inſtances, the articulation allows of rotation only; a convex ſurface turning in a concave, or a hollow ſurface rolling over a convex one; both of which may be ſeen in the motions of the bones of the fore-arm. In the laſt kind we obſerve only a gliding of plane articular ſurfaces on each other, more or leſs obſcure, limited on all ſides by ligaments binding the bones cloſely together. To make up for this very confined motion, we uſually find many ſuch joints united, producing in this ſtate a more ſenſible degree of motion than could poſſibly occur in any of them ſingly. This may be ſeen in the wriſt.

In all theſe articulations we find a ſmooth and poliſhed cruſt, of an elaſtic ſubſtance, called cartilage, on the ſurface of the correſponding bones, the immediate means of their motions on each other. It is ſuppoſed to obviate by its elaſticity the dangers reſulting from ſudden and violent ſhocks. The two correſponding cartilages of oppoſite bones are ſo diſpoſed as to touch at all points in ſome poſitions of the limb, whilſt in others they quit each other more or leſs, and are found oppoſite the ſoft parts ſurrounding the articulation. They are moulded into the form of the bone to which they adhere, preſerving its general figure. But in ſome caſes the cartilage is thicker in its middle than at the edges, thereby increaſing the convexity; in others the converſe may be obſerved, and the hollow of the articular ſurface is proportionably increaſed. Both occur in the hip and ſhoulder: the firſt in the heads of the thigh and arm bones, the laſt in the cavities which receive them, and in this manner the uniformity of contact is preſerved. In the other articulations the cartilaginous cruſts are nearly of equal thickneſs throughout.

The contact of the articular ſurfaces is ſecured by ligaments deſtined immediately for this purpoſe, and by the muſcles which paſs from one bone to another, ſupporting the joint either by the muſcular fibres, or their tendons. The ligaments are formed by very ſtrong fibres, a little elaſtic, diſpoſed in parallel lines, or interlaced in various directions. Their great reſiſtance inſures, at all times, more particularly when the limb is at reſt, the relations between the oppoſite bones; their ſituation limits in a great degree their inordinate motions. We obſerve them under many forms, and named either from theſe, or from their ſituation. Among the firſt are capſular ligaments, which are found ſurrounding ſome of the joints like cylindrical bags, embracing the oppoſite bones by the circumference of the two ends. Of this we have examples in the hip and ſhoulder, and nowhere elſe perhaps in the extremities. The ligamentous fibres are here interwoven and ſtrengthened by the adherence of the ſurrounding tendons, loſt at either extremity in the perioſteum, to which they are firmly united. The reaſon why capſular ligaments are found only in theſe articulations will be readily underſtood. They enjoy motion in every way nearly alike, and require on all ſides an equal degree of reſiſtance. Where, from the form of the articular ſurfaces, the motions are confined to narrower bounds, ligaments are neceſſary only in particular ſituations in order to regulate them. We find them in the other joints generally on the ſides, from which the name of lateral ligaments. Theſe are ſometimes rounded, ſometimes flat, interwoven with the perioſteum at each extremity, formed of fibres lying in parallel lines, or diverging at either end. There are other ligaments, not directly concerned in the joint, which ſtill ſtrengthen and regulate its motions, as may be remarked particularly in the ſhoulder. Beſides theſe we obſerve many irregular ſlips, or bands of ligaments, diſperſed here and there over the joint ſeparated by fat and cellular tiſſue from the neighbouring parts. The ligaments, of whatever deſcription, unite the oppoſite ſurfaces of bones, prevent their diſplacement, and yet allow of eaſy and rapid motions; a double advantage ariſing from their firmneſs on one part, from their flexibility on the other. They ſometimes give attachment to muſcles.

The muſcles ſurrounding the joints of the extremities are very powerful agents in ſecuring their contact, and the more ſo as their power increaſes in proportion as the chance of diſplacement is greater. The moſt vigorous efforts at diſplacement are made during violent and extended motions; at ſuch times the muſcles paſſing from bone to bone, and croſſing the articulation, are ſtrongly contracted, are firm in their contractions; and powerfully oppoſe the tendency which the extremities of the bones may have to abandon each other. In repoſe, when the muſcles are relaxed, and offer but little reſiſtance, the chances of luxation are few, but if they occur, the probability of its taking place is exceedingly increaſed.

In ſome joints of the extremities we find a ſubſtance of a ſomewhat cartilaginous ſtructure, occupying the interval between the cartilaginous ſurfaces, and called for this reaſon inter-articular cartilage. Such bodies are ſometimes moveable, as in the knee, correſponding to the varying want of uniformity in the articular extremities, or fixed more firmly to the end of the bone, or the neighbouring ligaments. They are elaſtic and highly flexible, reſembling cartilage in the firſt quality, the fibrous ligaments in the ſecond. This peculiarity of ſtructure has given riſe to the name of articular fibro-cartilages, a term beſtowed on them in recent times by the French anatomiſt Bichat.

Theſe ſurfaces are all moiſtened by a fluid, called ſynovia, on the compoſition of which we ſhall not dwell here. It is ſecreted by a delicate membrane which completes the ſtructure of the joint, by lining every part of its ſurface: whatever be the figure of the cartilages, or the ligaments, from both of which it is diſtinct, it adheres cloſely to them. It forms a bag without an opening ſpread over the whole organ, reflected from the cartilages to the ligaments or tendons; ſo that whatever it embraces is, in reality, without the articular cavity as it is termed, though projecting into it. To the whole it gives that ſmooth, poliſhed ſurface ſo neceſſary for the eaſy and rapid movements the articulations enjoy, at the ſame time ſecreting the fluid which facilitates them; it gives to the joint alſo its peculiar ſhining character.

The moſt ſimple motion of articular ſurfaces, common to them all, is gliding on each other in oppoſite directions; it is often ſo obſcure as to be ſcarcely perceptible. As we aſcend we find it multiplied in a variety of ways. The limb can be conſiderably bent, or extended; it can be removed from, or brought nearer to the axis of the trunk: the firſt of theſe motions is called abduction, the latter adduction; in ſome caſes, as in the ſhoulder, they are termed elevation, or depreſſion. The motions of ſome joints are confined to any two of theſe, as in the knee; others enjoy the whole, and all the intermediate degrees, as in the thigh. The union of theſe different movements, as exhibited in the arm or thigh, has been called circumduction. In this caſe the bone, inſtead of being moved in one direction, and back again to the oppoſite, is carried ſucceſſively through all, deſcribing by its extremity a circle, or the baſe of a cone, the apex of which is in the articulation above. Rotation, or rolling, is very different from this. In circumduction the bone is moved from its prior ſituation to a more diſtant one; in rotation it remains in the ſame place, it turns only on its axis, as may be obſerved in ſimply rolling the arm.

From this curſory review of the external characters of the bones of the extremities, of their modes of connection and motions, we proceed to the detailed deſcription of each. It will be neceſſary to premiſe, that in our terms of poſition and aſpect, we ſhall always ſuppoſe the body erect, the arms depending, and the hands ſupine, ſo that the little finger is in contact, or at leaſt next to the external ſide of the thigh. In this ſituation we ſhall ſuppoſe a vertical plane dividing the body into two halves, from before backward. With a clear impreſſion of this idea we ſhall find no difficulty or confuſion in the terms anterior and poſterior, ſuperior and inferior, external and internal, as applied to the different aſpects or ſurfaces of bones; by the latter, internal, we always mean the ſurface next the imaginary middle plane above-mentioned. Theſe arbitrary terms, though applicable only to one determined poſition of the body, are yet neceſſary to give tolerable preciſion to anatomical deſcription: when by their aſſiſtance we have made ourſelves familiar with the objects they are deſigned to illuſtrate, they may be diſmiſſed as eaſily as they have been adopted; our ideas of the relative ſituation of parts will be diſtinct, and may be applied readily to every poſſible variety of poſture. In order to obviate all ambiguity, we ſhall introduce alſo the nomenclature of Chauſſier, as conveying exact and preciſe notions of the relations of oppoſite bones to each other. The terms are generally ſimple, and always perſpicuous as applied to the preſent ſubject.

The upper extremity—is divided into four parts; the ſhoulder, the arm, the fore-arm, and the hand, each of which will be ſeparately conſidered.

The ſhoulder is the diviſion of the upper extremity attached immediately to the ſuperior and lateral parts of the trunk; it is formed by two bones, one broad, placed vertically behind, called the *ſcapula*, or ſhoulder blade, the other long, ſituated horizontally before, called the *clavicle*, or collar bone. The diſpoſition of theſe bones gives the broad form and character to the upper part of the cheſt, which is in itſelf very conſiderably contracted at this part, its apparent breadth and magnitude being derived from the lateral appoſition of the ſhoulders. Generally, alſo, there is a proportion between theſe and the dimenſions of the cheſt: they are large, and ſtrongly developed, when the latter is well formed; contracted and narrow when it is ſmall or badly ſhaped. The height of the ſhoulder depends on the ſituation of the ſcapula; it is lower proportionably in the female, and in males of a feeble body, than in individuals of the oppoſite character. In the latter caſe, though the bones form the outline, it is the brawny muſcles which fill it up, conſtituting, by their well-defined and maſſy forms, the diſtinguiſhing character of the ſex in man, and other animals.

The *ſcapula*, ſhoulder blade, or omo-plate, is a bone of an irregularly triangular figure, ſeated on the upper and back part of the trunk. It is connected by muſcles to the head, the vertebræ, and the ribs, by articulation to the clavicle and humerus. The ſcapula has ſuch a latitude of motion as to make it difficult to aſſign preciſely its ſituation on the trunk. But when the arm is at reſt, it covers the ſpace between the firſt and eighth ribs, with its baſe or poſterior margin at a ſmall diſtance from the vertebral column, to which it approaches nearer above than it does below. At this line the ſcapula lies pretty cloſe on the ribs; forwards, we find it receding conſiderably from the oppoſite ſurface of the trunk, in which ſituation it is conſtantly preſerved by its connection with the clavicle.

For convenience of deſcription, we divide the ſcapula into two ſurfaces, the dorſal or exterior, and the coſtal or interior; into three margins or coſtæ, the ſuperior, the poſterior, or baſe, and the inferior, or external coſta. The rounded points at which theſe edges meet are uſually called angles, and are named, from their ſeveral ſituations, the ſuperior, the inferior, and the anterior angles of the ſcapula.

The dorſal ſurface, the dorſum, or back of the ſcapula, is divided into two very unequal portions by a ſtrong and ſolid proceſs of bone projecting from it tranſverſely, called the ſpine of the ſcapula. It commences at the poſterior margin, about one-fourth part of the whole length below the ſuperior angle, increaſes gradually in depth as it advances obliquely forward towards the anterior angle, beyond which it projects in the form of a broad, flat proceſs, called the acromion. The ſpine is connected with the whole breadth of the dorſum, with the exception of that portion of it called the neck; its anterior edge is ſmooth, rounded, and concave, and is gradually loſt in the under ſurface of the arch of the acromion. The poſterior, or projecting ridge of the ſpine, is broad and flattened, varying however in breadth in different parts. At its commencement is a ſmooth, triangular ſpace, over which paſſes a part of the tendon of the trapezius. Further on it is rough, the upper margin of the criſta giving attachment to this muſcle, the lower to the poſterior half of the deltoid. The acromion is flattened in a direction contrary to that of the ſpine of which it is a continuation, is of conſiderable breadth, rough and ſomewhat convex above, concave and ſmooth below. On the internal edge, which is continuous with the ſuperior criſta of the ſpine, is a ſmooth oval ſurface for articulation with the clavicle. The external edge is rough and irregular, giving attachment to the middle part of the deltoid. The ſummit of the acromion is rounded, and marked by the attachment of a ligament which connects it with the coracoid proceſs. Towards the anterior part of the baſis of the ſpine, near the neck, we obſerve holes for the admiſſion of the nutrient veſſels. The upper ſurface of the ſpine is hollow, forming a portion of the ſupra-ſpinal foſſa, the name given to that portion of the dorſum ſituated above the ſpine, and which gives lodgment to the ſupra-ſpinatus muſcle. The lower ſurface is alſo concave, though irregularly ſo, and contributes to the formation of the infra-ſpinal foſſa, the part of the dorſum lying below the ſpine, which is occupied by the infra-ſpinatus muſcle; the latter portion ſcarcely deſerves the name of foſſa, being convex in its centre. Towards the inferior part of the dorſal ſurface is a ridge running in the direction of the inferior coſta, for nearly its whole length; it gives attachment to an aponeuroſis, which ſeparates the infra-ſpinatus from the teres major, and teres minor. Towards the inferior angle this ridge is met at a very acute angle by another, originating in the inferior coſta. The latter forms the line of diviſion between the two laſt mentioned muſcles, the upper and ſmaller part giving attachment to the teres minor, the lower and broader to the teres major.

The under or coſtal ſurface of the ſcapula is concave, marked by ſeveral converging ridges running from the baſe towards the anterior angle. They give attachment to the aponeurotic diviſions of the ſub-ſcapularis, its fleſhy bundles lying in the intervening ſhallow depreſſions. Towards the ſuperior and inferior angles we mark ſome projecting points, which give attachment to the ſerratus major anticus, as alſo more or leſs evidently a riſing line between, deſigned for the ſame purpoſe.

The ſuperior margin, or coſta of the ſcapula, is the ſhorteſt of the three borders. It is thin towards the ſuperior angle, becomes broader as we trace it forwards to its termination in a ſtrong curved proceſs, called, from its ſimilarity to a crow's beak, the coracoid proceſs. At the root of this proceſs we obſerve a deep notch, croſſed by a ligament, ſo as to form a circular hole; in many inſtances the circle is completed by bone. It gives paſſage to the ſupra-ſcapulary nerve, and uſually to a branch of the ſupra-ſcapulary artery and veins. Juſt behind this notch the omohyoideus muſcle has its origin. The coracoid proceſs is rather flattened, convex and rough above, where it gives attachment to ligaments connecting it with the under ſurface of the clavicle, concave and ſmooth below. Its internal edge gives attachment to the pectoralis minor, its external to a ſtrong ligament, croſſing from it to the acromion, its ſummit to the united heads of the biceps, and the coraco-brachialis.

The baſe of the ſcapula is the longeſt of the three margins, offering a waving line with an obtuſe projection in it, oppoſite the commencement of the ſpine; to this, and to the margin below it, the rhomboidei are attached. From its junction with the ſuperior coſta reſults the ſuperior angle, to which the levator ſcapulæ is partly attached.

The inferior coſta is much broader than the other, dividing at its anterior part into two projecting lines, with a hollow between them. Towards the inferior angle, where it joins the baſe, the edge is thinner, and convex, giving attachment to the teres major, and occaſionally to ſome fibres of the latiſſimus dorſi. The outer of the prominent lines gives origin above to the long head of the triceps; below to the teres minor. The inner line, and intervening hollow, is occupied by the ſub-ſcapularis. The inferior coſta terminates above, at the anterior angle, towards the coracoid proceſs, in an ovate, ſlightly hollowed ſurface, called the glenoid cavity. This ſurface is at right angles with the plane of the bone, its long diameter perpendicular, and its broader part below. It is covered by cartilage, the edges raiſed a little by a fibrous ring, which adds ſomewhat to its depth. At the upper end of the brim is attached the long head of the biceps. The glenoid cavity is articulated with the head of the humerus; it ſtands off a little from the body of the bone, ſupported by a ſhort proceſs, more contracted than the brim of the cavity, called the neck of the ſcapula. This narrowing is more particularly obſervable on the back, under the ſpine.

The ſcapula is, in its ſtructure, compact; thin and diaphanous every where but at its edges and proceſſes, where the bone is thick and cellular. Its oſſification commences at an early period in the fœtus, and advances conſiderably before birth. At the latter period, however, the acromion, the coracoid proceſs, and the baſe, ſtill exiſt in the ſtate of cartilaginous epiphyſes.

The clavicle, or collar bone, is placed nearly tranſverſely at the ſuperior and anterior part of the cheſt, between it and the top of the ſhoulder. In figure it ſomewhat reſembles the italic *ſ*; the two thirds next the ſternum being of an irregularly cylindrical, or nearly priſmatic form, and gently convex anteriorly; the third next the ſcapula flattened horizontally, broad, and with a more conſiderable convexity directed backwards. It is more ſlender, and leſs curved in the female than in the male.

The extremities of the bone are diſtinguiſhed from their ſituation by the names of the external or pectoral, and the ſcapular, or humeral ends of the clavicle. The firſt of theſe is triangular, preſents an irregular articular ſurface of conſiderable extent for connection with the ſternum; its plane is nearly at right angles to the body of the bone. The ſcapular extremity preſents alſo a flat, articular ſurface, oblong horizontally, accommodated to the oppoſite one in the acromion. The upper ſurface is rounded towards the ſternum, where the ſterno-cleidomaſtoideus is attached, ſmooth in its middle portion, flat and broader next the ſcapula. The under ſide, to which theſe characters are equally applicable, is marked near the ſternal end, by a roughened ſurface, for the attachment of a ligament connecting the clavicle to the firſt rib. Towards the middle is a conſiderable longitudinal hollow for the lodgment of the ſubclavius muſcle. Near the ſcapular end the face of the bone is unequal, with a rough eminence in it for the inſertion of ligaments which bind it to the coracoid proceſs of the ſcapula. Towards the ſternum the anterior edge is broad, and bends gently forwards, for about one-half of its length, where it gives origin to a portion of the pectoralis major; it then becomes thinner, ſlopes backwards, and terminates by ſuddenly turning forwards again towards its junction with the acromion. It gives attachment to the anterior half of the deltoid. The curvatures of the poſterior edge are the inverſe of the preceding. The bone is rounded, ſmooth and concave for the two-thirds next the ſternum; unequal and convex towards the ſcapula, where the trapezius is attached.

The clavicle is in ſtructure like the other long-bones; the medullary cavity is very confined. At the time of birth its form is already ſtrongly marked, and its oſſification nearly complete.

The articulations of the ſhoulder.—The ſcapula is connected with the trunk by a great number of muſcles, which partly ſupport it, and allow of all thoſe varied motions of which it is capable. It is cloſely bound alſo to the clavicle, which latter bone is immediately articulated with the ſternum. We have here only to examine the two laſt connections, beginning with that between the clavicle and ſternum, as forming the union between the ſhoulder and the trunk.

The ſternal end of the clavicle is covered by a cartilaginous cruſt of conſiderable thickneſs, preſenting an irregular convex ſurface. At the upper part of the ſternum is an articular cavity, ſlightly hollowed, of leſs extent than the oppoſite articular ſurface of the clavicle, ſo that the latter riſes conſiderably above it; a circumſtance particularly ſtriking in lean perſons.

The ligaments which connect theſe ſurfaces are four, an anterior and a poſterior, an inter-clavicular, and a coſto-clavicular ligament. To complete the joint, we find alſo an inter-articular cartilage, dividing it into two ſeparate cavities, and a diſtinct capſular membrane lining each of theſe.

The anterior ligament covers the front of the joint, lying between the ſkin and the ſterno-maſtoideus without, and the capſules immediately within. It is compoſed of fibres, which deſcend obliquely from the upper and anterior edge of the clavicle, diverging as they proceed to be fixed into the upper edge of the articular cavity in the ſternum. Theſe ligamentous fibres leave ſeveral intervals between them, which are occupied by cellular tiſſue and veſſels.

The poſterior ligament is ſmaller and not ſo ſtrong as the anterior. It ſeparates the ſterno-hyoideus and ſterno-thyroideus from the capſules to which it firmly adheres. It extends from the poſterior edge of the clavicle to the oppoſite part of the ſternum. The fibres deſcend a little in their paſſage, diverging as they approach the latter bone.

The inter-clavicular ligament is placed between the two clavicles, immediately above the hollow at the upper edge of the ſternum, with the integuments only in front, and the ſterno-hyoidei and ſterno-thyroidei behind. It is attached to the upper edge of the ſternal extremity of each clavicle, the fibres croſſing in a flattened form from one to the other, and longer above than below; they are often ſeparated by intervals filled up with cellular tiſſue.

The coſto-clavicular, or rhomboid ligament, paſſes obliquely upward from the cartilage of the firſt rib to the internal edge of the under ſurface of the clavicle, cloſe to its ſternal end. It is flat and ſhort, the fibres becoming longer as they recede from the ſternum. In front of it lies the ſubclavian muſcle, and immediately behind it the ſubclavian vein. It has no immediate connection with the articulation, but ſerves to ſtrengthen it and regulate its motions.

Between the clavicle and ſternum we find an intermediate round, flattened piece of fibro-cartilage, its ſurfaces accommodated to the ends of theſe two bones. Its circumference lying immediately under the ligaments of the joint, is united to the ſurface of the anterior and poſterior. It is united alſo above and below, by means of a ſtrong and thick fibrous ſubſtance, to the circumference of the articular ſurface of both the clavicle and ſternum. The fibro-cartilage is thicker above, and much thinner next the cartilage of the rib. The fibres which compoſe it are leſs apparent in its middle than nearer its edges. From its cloſe connection with the ſurrounding parts, it cannot be moved in any of the actions of this joint.

The capſular membranes adhere to the ligaments which ſurround the articulation, between the fibres of which they are often apparent. They both adhere alſo to the fibro-cartilage, one of them lining the cavity between it and the ſternum, the other the correſponding cavity between it and the end of the clavicle. The membrane is every where delicate, its inner ſurface moiſtened by ſynovia, which is ſecreted but in a very ſmall quantity.

From the diſpoſition of the ligaments belonging to this articulation, there remain but few intervals not covered and ſupported by them; ſo that it nearly approaches in ſtructure thoſe joints which we find ſurrounded by a fibrous capſule, as in the caſes of the ſhoulder and the hip, which it ſomewhat reſembles, alſo in the extent of its motions.

Articulation of the clavicle with the ſcapula.—At the ſcapular extremity of the clavicle we find a ſmall oval facet, covered by cartilage, correſponding to a ſimilar one in the internal edge of the acromion. We often meet alſo with a delicate inter-articular cartilage, its ſuperficies ſometimes equalling the articular ſurfaces of the bones, at others leſs; it is thickeſt above, and adheres by its circumference to the ligaments. To ſecure this joint, we find ligaments above and below it; and the clavicle is further bound to the coracoid proceſs of the ſcapula by ſtrong ligaments, without being any where in contact with it.

The upper ligament forms a broad and flat band, which covers the whole length of the articulation, croſſing from the upper edge of one articular ſurface to the other, the fibres being longer as they are ſeated more ſuperficially. It lies immediately under the tendinous aponeuroſes of the trapezius and deltoid, which form a ſtrong, diſtinct layer of fibres, not eaſily ſeparable from the ligament.

Underneath the joint lies another ligament, the fibres following the direction of the preceding, which it approaches in front, being ſeparated behind by an interval filled with cellular tiſſue. Above, it is in contact with the capſular membrane; below, with the ſupra-ſpinatus. The ſynovial membrane is found lining the articular ſurfaces, reflected from one to the other, and containing but little ſynovia. It is ſometimes double, where the inter-articular cartilage is perfect.

The ligaments which further connect the clavicle with the ſcapula are attached to the coracoid proceſs, from which they purſue different directions to be inſerted into the clavicle. The moſt delicate of theſe has been called the ligamentum bicorne. It ariſes from the inner edge of the coracoid proceſs, near its point, and, as it advances upwards and inwards, ſplits into two layers, which envelope the ſubclavian muſcle. The upper band is attached to the clavicle, near the end of the rhomboid ligament; the under layer paſſes to the rib immediately below it. It is not ſtrong enough to add much to the ſecurity of the connection between the bones. The other ligamentous bands, placed between the coracoid proceſs and the clavicle, have been divided by many authors into two diſtinct ligaments: one, the poſterior bundle, has been called, from its figure, conoides; the other, for a ſimilar reaſon, trapezoides. Though ſcarcely diſtinct in their origin, they differ ſo much in figure, and in the direction of their fibres, that we ſhall conſider them as ſeparate ligaments. The poſterior ligamentum ſcapulæ commune conoides is attached below, by the ſummit of the cone, to the root of the coracoid proceſs; above, to the rough tubercle ſituated on the under ſide of the humeral end of the clavicle. It is compoſed of ſhort thick fibres, radiating as they aſcend, parallel to, and continuous with thoſe of the anterior ligament, as they approach nearer the acromion. Below, its fibres are often united with thoſe forming the ligament croſſing the notch of the ſcapula. The anterior ligament, ligamentum commune trapezoides, croſſes obliquely from the coracoid proceſs to the clavicle, as a broad flattened band, exceeding the preceding in length. It is fixed below to the poſterior part of the upper ſurface of the coracoid proceſs, above, to an oblique line proceeding from the tubercle towards the end of the clavicle. The anterior fibres are longer than the poſterior; the latter, at the union with the fibres of the poſterior ligament, form an angle pointing towards the acromion, and leaving in front an angular cavity which is filled by fat. Theſe ligaments are covered by the ſubclavius in front, by the trapezius behind, leaving an interval of an inch or more towards the ſcapulo-clavicular articulation.

The ſcapula has two other ligaments proper to itſelf, which we ſhall deſcribe here, although they have no immediate relation with the articulation of the clavicle and ſcapula. One cloſes the notch in the laſt-named bone, the other is extended between the coracoid proceſs and the ſcapula. The firſt, conſiſting of a flat, compact band of ſilvery ſhining fibres, croſſes from the poſterior angle of the notch to the baſe of the coracoid proceſs, converting it into an hole, through which the ſupra ſcapulary nerve, and frequently alſo the ſupra ſcapulary veſſels paſs.

The ligament placed between the coracoid proceſs and the acromion is of a triangular form, of conſiderable ſurface, thin, and flattened. Its baſe is attached along the external edge of the coracoid proceſs, from which it proceeds in two diſtinct bands, ſeparated by cellular tiſſue, and converging, as they approach the acromion, into one common ſheet. The poſterior fibres paſs obliquely outwards, the anterior are directly tranſverſe; the interval between them is croſſed by ſome ſcattered ſlips of ligament. Its upper ſurface is covered by the deltoid and clavicle, its lower ſide is in contact with the ſupra-ſpinatus. Its anterior edge is not defined, but continuous with a thick and denſe layer of cellular membrane, lying between the deltoid and the tendons of the infra and ſupra-ſpinatus. This ligament completes the arch formed by the coracoid proceſs and acromion over the ſhoulder-joint.

The mechaniſm and motions of the ſhoulder.—The ſcapula, by its muſcular connection with the trunk, is capable of powerful and varied motion; the clavicle, on the contrary, can only follow the impulſe communicated by the ſcapula, whoſe motions it regulates and limits under certain circumſtances. The ſcapula forms the eſſential part of the ſhoulder, the clavicle can be conſidered only as acceſſory in man, and ſome animals who uſe their anterior extremities for other purpoſes beſides progreſſion. The ſcapula may in ſome meaſure be conſidered as defending that part of the thorax over which it moves; but its more evident uſe is to ſerve as the baſe of all the motions of the arm, which at the ſame time it increaſes moſt extenſively. In this reſpect it differs from the hip, which is in itſelf motionleſs, although affording a point from which the thigh directs all its movements. We ſhall recur to this difference hereafter: in this place it will be ſufficient to notice, that notwithſtanding the apparent want of firmneſs in the ſhoulder, it is enabled, by means of its numerous and powerful muſcles, to offer a ſolid reſiſtance to the impulſe communicated from the arm in any of the violent actions of the upper extremity. The ſcapula plainly accompanies the motions of the arm, forwards and backwards, but in the ſimple elevation outwards, and in depreſſion of that bone, its movement is ſcarcely obſervable. In the former caſes it rotates on an imaginary axis, perpendicular to its plane, placed ſomewhat about the middle of the bone.

In the inſtance where the arm paſſes forward from the ſtate of adduction, the ſuperior angle of the ſcapula is lowered a little, and approaches the vertebral column, whilſt the inferior recedes from it, and is at the ſame time ſomewhat elevated. Where the arm is carried backwards the converſe of this occurs. In theſe rolling motions the clavicle is concerned but little if at all; the ſcapula turning on it at the joint which unites them, the articular ſurfaces gliding on each other, and the ligaments above and below becoming alternately ſtretched or relaxed, as the motions are ſucceſſively continued. They, however, are not capable of reſiſting alone any violent effort tending to diſplace the bones in this rotatory motion; it is the ſtrong ligaments croſſing from the coracoid proceſs to the tubercle of the clavicle which, by their alternate tenſion, ſecure their relations under theſe circumſtances. This articulation is further defended from injury by the mobility of both bones, which would recede before any violent ſhock.

The clavicle acts as a prop, preventing the ſhoulder and arm from falling forwards and approaching the breaſt, either by their weight or by the action of the muſcles which move them. It is partly preſerved in its ſituation by muſcles which are fixed to it above. Its exiſtence is neceſſary for many of the motions of the upper extremity, particularly thoſe in which it is carried forward; it favours alſo the circumduction of the arm, by keeping it at a diſtance from the trunk, and allows the whole limb to deſcribe arcs of a ſphere, the centre of which is found at its ſternal end. We find conſequently that animals without clavicles enjoy theſe motions but imperfectly, in many inſtances in no degree. Their abolition in the caſe of fractured clavicle is another proof of the utility of the latter in directing the actions of the ſhoulder.

The combined motions of the ſcapula and clavicle are thoſe of depreſſion, elevation, thoſe in which the ſhoulder is carried forward, or backward, and the combination of theſe or circumduction.

When we raiſe the ſhoulder, the ſcapula paſſes during its elevation a little obliquely forward. The inferior angle advances, whilſt the upper edge or coſta recedes from the trunk. The ſcapular end of the clavicle is neceſſarily alſo raiſed, ſo as to increaſe the ſpace between it and the firſt rib, and to diminiſh ſomewhat the angle it forms with the acromion, its ſternal end preſſing more and more on the articular cavity in the ſternum; the rhomboid ligament is ſtretched, limiting the elevation, and the inter-clavicular ligament relaxed.

In depreſſing the ſhoulder the exact inverſe of theſe effects is produced, and requires not therefore a minute detail. We ſhall obſerve only that the lower ſurface of the clavicle may be brought ſo near to the firſt rib, as to compreſs the intervening veſſels very conſiderably, and produce a painful ſwelling of the arm. The depreſſion is much limited by this contiguity of the rib, which lies pretty cloſe to the clavicle in the moſt common and eaſy poſition of the ſhoulder.

When the ſcapula advances forwards its anterior angle recedes from the trunk, being kept off by the clavicle, the baſe at the ſame time approaching nearer the breaſt. The clavicle becomes more diſtant from the firſt rib in the horizontal direction, the inter-clavicular, and the poſterior ligaments are rendered tenſe, the ſternal end preſſing inwards and backwards. In this ſituation luxations have occurred, but the accident is rare, as the ſhoulder is ſeldom expoſed to any violence under theſe circumſtances, that by its direction would probably effect it.

In carrying the ſhoulder backward, the anterior angle of the ſcapula is brought nearer to the cheſt, and the baſe approaches the ſpine. As the ſcapula has a conſiderable extent of motion in this direction, and is accompanied by the ſcapular end of the clavicle, it will readily be conceived, that if the movement is ſudden and violent, the ſternal end will diſtend its anterior ligament, may rupture it and become luxated forwards on the ſternum. In fact this is the moſt common mode of diſplacement.

The ſhoulder may be moved in any of the intermediate directions to thoſe we have deſcribed; and in all we are to conſider it as a lever compoſed of two parts, one horizontal, the other vertical, the ſternal end of the clavicle being the reſting point, or the centre of the movements of the lever. The continued ſucceſſion of all theſe motions produces the circumduction of the ſhoulder, a motion in which the clavicle deſcribes a cone, the ſummit of which will be at its ſternal, and the baſe traced by its ſcapular extremity. We are not to confound this motion of the ſhoulder with that of rotation, deſcribed above.

The direction of the ſhoulder is ſubject to variations from the ſlighteſt motion; in general it is ſo inclined that the glenoid cavity points outwards, proving moſt evidently, if any argument were wanting, that the upper extremities are not deſigned to ſupport the body in the attitude of a quadruped. In fact, in that poſition, the head of the arm bone would preſs, not againſt the glenoid cavity, but on the capſular ligament which ſurrounds it, and which is utterly incapable of long reſiſting the effort.

The Arm.—The humerus, the only bone in the arm, the largeſt and ſtrongeſt of thoſe of the upper extremity, is placed between the ſhoulder and the fore-arm. It is nearly ſtraight, bending gently forwards below, "tanquam ad meliorem amplexem," ſays Albinus. Of an irregular priſmatic form, ſomewhat rounded at its upper and middle portions, flattened and gradually widening below, ſo as to be broadeſt at its lower end where it ſupports the fore-arm. It has the appearance of having been twiſted in the middle, as if at an early period the upper end had been carried round forcibly outwards, and the lower end in the oppoſite direction. We divide it into two extremities, a ſuperior or ſcapular, and an inferior, or cubital; and into a middle portion or body.

At the upper end, the moſt bulky part of the bone, are three eminences; the head, and the great and ſmall tubercle of the humerus. The head of the humerus is rounded, forming nearly the half of a ſphere, ſmooth, covered by cartilage, articulated with the glenoid cavity of the ſcapula. It ſtands on a very ſhort proceſs, ſomewhat more contracted than the articular circumference, called improperly, perhaps, the neck of the humerus. The head and neck are directed obliquely upwards, ſo that a line drawn in their axes would form an obtuſe angle with the body of the bone; they are alſo inclined backwards with reſpect to the plane of the condyles at the lower extremity. From this oblique poſition of the head with regard to the body of the humerus, the neck is longer, and the contraction more ſtrongly marked below than it is above, where we remark only a ſhallow groove dividing the head from the tubercles.

The great tubercle is placed externally, oppoſite to the head. It is rough, broad, and flattened; marked by three diſtinct ſurfaces for the attachment of tendons. One, anterior, for the tendon of the ſupra-ſpinatus muſcle; a middle ſpot, for that of the infra-ſpinatus, and one below for the teres minor. The leſſer tubercle, placed in front of the bone, is rough, much ſmaller but more elevated than the laſt. It gives attachment to the ſub-ſcapularis. Dividing the tubercles is a deep longitudinal groove, of which we ſhall ſpeak below.

The body of the humerus, though of a very irregular form, is ſufficiently marked for us to divide it into three differently inclined ſurfaces, and as many projecting lines between them. Owing to the twiſted figure of the bone theſe angular lines purſue rather a ſpiral than a ſtraight courſe.

The anterior ridge or ſpine commences at the inner edge of the great tubercle, and is continued through the middle of the bone to the lower end. It is rough in its upper half, giving attachment above to the pectoralis major, and lower down to a portion of the deltoid: below it is rounded and ſmooth, giving attachment to and covered by the brachialis internus. The internal line deſcending from the ſmall tubercle, gives attachment above to the latiſſimus dorſi, and lower down to the coraco-brachialis and triceps. Towards the anti-brachial extremity it becomes much more prominent, affording attachment to a ſtrong inter-muſcular aponeuroſis. The external edge begins at the under ſide of the neck, running obliquely forwards as it deſcends. It is but faintly marked above where it gives attachment to a portion of the triceps; is interrupted towards the middle, leaving a ſmooth flat ſurface, over which the radial nerve and accompanying veſſels turn; below it riſes again into a more acute, and elevated ridge, which gives attachment to an inter-muſcular ligament, and ſome muſcles belonging to the fore-arm. In the internal ſurface, bounded by the anterior and inner lines, we obſerve above the bicipital groove, continued between the tubercles and the ſpines, proceeding from them for ſome way down the bone, increaſing in breadth, and gradually becoming obliterated. It is lined by cartilage, and provided with a ſynovial membrane, where it lodges the tendon of the long head of the biceps. Towards the lower end of the groove, at its outer ſide, is a rough line for the inſertion of the tendon of the teres major. About the middle of the internal ſurface the coraco-brachialis has an attachment, and below this the brachialis internus. The external face is larger than the preceding: covered above by the deltoid, ſtrongly marked by a rough prominence interſecting it obliquely for the inſertion of this muſcle. Immediately below this ridge is a broad ſhallow oblique depreſſion, along which the radial nerve and ſome veſſels paſs. Towards the lower extremity the bone is ſlightly concave, and gives attachment to the brachialis internus. The poſterior ſurface is ſmooth and rounded, altering its direction in a conſiderable degree as we trace it downwards: it gives origin to and is covered by the triceps.

The lower, or anti-brachial extremity of the humerus, is broad and flattened tranſverſely, and advances a little forwards from the axis of the body of bone. In the middle is an articular ſurface for connection with the fore-arm, and on either ſide a projecting point, called tuberoſity, or condyle. Of theſe the internal (poſterior of Albinus) is the moſt projecting. It is ſomewhat flattened, continuous above with the internal ſpine, marked irregularly below by the attachments of muſcles, and the internal lateral ligament of the elbow joint. The external condyle (prior Albini) is much leſs prominent, and gives attachment to the external lateral ligament, as well as to ſeveral muſcles which lie on the radial and dorſal ſides of the fore-arm.

The articular ſurface, placed between theſe two points, deſcends a little way beyond them. It is marked by ſeveral eminences and hollows. Next to the external condyle is a rounded eminence (capitulum of Albinus) adapted to the hollow in the head of the radius, and at its inner ſide is a groove for the internal projecting edge of that hollow. The remaining diviſion forms the pulley or trochlea (rotula of Albinus) for articulation with the ulna. We obſerve two prominent edges and a depreſſion between them. The edge next the radius is not ſo prominent in front as behind, neither does it riſe ſo high as the edge next the internal condyle, which deſcends a conſiderable way below the reſt of the articular ſurface, ſloping gradually into the hollow of the pulley on one ſide, and terminating abruptly by an acute margin on the other. The hollowed part, forming nearly three-fourths of a circle in extent from before backwards, is much broader behind, directed from thence obliquely inwards as we follow it to the front of the bone. Above the middle of the pulley, at its back part, is a deep cavity, oblong tranſverſely, which receives the olecranon, or extremity of the ulna, during the extenſion of the fore-arm. Oppoſite to this, at the termination of the pulley in front, is a ſmaller hollow for the reception of the coronoid proceſs of the ulna, when the fore-arm is bent. Between theſe correſponding hollows there remains but a thin plate of bone, in many inſtances diaphanous.

The humerus reſembles in ſtructure the other long bones. Its oſſification commences at three points; at the middle and at each end. At the time of birth the ſcapular extremity of the humerus is entirely cartilaginous, and of greater proportionate bulk. At the lower extremity the capitulum is much larger in compariſon with the trochlea than in the adult bone.

The articulation of the humerus with the ſcapula, forming the ſhoulder joint.—The head of the humerus is covered by a layer of cartilage, much thicker in the middle than at the circumference. The glenoid cavity of the ſcapula is lined by cartilage, thinner in the middle than round its edges. The margin of the cavity is further provided with a fibrous elevated border, proceeding above from the tendon of biceps which gives off a bundle on either ſide; below, from the circumference of the articular cavity. Over the joint is the bridge formed by the acromion, the coracoid proceſs, and the ligament ſtretched acroſs between them. The head of the humerus moves on the glenoid cavity; but from the ſmall relative ſize of the latter, the ſurface of the head of the humerus in contact with it forms but a ſmall part of its articular ſuperficies, the remainder of which is thus out of the cavity, and correſponds to the capſular ligament.

The capſular or orbicular ligament encloſes the whole of the joint in the form of an oblong ſac, contracting a little at each extremity. The upper edge is fixed round the glenoid cavity of the ſcapula, beyond the fibrous ring we have juſt mentioned. In ſome inſtances there is an interval left on the inner ſide, which is then ſupplied by the tendon of the ſub-ſcapularis. The lower edge is attached round the neck of the humerus; cloſe to the margin of the articular cartilage above, at a greater diſtance from it below. The attachment is interrupted between the two tubercles, the ligament croſſing from one to the other over the bicipital groove. The deficiency occaſionally obſerved on the inner ſide is ſupplied as above by the tendon of the ſub-ſcapularis, which may be ſeen from within the joint covered only by the reflected ſynovial membrane. The capſular ligament is remarkable for its length, which allows the articular ſurfaces of the two bones to be ſeparated from each other, by the diſtance of an inch, on the admiſſion of air into the cavity. It is covered above by a denſe ligamentous band paſſing from the outer edge of the coracoid proceſs, to the anterior part of the larger tubercle, where it unites with the tendon of the ſupra-ſpinatus; and ſo cloſely joined by its under ſurface to the capſular ligament, that, but for its attachment to the coracoid proceſs, it would be difficult to make any diſtinction between them. It is this acceſſary band which makes the capſular ligament thicker above than in any other part. The ſhoulder joint is further ſtrengthened by the tendons of the ſupra-ſpinatus, infra-ſpinatus, teres minor, and ſub-ſcapularis, which ſurround it, and which are firmly united to different parts of the capſular ligament. The latter is in contact alſo with the deltoid above, and the origin of the long head of the triceps below. It is formed by fibres running in various directions, and croſſing each other, is thinneſt where covered by the infra-ſpinatus, and teres minor, ſtronger on the inner and under ſides; apparently inſufficient to ſecure the firmneſs of the articulation, if not ſupported by the muſcles proceeding from the ſcapula. The ſynovial membrane is ſpread over its internal ſurface, and reflected over the articular cartilages. At the edge of the bicipital groove a proceſs goes from it, which deſcends along the groove, lining it for the ſpace of about an inch. It is then reflected on all ſides over the tendon of the long head of the biceps, and continues to give it a covering in its paſſage through the joint to its attachment above the glenoid cavity. By the reflection of the ſheath below, the eſcape of ſynovia is prevented, and the tendon may ſtill be ſaid to be exterior to the cavity of the joint.

The mechaniſm of the ſhoulder joint as to mobility and reſiſtance.—Although motion be the principal office of the upper extremity, there are many accidental circumſtances in which firmneſs of oppoſition is as neceſſary as in the lower, and the means nearly as complete.

The motions of the arm are very extenſive, generally combined in different degrees with thoſe of the ſhoulder. Indeed ſo great is its mobility, that it eſcapes on that account many injuries it would otherwiſe be liable to, from the looſeneſs of its articulation with the ſhoulder. Add to this that the point of ſupport, the glenoid cavity of the ſcapula, is in itſelf ſo moveable, as further to modify and leſſen the effects of external impulſes. We have before obſerved that the ſcapula more particularly accompanies the arm in its motions backwards and forwards, leſs ſo in its elevation outward and depreſſion; the clavicle neceſſarily partakes of the movement, and from this diſpoſition two advantages are derived that the circuit of motion is enlarged, whilſt tendency to diſplacement is diminiſhed by the diſtribution of the effort over three points inſtead of one.

The arm, and conſequently the whole limb, may be elevated, depreſſed, carried forward, backward, and in all the intermediate directions; it may be rolled alſo on its axis in any of theſe conditions.

When the arm is raiſed, the head of the humerus glides from above downwards in the glenoid cavity, in ſome meaſure abandons it, and reſts againſt the lower ſide of the capſular ligament, which it diſtends more or leſs according as the ſcapula has accompanied it in its movement. If the arm be elevated outwards or abducted, it cannot be much aſſiſted by the ſcapula; the great tubercle is buried under the arch formed by the acromion, the coracoid proceſs, and the ligament between them, and in this ſituation the capſule is particularly ſtretched, is liable to be torn, and the arm luxated downwards. When the arm is thus raiſed above the horizontal line, at a diſtance from the trunk, the weight of the body brought to bear with force on the head of the bone, as in the caſe of falling, tends to depreſs it ; and at the ſame time the actions of the pectoralis major, latiſſimus dorſi, and teres major, concur in producing the ſame effect ; ſince they have their fixed points in the trunk, and their moveable point in the humerus. Luxation, under theſe circumſtances, is by no means rare. The action of muſcles alone is ſcarcely adequate to the effect, which is generally the conſequence of ſome violent impulſe.

In depreſſion or adduction, the arm returns to its natural poſition, in which diſplacement is almoſt impoſſible. Where the limb is perpendicular, any external impulſe acting on its lower end, would only preſs the head of the bone firmly againſt the arch of the acromion. The only mode in which it could be made to paſs beyond the arch, would be by carrying the lower end inwards ; but this is oppoſed by the trunk, ſo that in this poſition of the arm luxation upwards is effectually prevented.

When the arm is carried forward to a conſiderable height, it is accompanied in its motion by the rotation of the ſcapula, and the head of the bone ſcarcely quits the glenoid cavity. It is on theſe accounts that when in falling forward the arm is projected conſiderably beyond the head, luxation is rarely the conſequence, though the ſhock be ſevere. In the motion backwards the head of the humerus quits in ſome degree the articular cavity, and bears againſt the capſular ligament and the tendon of the ſub-ſcapularis. The extent of this motion is alſo increaſed by the coincident movement of the ſcapula, and at the ſame time the probability of luxation diminiſhed ; it is not, however, ſo free as the motion forwards.

Circumduction, or the ſucceſſion of theſe motions, is enjoyed extenſively in the joint of the ſhoulder ; the execution of it in the anterior half of the circle is more eaſy, becauſe more unconfined than in the poſterior. And we may obſerve as a general axiom, applicable to all the motions of the arm, that the movements forwards are far more extenſive than thoſe in the contrary directions, whatever be the point from which they commence, in whatever direction the limb may be ; examples of theſe are too familiar for us to particularize them, the cauſe will be readily underſtood from our account of the mechaniſm of this part of the upper extremity.

The rotation of the arm takes place excluſively in the ſhoulder joint, not accompanied as the others by any correſponding motion of the ſcapula and clavicle. In this motion the head of the humerus merely glides backwards or forwards in the glenoid cavity, according as it is rolled inwards or outwards ; it is not extenſive, and cannot give occaſion to diſplacement of the bones. In caſes where the functions of the elbow joint have been ſo far deſtroyed, as to prevent the rolling of the bones of the fore-arm one over the other, the rotation of the humerus has been obſerved to be more marked, to compenſate the deficiency.

The fore arm, placed between the arm and the hand, is compoſed of two bones, the ulna and radius.

The ulna, the largeſt of the two, is on the inner ſide. Irregular in ſhape, ſtrong, and larger above, leſſening gradually in ſize to its lower end. We divide it into two extremities, an upper or humeral, a lower or carpal ; and into a middle portion or body.

The humeral extremity compriſes two ſtrongly marked eminences, the olecranon and coronoid proceſſes, and two lunated cavities, the largeſt articulated with the pulley in the lower end of the humerus, the leſſer with the head of the radius. The olecranon projects beyond the coronoid proceſs in a line with the body of the bone ; it is ſtrong, ſomewhat curved, rough above, where it affords attachment to the triceps ; ſmooth behind, where it lies immediately under the ſkin ; concave before, where it forms the upper part of the great ſigmoid cavity. The coronoid proceſs ſtands oppoſite to the olecranon in front of the bone. Its upper ſurface forms the lower part of the laſt named cavity, the under is marked by the attachment of the brachiæus internus. The edge next the radius is hollowed by the leſſer ſigmoid cavity, the oppoſite margin is acute, and gives attachment to the pronator teres, the flexor ſublimis, and the internal lateral ligament of the elbow joint. The great ſigmoid cavity (ſinus lunatus of Albinus) lies between theſe proceſſes. It is deeply concave longitudinally, adapted to the figure of the trochlea of the humerus ; divided tranſverſely in the middle by a contraction of the articular ſurface, and a faintly marked line between the narrowed points. The upper diviſion made by the olecranon is the largeſt. The cavity is divided alſo into two unequal portions, by a convex line traverſing its whole length, the internal diviſion is the largeſt, and moſt hollowed, for the reception of the inner border of the trochlea. The leſſer ſigmoid cavity is oval tranſverſely, ſlightly hollow, continuous above with the larger cavity.

The body of the ulna is of an irregular priſmatic form, largeſt above, curved gently forward, and turning towards the radius below. We diſtinguiſh in it three ſurfaces, and a like number of angular ridges between them. The anterior edge or ſpine paſſes from the leſſer ſigmoid cavity in a curved line to the carpal extremity ; it is acute above, and gradually ſoftened below, till it becomes ſcarcely viſible. It gives attachment to the interoſſeous ligament. The internal edge (poſterior, Alb.) is rounded, giving attachment to the flexor profundus above, to the pronator quadratus below. It follows a curved line from the inſide of the coronoid proceſs, and is ſomewhat more prominent below, for the attachment of the latter muſcle. The poſterior edge (exterior, Alb.) beginning from behind the olecranon, is ſtrongly marked in its upper two thirds, and inſenſibly loſt below. It gives attachment to an aponeuroſis. The anterior ſurface (latus interius, Alb.) is broader above than below, gibbous in the middle, and concave at each end ; the hollow part below is occupied by the pronator quadratus, the remainder gives attachment to flexor profundus. Towards the upper end is a ſmall hole directed upwards for the admiſſion of the nutrient veſſels. The poſterior ſurface (prius, Alb.) is divided through its whole length by a prominent line ; at the upper end of the internal diviſion is a triangular ſpace for the attachment of the anconæus ; below it is covered by the extenſor carpi ulnaris. The external diviſion, that neareſt the radius, gives attachment above to the ſupinator brevis, below to the extenſors of the thumb and fore-finger. The internal ſurface is broad, and a little concave above, giving attachment to the flexor profundus, convex and much narrower below, lying immediately under the ſkin.

The carpal extremity is ſmall, marked by two eminences ; one placed externally, called the head or capitulum, the other, from its ſhape, the ſtyloid proceſs. The head preſents a rounded articular ſurface, correſponding below to a triangular inter-articular cartilage placed between it and the carpus ; externally to an articular cavity in the inner ſide of the carpal extremity of the radius. The ſtyloid proceſs projects beyond the head ; it is ſmall, of a conical ſhape, the point giving attachment to the internal lateral ligament of the wriſt. Between theſe proceſſes is a tranſverſe groove, which gives attachment to the fibro-cartilage juſt mentioned. Behind they are ſeparated by another longitudinal groove, which lodges the tendon of the extenſor carpi ulnaris.

The ulna is formed from three points of oſſification, as the other long bones. At the time of birth the form of the olecranon is fully determined, whilſt the coronoid proceſs projects but little. The conſequence is, that the great ſigmoid cavity is leſs concave in compariſon than in the adult, and the leſſer ſigmoid cavity is proportionably ſmall and ſhallow.

The radius is ſituated on the outer ſide of the fore-arm. It is ſhorter than the ulna; ſmaller above than below, and gently curved in the middle. The upper or humeral extremity, called alſo the head of the radius, preſents a circular articular ſurface; ſlightly hollowed in the middle, correſponding to the rounded eminence on the cubital end of the humerus. The ſmooth articular ſurface is continued a ſhort way down the bone, and is broadeſt on the inſide, where it lies in the leſſer ſigmoid cavity. This diviſion is ſupported by a narrower portion of bone, cylindrical, and of an inch in length, called the neck of the radius. Immediately below, on the inner ſide, is an oval protuberance, ſmooth on its anterior half, over which the tendon of the biceps paſſes, ſeparated from it by a burſa mucoſa; rough poſteriorly where this tendon is inſerted.

The body of the radius is of an irregular priſmatic form, which makes a natural diviſion of it into three faces, and as many angular lines. The anterior edge is more prominent above than below. The upper part gives attachment to the long flexor of the thumb, to the flexor ſublimis, and to the ſupinator brevis; its lower to the pronator quadratus. The internal edge or ſpine, acute in the middle, rounded at each end, gives attachment to the interoſſeous ligament. The poſterior, prominent alſo in the middle, and diſappearing inſenſibly above and below, gives no muſcular attachments. The anterior ſurface is concave above, where it gives origin to the flexor longus pollicis; a little convex below, where the pronator quadratus is fixed. About its middle is the hole for the nutrient veſſels of the bone. The poſterior ſurface, like the former, increaſes gradually in breadth from above downwards, is irregular, gives attachment above to the ſupinator brevis, and lower down to the extenſors of the thumb; its inferior part, covered by the extenſor communis, the extenſor tertii internodii pollicis, and the indicator. The external ſurface is convex throughout. Its upper third gives attachment to the ſupinator brevis: about its middle is a rough eminence, into which the pronator teres is implanted; below it is covered by the radial extenſors of the carpus.

The carpal extremity is larger than the ſuperior, irregularly quadrilateral, the longeſt ſide anterior. We obſerve in it an articular cavity, oblique, ſlightly hollowed, croſſed by a riſing line from before backwards, adapted to two of the bones of the carpus; the outer diviſion to the os ſcaphoides, the internal to the ſemi-lunare. The anterior edge of the cavity is rough for the inſertion of ligaments. The poſterior offers two grooves; the internal, broad and ſuperficial, gives paſſage to the extenſor communis and indicator, the outer, narrow and deeper, follows an oblique courſe from within outwards and downwards: through it paſſes the extenſor tertii internodii pollicis. On the inner margin is a lunated articular ſurface, correſponding to the capitulum of the ulna. The outer ſide, divided from the poſterior by a riſing ſpine, is marked in a ſimilar manner by two hollows. The anterior offers two grooves for the extenſores primi and ſecundi internodii pollicis; the poſterior is marked by the tendons of the radial extenſors. At the ſharp ridge, between this ſide and the anterior, the ſupinator longus is implanted. The prominence between the hollows is continued downwards into a blunt proceſs, paſſing beyond the articular ſurface, called the ſtyloid proceſs of the radius. It gives attachment to the external lateral ligament of the wriſt. The radius reſembles, both in its formation and ſtructure, the other long bones. At the time of birth its extremities are yet cartilaginous; the lower end is ſooneſt completely oſſified.

The elbow joint; the articulation of the ulna and radius with the humerus.—The lower end of the humerus preſents an articular ſurface compoſed of alternate eminences and depreſſions, covered by a continued cruſt of ſmooth cartilage. The great ſigmoid cavity of the ulna is lined by cartilage, interrupted in the middle by a tranſverſe contraction and groove; continued into the leſſer ſigmoid cavity. The head of the radius is alſo covered by cartilage, continued over its circular margin for a ſhort way down its cylinder. The humeral end of the ulna correſponds to the pulley, that of the radius to the capitulum at the lower extremity of the humerus. Theſe ſurfaces are bound together by ligaments, and covered by a ſynovial membrane reflected from one to another.

The ligaments which more particularly ſecure the joint are called lateral, one being placed on its outer, the other on its inner ſide. The internal lateral ligament is fixed above to the internal condyle of the humerus. It radiates as it deſcends, dividing into two portions; the anterior is fixed to the inner ſide of the coronoid proceſs of the ulna, the poſterior, the ſmalleſt of the two, to the olecranon. The anterior diviſion is covered by the tendon common to the muſcles proceeding from the internal condyle, and is partially united to it. Immediately under the ligament is the capſular membrane. The external lateral ligament can with difficulty be diſtinguiſhed from the common tendon of the muſcles attached to the external condyle. It is fixed above to this condyle, below it is united to a large portion of the circle of the annular ligament of the radius. It is not ſo ſtrong, ſo large, nor ſo clearly defined as the internal lateral ligament, its fibres diverge conſiderably, and are in contact with the ſynovial membrane. In addition to theſe ligaments we find ſcattered bands of fibres traverſing in different directions, both before and behind the articulation; their irregularity ſcarcely admits of deſcription. Between them and the ſynovial membrane lie ſome cellular tiſſue and fat. This ſynovial membrane is reflected from the humerus cloſe at the margin of the articular cartilage, and is continued under the ligaments to the oppoſite ſurfaces of the ulna and radius, lining the ſigmoid cavities of the firſt, and ſpread over the head of the latter. It is common therefore to the articulations of the fore-arm with the arm, and of the bones of the fore-arm between themſelves. This joint is ſtrengthened alſo in a remarkable degree by the numerous muſcles which are attached round it, and which cover it on every ſide.

The motions of the fore-arm on the arm—are confined to flexion and extenſion, the ulna executing the principal part, the radius neceſſarily following the ſame direction. In a ſtate of complete flexion the coronoid proceſs of the ulna and the prominent margin of the head of the radius are found correſponding to the oppoſite hollows in front of the humerus, the olecranon below the condyles, having moved a conſiderable diſtance from the internal one. At this time the lateral ligaments are relaxed; the poſterior half of the trochlea of the humerus in contact with the capſular membrane, reflected from it to the olecranon, and protected by the triceps. Under theſe relations the joint is ſecure; diſplacement in any direction would be almoſt impoſſible, without ſome fracture of bone. In the intermediate ſtates between flexion and extenſion the articulation has not the ſame appearance of ſecurity; but from the great mobility of the lower end of the humerus; from its receding eaſily before every ſhock when the fore-arm is in ſuch ſituation, we ſeldom meet with a diſlocation of the latter under theſe circumſtances. In the extenſion of the fore-arm on the arm, the radius and ulna glide backwards over the articular ſurface of the humerus, until ſtopped by the olecranon becoming locked in the cavity adapted for its reception in the latter bone. At this time the lateral ligaments are tightened as well as the capſule in front of the joint. It is in the ſtate of complete extenſion that luxations moſt uſually occur, the humerus paſſing down in front of the bones of the fore-arm. This frequently happens in a violent fall on the hands. The whole weight of the body is carried forwards with conſiderable impetus on the arms which are ſtretched out to ſave the head from coming to the ground. In this caſe the fore-arm is fixed, and the humerus, following the impulſe of the body, ruptures the ligaments, and is thruſt forwards, the olecranon oppoſing itſelf to all diſplacement backwards. It would appear alſo, that a diſlocation might occur from lifting a heavy weight with the arm fully extended; but here the effort is voluntary, and the pain felt in the bend of the elbow is a ſufficient warning to deſiſt. When the fore-arm is extended it forms an obtuſe angle with the arm, and when bent it is not found in the ſame line with the humerus, but ſlants a little inwards towards the breaſt. Both theſe circumſtances depend on the obliquity of the pulley at the lower end of the humerus. This direction of the fore-arm, and conſequently of the hand in the ſtate of flexion, is particularly obſervable in man, and neceſſarily requires the exiſtence of a clavicle, without which the fore-arm, when bent, would be carried to the oppoſite ſhoulder. Thus in the different ranks of animals the exiſtence of a clavicle, and the motion of pronation, are found generally connected with this obliquity in the flexion of the fore-arm. In the ſtate of demi-flexion we may obſerve a ſlight lateral motion of the fore-arm on the arm, which cannot take place in the ſtates either of complete flexion, or extenſion.

The articulations of the radius with the ulna.—Theſe bones are in immediate contact at their humeral and carpal extremities; between theſe points there is a vacancy occupied by a flat interoſſeous ligament. Above, the head of the radius is received into the leſſer ſigmoid cavity of the ulna; below, it offers a ſhallow articular ſurface, which revolves on the capitulum at the carpal end of that bone. Firſt we ſhall examine the articulation at the humeral ends. It is lined by the ſynovial membrane common to it, and to the articulation of the fore-arm with the arm, and ſecured by a ſtrong flat circular band of fibres, called the annular or orbicular ligament of the radius. This ligament forms three-fourths of a circle, which is completed by the leſſer ſigmoid cavity, and in which the head of the radius turns. It is about three lines in breadth, fixed before and behind to the ends of the leſſer ſigmoid cavity, loſt inſenſibly above over the ſurface of the ſynovial capſule, to which it is firmly united, terminating by a more defined edge below. It is compoſed of parallel circular fibres, into which the external lateral ligament is fixed from above, as alſo ſome oblique fibres proceeding from the olecranon, the ligamentum adceſſorium poſticum of Weitbrecht. The annular ligament is of a denſe compact texture, frequently cartilaginous in advanced age. It lies immediately over the ſynovial membrane, but is no where connected in any degree with the radius. It is covered by muſcles.

The ſpace between the upper and lower articulations is filled by the intervention of ligamentous fibres, which further ſecure the relations between the radius and ulna. A portion of theſe has obtained the name of the oblique ligament, or chorda tranſverſalis; the remainder is included under the general term of interoſſeous ligament. The oblique ligament, a ſmall and flat band of fibres, paſſes obliquely from the inner edge of the coronoid proceſs below the leſſer ſigmoid cavity to be inſerted into the radius at a point which lies juſt below its tubercle. In this courſe it accompanies the inner edge of the tendon of the biceps, its direction being oppoſite to the fibres of the interoſſeous ligament, and in a plane anterior to them. Between this ligament and the head of the radius there is left a triangular ſpace filled by cellular tiſſue, in which the tubercle of that bone revolves. The interoſſeous ligament commences below the tubercle attached to the inner ridge or ſpine of the radius, from which the fibres paſs obliquely downwards and inwards to be attached to the oppoſite ſpine of the ulna. It is compoſed of flat parallel fibres, leaving various intervals for the paſſage of veſſels. It is covered on both its ſurfaces by the deep ſeated muſcles of the fore-arm, to which it affords attachments. It is more delicate above, inſenſibly loſing its ſhining appearance, and interrupted by a large vacancy, which gives paſſage to the poſterior interoſſeous veſſels; ſtronger below, where we find another opening for the paſſage of the anterior interoſſeous veſſels. On the poſterior ſurface of this ligament, and more eſpecially at the upper end, we often find flat bands of fibres decuſſating it: they have been deſcribed under the name of the poſterior tranſverſal chord.

The inferior articulation between the radius and ulna, or that at the carpal ends of theſe bones, is provided with a ſynovial capſule, and a triangular fibro-cartilage interpoſed between the ulna and the bones of the carpus, and filling the vacancy obſerved between them in the ſkeleton.

This triangular cartilage is fixed by its baſe to the prominent edge which divides the articular cavity at the bottom of the radius, from that which receives the capitulum of the ulna. It is attached by its ſummit to the groove between the capitulum and the ſtyloid proceſs. Its edges are united to the ſynovial membranes of both articulations, the radio-carpal and the radio-cubital. Its upper and lower ſurfaces are concave and ſmooth, the ſuperior correſponding to the lower ſurface of the ulna. It is occaſionally incomplete at the baſe, allowing of the contact of the two capſular membranes juſt mentioned.

The capſular membrane is looſe, ſo as not to impede the extended rotation of the radius. It is continued from the upper ſurface of the inter-articular cartilage over the articular ſurfaces of the radius and ulna. It is ſometimes covered here and there by a few ſcattered ligamentous fibres, which are in many inſtances ſcarcely obſervable.

The motions of the bones of the fore-arm, between themſelves and their powers of reſiſtance.—We have hitherto conſidered the fore-arm only in its relation to the arm, in which the ulna was more eſſentially concerned; the movements in the preſent caſe depend chiefly, and almoſt excluſively, on the radius, and are neceſſarily communicated to the hand with which it is articulated below, the ulna concurring but little in the conſtruction of the joint of the wriſt. Theſe bones are thus diſpoſed inverſely as to importance in the joints of the elbow and wriſt: above, the ulna plays the principal part, the radius being acceſſary only; whereas below, the ulna is of comparatively little importance, the radius of the greateſt. Their form is accommodated to the different uſe of each: the ulna large above and ſmall below; the radius of little volume at its upper extremity, broad and ſolid at its lower, where it ſupports the hand. This double oppoſition in the form of the bones is not only accommodated to their functions, but renders the ſolidity of the fore-arm nearly equal throughout.

out. The radius, however, from its more direct connection with the hand, more immediately ſuſtains any effort impreſſed on the latter, as in puſhing violently, or falling, and is often fractured under ſuch circumſtances. Still the reſult of the general mechaniſm will be, that the ſame bone, not having to ſupport the motions of the two joints, the elbow and wriſt, motions which are often ſimultaneous, fractures and diſlocations are the leſs likely to occur.

The radius may be rolled on the ulna inwards and outwards. In the former caſe, ſuppoſing the radius to be horizontal, the palm of the hand is turned downwards, and the motion called on that account pronation; in the latter it is turned upwards, and the motion called ſupination. In pronation, which is the moſt common poſition, the humeral end of the radius turns on its axis in the hoop formed for it by the leſſer ſigmoid cavity dna the annular ligament, while the carpal extremity rolls over the lower end of the ulna, tracing an arc of a circle. In this ſtate the relative ſituations of the bones are changed, the radius croſſing the ulna, and diminiſhing the ſpace between them. If pronation be carried forcibly too far, a diſlocation may take place in either articulation; more readily in the lower, on account of the greater extent of motion, and leſs ſtrength of reſtraining ligaments; in the upper, the radius does not quit its ſituation, and is ſecured by a very ſtrong ligament, beſides the powerful ſupport of the muſcles attached round it. In ſupination the radius moves in the contrary direction, until it becomes parallel to the ulna, beyond which it cannot go. If it is forced beyond theſe limits a diſlocation of one of the articulations muſt enſue, moſt probably of the lower. A great obſtacle to luxations of this joint, either in pronation or ſupination, is found in the triangular fibro-cartilage at the lower end of the bones, which is very ſtrong, and which muſt neceſſarily be torn.

Although at firſt ſight one might be diſpoſed to imagine the ulna an immoveable fulcrum, round which the radius rolls, it is certain that in pronation the carpal end of the ulna paſſes outwards, in ſupination in the contrary direction, ſo that it traces arcs of a circle in a contrary way to the carpal end of the radius. Of this any one will be effectually convinced by obſervation or experiment. But as the ulna cannot roll on the lower end of the humerus, it neceſſarily involves the latter bone in the execution of theſe motions, which it thus aſſiſts by its powers of rotation. Pronation and ſupination then depend not only on the rotation of the radius, but on the oppoſite motion of the ulna, and the rotation of the arm. The latter of theſe is very much more ſenſible if the motions take place when the fore-arm is extended on the arm, than when it is bent: in the former caſe, from the diſpoſition of the bones and ligaments, any rotatory motion of the ulna is impoſſible, in the latter it may exiſt in a ſlight degree.

We have obſerved that the diſpoſition of the bones of the fore-arm is ſuch as to offer the beſt poſſible reſiſtance to external efforts: nor is their poſition as to theſe motions leſs favourable, the head of the radius lying a little before the ulna, and the breadth of its carpal extremity removing its axis from the lower end of the ulna, ſo as to increaſe and facilitate the pronation and ſupination of the hand, offering at the ſame time a broad baſis for its ſupport.

The hand—forms the fourth and laſt diviſion of the ſuperior extremity; it is articulated with the lower end of the fore-arm. It varies conſiderably in ſize and form in different individuals: moſt commonly is comparatively ſmaller in females. We diſtinguiſh in it two ſurfaces, a dorſal and a palmar; two edges, a radial and ulnar; and alſo an upper or anti-brachial, and a lower or digital end. It is compoſed of twenty-ſeven bones, which have been arranged under the different titles of carpus, metacarpus, and fingers.

The Carpus.—The carpus, or wriſt, is oval tranſverſely, convex on its dorſal, hollowed on its palmar ſurface, where it gives paſſage to the flexor tendons. This hollow is bounded laterally by four eminences reſulting from different bones of the carpus, which give attachment to a ſtrong ligament confining the tendons in their ſituation. It is convex at the edge next the fore-arm, offering a number of irregular articular ſurfaces at the border next the metacarpus. It is formed by two rows of ſmall irregularly ſhaped bones, the upper range called anti-brachial, the lower metacarpal. Each of theſe ranges is compoſed of four bones: thoſe in the anti-brachial row, commencing from the radial edge, are the ſcaphoides, lunare, cuneiforme and piſiforme; in the metacarpal row the trapezium, trapezoides, magnum and unciforme. Although varying much in figure, they have ſome characters in common, which allow of our deſcribing them with tolerable preciſion, without rendering confuſed or obſcure our ideas of their mutual relations. We diſtinguiſh in each bone ſix ſurfaces, or ſides; an upper or anti-brachial, a lower or metacarpal, an anterior or palmar, a poſterior or dorſal, an outer or radial, and an inner or ulnar.

The ſcaphoides, ſo called from a ſuppoſed reſemblance to a boat, is the largeſt bone of the firſt row. It is ſomewhat oval in figure, the long axis being directed obliquely from above outwards and downwards. The upper ſurface is convex, triangular, articulated with the radius; the lower is alſo convex, correſponding to the oppoſite ſurfaces of the trapezium and trapezoides. The poſterior narrow, and grooved by the inſertion of ligaments; the anterior long and contracted, concave towards the fore-arm, convex and projecting below, forming one of the eminences before mentioned. The outer, or radial ſide, is rough for the attachment of the external lateral ligament of the wriſt; the internal preſenting a double articular ſurface, the upper narrow and convex, connected with the os lunare; the lower broad and concave, forming part of the articular cavity for the reception of the os magnum of the ſecond row.

The lunare, or ſemi-lunare, has obtained its name from the figure of one of its articular ſurfaces, which reſembles a creſcent. It is not ſo elongated in form as the laſt bone; convex and triangular above when articulated with the radius; concave below, narroweſt in its tranſverſe diameter, articulated with the os magnum, and in a ſmall degree with the unciforme; rough and unequal on the anterior and poſterior ſurfaces for the attachment of ligaments, the anterior ſide the ſmalleſt; the outer face narrow, ſmooth, in the form of a creſcent, with the convexity upwards in contact with the ſcaphoides; the inner alſo ſmooth, plane, articulated with the cuneiforme.

The os cuneiforme (triquetrum of Albinus) leſs in volume than the preceding, oblong and ſomewhat pyramidal in ſhape, its baſe next the os lunare, its apex directed obliquely inwards and downwards. The upper ſurface is convex, articulated with the bottom of the ulna by the intervention of the triangular fibro-cartilage before mentioned; the lower oblique, concave, articulated with the unciforme; the anterior preſents on its inner ſide a flat circular articular facet articulated with the piſiforme, on its outer it is rough for the attachment of ligaments; the poſterior and internal are alſo unequal and rough for ſimilar purpoſes; the external or radial ſurface is plane and ſmooth, articulated with the lunare.

The os piſiforme (ſubrotundum of Albinus) has obtained its name from its rounded figure. It is the ſmalleſt of the bones of the carpus. On its poſterior ſurface we obſerve a ſlightly hollowed articular ſurface, where it reſts on the laſt deſcribed bone, "aſſidens patellæ in modum, aut ſeſamoidei," (Alb.) With this exception the bone is convex on all ſides, projecting beyond the plane of the other carpal bones, rough, and unequal, giving attachment above to the flexor carpi ulnaris, below to the abductor of the little finger, and before to the annular ligament of the wriſt. It conſtitutes one of the four prominent points of the palmar ſide of the carpus.

The trapezium (multangulum majus, Alb.) is the firſt bone on the radial ſide of the ſecond range of carpal bones, and lies ſomewhat anterior to them. Above it offers a concave articular ſurface, ſemi-circular, oppoſed to the ſcaphoides; below another, convex antero-poſteriorly, concave tranſverſely, articulated with the metacarpal bone of the thumb; on the front rough, with a deep groove at the upper end for the paſſage of the flexor carpi radialis; the outer edge of the groove giving attachment to the annular or tranſverſe ligament, and forming one of the eminences already mentioned; on the back and outer ſides rough and unequal for attachment of ligaments; on the inner ſide are two articular ſurfaces; the upper, large and concave, connected with the trapezoides; the lower, narrow and plane, for the metacarpal bone of the fore-finger.

The trapezoides (multangulum minus, Alb.) is very irregular in figure, placed like a wedge between the laſt and the following bones, the baſe of it being poſterior, the point towards the palm. The upper ſurface is concave, quadrilateral, and articulated with the ſcaphoides; the lower divided by a convex line croſſing from before backwards, adapted to the hollow of the metacarpal bone of the fore-finger; the dorſal or poſterior, convex, rough and broad; the anterior poſſeſſing the former characters, but much ſmaller; the external, convex articulated with the trapezium; the internal or ulnar, ſmaller and concave, ſmooth anteriorly where articulated with the following bone, rough behind for ligamentous attachments.

The os magnum (capitatum, Alb.) is the largeſt of the eight; longeſt in its vertical axis, rounded into an articular head above, (from whence it derives its name,) of a quadrilateral form below. The upper articular ſurface is convex, divided by a prominent line into two portions, one for the ſcaphoides, the other for the lunare; the lower is divided into three facets, the external articulated with the ſecond bone of the metacarpus, the middle the largeſt of the three, concave, ſupporting the third, the internal or poſterior very ſmall, plane, oppoſed to the inner edge of the fourth; the palmar and dorſal ſurfaces, rough and unequal for ligaments, the latter the largeſt of the two, the external narrow, articulated with the trapezoides; the internal of greater extent than any of the preceding, ſmooth above where contiguous to the unciforme, rough below, giving attachments to ligaments.

The unciforme (os hamatum; cuneiforme Alb.) completes the ſecond row of carpal bones, being the laſt on the ulnar ſide. Above is a rounded angle oppoſed to the lunare; below a ſmooth ſurface, convex tranſverſely, the outer ſurface ſupporting the fourth, the inner the fifth metacarpal bone; on the anterior ſide we obſerve, below, a curved proceſs projecting forward, to which the annular ligament is attached, as alſo ſome muſcles of the little finger; it forms the laſt of the four eminences referred to before; the ſuperior part of this ſurface is narrow, unequal, but ſmooth, giving attachment to ligaments; the poſterior ſurface is broad, triangular, and rough; the external offers an articular ſurface above, in contact with the os magnum, is rough below for ligamentary connections; the internal is directed obliquely, preſenting a curved, oblong, articular facet, and a rough line below it; the former oppoſed to the cuneiforme, the latter ſerving for attachments to ligaments.

The bones of the carpus reſemble each other in ſtructure; compoſed of a cellular or ſpongy ſubſtance, externally covered by a thin layer of compact bone. They are developed from ſingle points of oſſification, which do not commence till after birth. At that period they are entirely cartilaginous, diſtinct, well marked, and not at all proportionably larger than when fully oſſified, and on this account differing from the cartilaginous extremities of the long bones.

The articulation of the fore-arm with the carpus, or joint of the wriſt.—The ſuperior ſurfaces of the ſcaphoides, lunare, and cuneiforme, form by their union a common convex ſurface, oblong tranſverſely; each bone is covered by its proper cartilage, firmly united to the next by an intervening band of a fibro-cartilaginous ſtructure, which ſeparates this joint from the articulations of the carpal bones between themſelves. The lower extremity of the radius, and the triangular cartilage at the bottom of the ulna, form an elliptical concave ſurface, which receives the oppoſite convexity of the carpus, ſo that the ſcaphoides and lunare are oppoſed to the radius, and the cuneiforme to the inter-articular cartilage which ſeparates it from the ulna. The joint is ſtrengthened by ligaments on each ſide, and alſo before and behind, and lined by a ſynovial membrane.

The external lateral ligament is attached above to the ſtyloid proceſs of the radius; it advances forward a little as it deſcends, and is fixed on the outer ſide of the ſcaphoides. The fibres of which it is compoſed diverge below, and become continuous with the anterior ligament: we can often trace them on to the trapezium. Its form is irregular, and by no means defined, the edges being variouſly connected with the parts around it. The internal lateral ligament proceeds from the ſtyloid proceſs of the ulna, and is attached below to the inner ſide of the os cuneiforme. it is implanted alſo by ſome of its anterior fibres into the annular ligament, and piſiforme bone.

The anterior ligament is broad, and flat; fixed above to the anterior part of the ſtyloid proceſs of the radius, and the whole anterior edge of the articular cavity; from hence the fibres deſcend obliquely inwards, and are fixed below in an irregular line to the ſcaphoides, lunare, and cuneiforme; ſome fibres go to the piſiforme, the greateſt number are attached to the lunare. The flexor tendons lie in front, the ſynovial membrane immediately behind it. The poſterior ligament is not ſo broad as the preceding, and more evidently fibrous; its direction is nearly the ſame, being fixed above to the poſterior border of the articular hollow of the radius, below the lunare, and cuneiforme; it is covered by the extenſor tendons. Theſe ligaments are in nowiſe connected with the ulna, ſo that they cannot in any ſituation impede the rotation of the radius on that bone. The ſynovial membrane is ſpread over the articular ſurfaces of the radius, and triangular cartilage above, and the three bones of the carpus below; it is reflected between them under the ligaments, appearing in the intervals between their fibres in ſeveral ſpots. The joint of the wriſt is ſtrengthened on every ſide by ſtrong and numerous tendons, ſome of which are inſerted in its vicinity, others cloſely bound to its ſurface by ſtrong tranſverſe ligaments as they paſs from the fore-arm to the hand and fingers. The ſecurity derived from this conſtruction muſt be very great, without it the joint would preſently yield to the many violent impulſes it has to ſuſtain, to which the ligaments alone would offer a very inadequate reſiſtance.

The motions of the carpus on the fore-arm—are thoſe of flexion, extenſion, lateral inclinations or abduction, and adduction, and circumduction. From the cloſe connection of the carpal bones between themſelves, and with the reſt of the hand, theſe motions of the carpus may be conſidered at the ſame time as general motions of the hand. Thoſe of pronation and ſupination depend on the motions of the bones of the fore-arm, and are in nowiſe dependant on this joint.

In flexion the articular convexity of the carpus glides from before backwards in the correſponding cavity of the fore-arm, and the poſterior ligament and extenſor tendons are ſtretched; it may be carried to nearly a right angle without violence; an effort preſſing beyond this point would ſtrain, and might certainly diſlocate the bones.

In extenſion an oppoſite ſucceſſion of phenomena occurs, it is the anterior part of the joint which has the effort to ſuſtain. This motion is not confined to the bringing the carpus and hand into the ſame ſtraight line with the fore-arm, but may be continued in the oppoſite direction to ſome extent, ſo as to make them form a conſiderable angle with it on the dorſal aſpect. The freedom of motion enjoyed by the carpus in this ſenſe is ſubſervient to many of the important uſes of the hand, and is not to be found in other analogous joints, where the power of flexion is greater, and that of extenſion limited to bringing the oppoſite bones into the ſame axis, as in the elbow, knee, &c. The lateral motions, thoſe of abduction and adduction, are more confined, eſpecially the laſt. The lateral ligaments are alternately ſtretched and relaxed, preventing their too great extent. Circumduction is alſo confined to narrow bounds, more particularly ſo when pronation and ſupination are not concerned in producing it.

The articulations between the carpal bones—all communicate together, being lined by a continuous ſynovial membrane. The bones lie in cloſe appoſition, and are bound firmly by ligaments on the palmar and dorſal ſurfaces, ſome by ligaments paſſing deeply between them. The three firſt bones of the upper row are in contact by nearly plane ſurfaces covered by cartilage, the ſcaphoides connected with the lunare, the latter with the cuneiforme. The palmar ligaments uniting them lie deep under the anterior ligament of the wriſt, the fibres of each paſſing tranſverſely from bone to bone. The dorſal ligaments are more diſtinct, the fibres longer as they are more ſuperficial, they have the ſame direction as the former. The ſuperior, or interoſſeous ligaments, have been already mentioned in ſpeaking of the joint of the wriſt, as ſeparating it from the articulations of the carpus. They are of cloſe condenſed texture, paſſing between the bones from before backwards, one joining the ſcaphoides to the lunare, the other this laſt bone to the cuneiforme. They are very narrow, the upper ſide ſmooth, covered by ſynovial membrane forming a poliſhed ſurface with the convexity of theſe bones, with the edges of whoſe cartilages they are continuous. The os piſiforme is placed without the ranks of the carpal bones, and has no communication with the common joint between them. It reſts by a ſlightly concave articular ſurface on a correſponding convexity of the cuneiforme; the joint is lined by a ſynovial membrane reflected from one to the other, ſtrengthened by ſcattered ligamentous fibres. Two bands of theſe, of conſiderable ſize and ſtrength, paſs from the lower ſide of the bone, one to the root of the metacarpal bone of the little finger; the other to the os unciforme. The piſiform bone is retained in its ſituation by theſe, and, in ſome meaſure, alſo by the abductor muſcle of the little finger, to which it gives attachment. Above we obſerve ſome ligamentous fibres paſſing from it to the ulna, and the inſertion of the flexor carpi ulnaris. It performs the office of a patella, or ſeſamoid bone, for this latter muſcle "poſitum porrectumque inter ejus tendinem, ligamentumque ad os metacarpi digiti auricularis pertinens." Its motions are very limited; it forms, together with its connections above and below, a large portion of the channel through which the flexor tendons glide.

To form the articulation between the firſt and ſecond row we find the ſcaphoides touching the trapezium and trapezoides, forming, in conjunction with the lunare, a cavity for the reception of the head of the os magnum, and the cuneiform bone ſupporting the unciforme. The reſpective articular ſurfaces are covered by a thin cruſt of cartilage, and preſerved in their ſituations by palmar, dorſal, and lateral ligaments. The palmar ligaments are ſhort and ſtrong, formed by fibrous bands, paſſing from one row to the other in different directions; the moſt ſuperficial are confounded with the anterior ligament of the wriſt. The dorſal ligaments reſemble them in their paſſing from the upper row to the lower, but are too irregular in ſize and direction to allow of ſpecific deſcriptions. Indeed they are both ſo mixed with the ſurrounding ligamentous fibres as ſcarcely to admit of diſtinction. Of the lateral ligaments, the external is the ſhorteſt and ſtrongeſt, paſſing from the ſcaphoides to the trapezium; the internal ſtretched between the cuneiforme and unciforme.

The bones of the ſecond row are in contact by cartilaginous ſurfaces, and connected by ligaments, as thoſe of the firſt. The dorſal tranſverſe ligaments, are very diſtinct, one between every two correſponding bones; the palmar are not ſo well defined, the fibres of each being ſhorter and more numerous, as they are more deeply ſeated. We can obſerve one band, paſſing from the trapezium to the os magnum in front of the trapezoides, independent of thoſe between the contiguous bones. Between the unciforme and os magnum is a ſtrong collection of fibres paſſing from ſide to ſide through the depth of the carpus, adhering firmly to ſuch parts of the correſponding bones as are not covered by cartilage. A ſimilar connection exiſts alſo between the os magnum and unciforme.

The ſynovial membrane is continued from one articular facet to another, lining the ligaments we have deſcribed, appearing in many places between their fibres. Nor does it form a continued ſurface only between the carpal bones, it is extended below into the joints, between the carpus and metacarpus; not always, however, into thoſe formed above by the os magnum and unciforme. Owing to this general communication, diſeaſe of one articular ſurface is preſently propagated to the whole; in this reſpect it muſt be conſidered only as a ſingle joint.

The piſiform bone is in nowiſe concerned in the mechaniſm of the carpus; its uſes have been mentioned above. So cloſely are the bones of each row bound one to another, that they allow of ſcarcely any perceptible gliding motion. The articulations between the two rows allow of a more ſenſible movement; though this is confined to narrow limits. It reſembles ſomewhat that obſerved in the joint of the wriſt; they can be bent, and extended a little on each other, as well as inclined laterally; the firſt of theſe is the moſt evident. The little motion they poſſeſs is produced principally by the articulation of the head of the os magnum, which has the greateſt effort to ſuſtain, and has been ſometimes luxated backwards. Notwithſtanding the obſcurity of movement in the carpal bones, it co-operates in increaſing the mobility of the hand, whilſt at the ſame time, by the number of articulating ſurfaces, impulſes may be to a certain degree weakened.

Before we enter on the latter point, it will be proper to take ſome notice of another ligament, materially affecting the ſolidity of the carpus, though deſtined but in a ſecondary way for this purpoſe, its firſt office being to confine the flexor tendons in their paſſage to the fingers. The annular ligament in front of the wriſt, (ligamentum armillare, ligamentum carpi proprium,) paſſes from the eminences formed by the piſiform and unciform bones to the oppoſite ones of the ſcaphoides and trapezium, completing the canal for the flexor tendons. It is compoſed of very ſtrong and thick fibres, becoming gradually thinner above and below; rough ſuperficially, lined behind by a ſynovial burſa. It gives attachment to ſeveral muſcles of the thumb and little finger. The fibres are all tranſverſe, numerous and compact, ſecuring, in addition to its other uſes, the arch formed by the carpal bones. The carpus then derives its firmneſs from the large ſurface of the articulating facets in compariſon with the ſmallneſs of the bones, from their number, from the numerous ligaments, and from the arched form reſulting from the connection of the whole. It is further ſtrengthened by numerous tendons, the flexors in front, the extenſors on its dorſal ſurface. Another cauſe of the ſolidity of the carpus is, that the articulations between the two ranks are not in the ſame tranſverſe line, the unciforme, and more eſpecially the head of the os magnum, mounting far beyond the level of the trapezium and trapezoides, ſo that any impulſe would not act on all at once, and cauſe a general diſplacement, the effort and the injury muſt be partial, confined to the articulations between one or two of the bones.

The metacarpus (die mittelhand, Germ.) is compoſed of five bones, reſting on the carpus above, giving ſupport to the thumb and four fingers below. They are ſtrong, thoſe ſupporting the fingers parallel to each other, the other a little anterior, and capable of altering its poſition. The intervals between them are filled by muſcles ſo as to form a broad and ſolid body. The anterior face of the metacarpus is concave, conſtituting the palm of the hand, the poſterior convex, and forms the back. The bones are diſtinguiſhed, from the connections below, into the metacarpal bones of the thumb, the fore, the middle, the ring, and the little fingers, or we claſs them numerically, beginning on the radial ſide with the metacarpal bone ſupporting the thumb. Of theſe diviſions we ſhall adopt the latter. The firſt metacarpal is the largeſt, and ſhorteſt of the whole; the ſecond and third are nearly of the ſame length; the fourth and fifth are ſucceſſively ſhorter and ſmaller. They are all ſomewhat concave before, and flat behind, preſenting ſeveral more or leſs acute angles; larger at each extremity, the upper angular and unequal, the lower forming a convex head, compreſſed laterally, with an articular ſurface terminating on the palmar ſide in two prominent points; ſmalleſt in the middle of the body of the bone, increaſing gradually in ſize above and below. In conſidering the diſtinguiſhing characters of each metacarpal bone, we ſhall obſerve them as ſeen on the carpal extremities, the bodies, and the digital extremities of each ſucceſſively, and not tire the reader by a ſeparate deſcription of the ſeveral bones, in which it would be impoſſible to avoid repetition, and which muſt neceſſarily be of greater length.

At the upper or carpal end of the firſt metacarpal bone we obſerve an articular ſurface convex tranſverſely, ſlightly concave in the oppoſite direction, oppoſed to the trapezium. It is ſurrounded by ligaments, and gives attachment on the outer ſide to the extenſor oſſis metacarpi pollicis.

In the ſecond are three articular ſurfaces, the middle concave, correſponding to the prominence of the trapezoides; the external ſmall and flat, articulated with the trapezium; the internal divided into two portions, the upper articulated with the os magnum, the lower with the following bone. The circumference of this extremity is rough, and gives attachment to ligaments. On the palmar ſide is a rough ſpot, which gives attachment to the flexor carpi radialis; on the dorſal a tubercle, into which the extenſor carpi radialis longior is inſerted.

In the third a quadrilateral articular ſurface oppoſite to the os magnum, bounded before and behind by inequalities, giving attachments to ligaments; on the outſide by a ſmooth facet articulated with the preceding bone; on the inſide by two ſmall round articular ſurfaces, ſeparated by a hollow contiguous to the following bone. At the external dorſal angle is a pyramidal eminence (proceſſus ſtyliformis), and cloſe on the inner ſide the inſertion of the extenſor carpi radialis brevior.

In the fourth, at the top, a double articular ſurface, accommodated to thoſe of the os magnum and unciforme, ſurrounded before and behind by rough points for ligamentous attachments, on the outſide by two prominent articular facets, correſponding to thoſe of the laſt bone; on the inſide by a ſlightly concave ſurface articulated with the following.

In the fifth, a broad articular ſurface, convex from before backwards, concave tranverſely; ſlanting outwards and upwards, oppoſed to the unciforme, bounded before and behind by rough ſurfaces for ligaments, on the outſide by a ſmall articular facet connected with the laſt bone on the inſide by a tubercle which gives attachment to the tendon of the extenſor carpi ulnaris.

The bodies of the metacarpal bones are all concave anteriorly, and ſlightly convex on their dorſal ſurface. Although rather irregular in figure we can diſtinguiſh in them four ſides, an anterior, a poſterior, an internal, and external. In the firſt the poſterior ſurface is broad; in the three next we obſerve above a prominent line running lengthwiſe, which ſoon bifurcates, forming the lateral boundaries of a flat triangular ſurface, the breadth of which increaſes as it approaches the digital extremity; in the laſt an angular line, running diagonally from the inner ſide of its carpal end to the outſide of its lower extremity. In all of them the poſterior ſurface is covered by the extenſor tendons.

The anterior or palmar ſurface preſents alſo a longitudinal riſing line, generally more prominent towards the lower end. It ſeparates the attachments of the interoſſei muſcles, and has ſomewhat different directions in the ſeveral bones. In the firſt rounded, covered by the opponens, and flexor brevis pollicis; in the third giving attachment above to the latter muſcle, below to the adductor pollicis. The lateral ſurfaces of theſe bones are broad, inclined obliquely in various directions, giving attachment to muſcles. In the firſt they are compreſſed and rounded, the outer ſide giving attachment to the opponens, the inner to the firſt external interoſſeus (the abductor indicis of Albinus). In the laſt the inner or ulnar ſide gives attachment to the adductor oſſis metacarpi minimi digiti; the outer ſide, as well both ſides of the other metacarpal bones, give attachment to and are covered by the external and internal interoſſeous muſcles.

The digital extremities are in all convex, and nearly alike in figure. On the palmar ſide of the firſt we obſerve two ſlight depreſſions correſponding to the ſeſamoid bones in front of the joint; on the ſides of the articular ſurfaces of each deep hollows for ligaments, which ſecure the articulations between theſe bones and the fingers.

The metacarpal bones reſemble in ſtructure and formation the other long bones. At the period of birth the extremities are cartilaginous, oſſification commencing in the body of the bone in the embryo of three months.

In the preceding deſcription we have reckoned five metacarpal bones, according to the plan followed by the moſt eminent anatomiſts. By many the firſt metacarpal bone has been omitted, and deſcribed as the firſt bone of the thumb, which they conſider as compoſed of three bones, like the fingers. By Albinus the metacarpus is divided into two portions, one, compriſing the four laſt bones, he calls the metacarpus manus; the other, the metacarpus pollicis.

The articulations between the bones of the carpus and metacarpus are nearly ſimilar in all but the firſt. The articular ſurface at the upper end of the metacarpal bone of the thumb is convex and concave in oppoſite directions, adapted to the correſponding ſurface of the trapezium. The joint is ſurrounded by ligamentous fibres paſſing from one bone to another, amongſt which the external and dorſal are the moſt ſtrongly marked, and the moſt in number, the internal and anterior are continued on to the annular ligament. It is lined by a diſtinct ſynovial membrane. The diſpoſition of the ligamentous fibres is ſuch as to form a capſule round the articulation, like that obſerved in the ſhoulder joint, but not ſo looſe. The whole is ſupported by the muſcles and tendons of the thumb. The ſecond metacarpal bone is articulated with the trapezium, the trapezoides, and the os magnum; the third with the latter only; the fourth with it and the unciforme; the fifth with the laſt alone. The ſurfaces are covered by cartilages continuous with thoſe forming the joints between the metacarpal bones themſelves, and lined by a common ſynovial membrane with occaſional exceptions, as mentioned when ſpeaking of the carpus. The ligaments on the dorſal ſurface paſs in different directions from the lower row of carpal bones, to the upper end of thoſe of the metacarpus. There are two for the ſecond of theſe, one from the trapezium, the other from the trapezoides; the third has but one from the os magnum; the fourth two, paſſing from this bone and the unciforme; the fifth a ſingle band from the latter. They are all ſhort, flat, and compact. The palmar ligaments are leſs diſtinct, being confounded with thoſe around them. The moſt evident are, a band paſſing from the trapezium to the third and fourth metacarpals, confining in its paſſage the tendon of the flexor carpi radialis; and a band between the trapezium and firſt metacarpal.

The articulations of the metacarpal bones between themſelves.—The metacarpal bones, with the exception of the firſt, touch at both ends by lateral articular facets, which have been already deſcribed. The ſynovial membrane lining thoſe at the carpal extremity is open above, forming a free communication with the carpus. They are ſecured in their relations by tranſverſe ligaments at both ends. At the carpal end theſe are found on the palmar and dorſal ſurfaces; on the firſt of theſe the ſuperficial ligaments form a continued layer, paſſing from the ſecond to the laſt, the more deeply ſeated paſſing from bone to bone. The dorſal ligaments paſs acroſs between each bone. Beſides theſe, we find immediately below the articulations ſtrong ligaments paſſing deeply between the bones, uniting them moſt firmly together. At the digital end is a ſtrong tranſverſe ligament on the palmar ſide, the ſuperficial fibres paſſing from the firſt bone to the laſt, thoſe more deeply ſeated between each individual bone. It is covered in front by tendons and veſſels, behind it ſupports the interoſſei muſcles, and is united to the ligaments connecting the metacarpus with the fingers.

Among the bones of the metacarpus, the firſt enjoys very extenſive motions in every direction. The moſt important motion is that which brings the thumb in oppoſition to the fingers, and enables us to graſp the object before us; an office which made Albinus beſtow on it the emphatic name of "manus parva majori adjutrix." The freedom of this motion depends on the extent and obliquity of the articular ſurfaces, between it and the trapezium, and is favoured alſo by their being on a plane anterior to the reſt of the hand.

Circumduction of the thumb is very free towards the palm, very much leſs ſo in the oppoſite direction. The interval between this and the other metacarpal bones is highly advantageous in allowing of all its motions. The four laſt bones of the metacarpus are bound ſo cloſely together, as to allow of much individual motion. They can be brought cloſer together below, and bent a little forwards, ſo as to increaſe the hollow of the hand; this motion is moſt evident in the two laſt, thoſe of the ring, and little fingers. The four laſt bones of the metacarpus hold a middle rank, as to motion and ſolidity, between the carpus and fingers; above they partake of the firmneſs of the carpus, below approach nearer the mobility of the fingers.

The fingers, including the thumb,—are five in number. They are either reckoned numerically from the radial to the ulnar ſide, or diſtinguiſhed by proper names. The latter are in common acceptation. We count, therefore, the thumb as the firſt; the fore-finger or index as the ſecond; the middle finger as the third; the ring finger as the fourth; and the little finger as the fifth. By this arrangement we can immediately compare their relations to the metacarpal bones, which have been deſcribed alſo in a ſimilar numerical order. The fingers are compoſed of rows of long bones, placed vertically one beyond another, called *phalanges;* of theſe we find three in the fingers, properly ſo called, and two only in the thumb, the middle phalanx being wanting. They are diſtinguiſhed by the names of the firſt or metacarpal phalanx, the ſecond or middle, and the third or unguinal. As the correſponding bones of the ſeveral rows are eſſentially alike in all, we ſhall include them in one deſcription, noticing the peculiarities of each. We divide them into two extremities, and a body.

The firſt, or metacarpal phalanges,—are the largeſt, and longeſt of the three; of different lengths and ſize, the third being the longeſt, and all diminiſhing ſucceſſively in volume from the firſt to the laſt. They are convex on the dorſal ſurface, the tranſverſe convexity forming nearly half a circle; concave anteriorly, with ſharp angular edges laterally. At the ſuperior extremity we obſerve an articular ſurface, oblong tranſverſely, ſlightly hollowed, articulated with the correſponding bone of the metacarpus; a broad tubercle on each ſide giving attachment to lateral ligaments, divided anteriorly by a depreſſion, in which the flexor tendons paſs. In the thumb this extremity gives attachment to the abductor, the flexor brevis, and the adductor. The bodies of the phalanges are convex poſteriorly, covered by the extenſor tendons; concave on the palmar ſide with projecting edges, ſo as to form a kind of gutter, in which the flexor tendons are partly lodged; the edges give attachment to ligamentous ſheaths confining the tendons in their ſituation. The lower extremity offers an articular pulley, extended further and much broader on the palmar ſide than on the oppoſite, and the edges diverging conſiderably from behind forwards. On each ſide are depreſſions, which give attachment to lateral ligaments.

The ſecond, or middle phalanges,—are ſmaller and ſhorter than the firſt, which they reſemble much in general figure. The thumb poſſeſſes none. As to individual compariſon, they differ but little, that of the middle finger is the longeſt, the laſt belonging to the little finger the ſhorteſt and ſmalleſt. The upper extremity offers an articular ſurface croſſed antero-poſteriorly by a riſing line, correſponding to the oppoſite pulley of the firſt phalanx; on each ſide are tubercles giving attachment to ligaments. The body reſembles that of the metacarpal phalanx. About the middle of the anterior ſurface are two rough prominences, giving attachment to the divided tendon of the flexor ſublimis, and to a fibrous ſheath, which croſſes over it from ſide to ſide, confining alſo the tendon of the flexor profundus. Its poſterior ſurface gives attachment to a portion of the tendon of the extenſor communis. The lower extremity reſembles that of the firſt.

The third, or unguinal phalanges—are found, in all, five, diminiſhing in ſize from the thumb to the little finger, that of the former being by far the largeſt of the whole. The upper extremity or baſe (from a compariſon of the bone to a pyramid with its apex downwards), forms an articular ſurface, oval tranſverſely, with a convex line croſſing from before backwards, accommodated to the pulley of the middle phalanx; is tuberculated for ligaments on each ſide, giving attachment behind to extenſor tendons. The body is contracted; on its anterior ſurface the flexor profundus is fixed in the fingers, and flexor longus in the thumb. The lower extremity, or point, is flat, rounded, broader than the body, ſcabrous at the edges and on the anterior ſide, ſmoother behind, where it ſupports the nail.

The bones of the fingers have nothing peculiar in ſtructure or formation: the firſt and ſecond phalanges are formed from three oſſifying points, the third from only two. At the time of birth, their figure is well marked, and their formation very conſiderably advanced.

The articulations of the thumb and fingers with the metacarpus.—The convex heads of the metacarpal bones are covered by articular cartilages, in contact with thoſe lining the concave ſurfaces of the firſt digital phalanx. They are bound together by lateral ligaments, and ſtrengthened in front by the ſheaths of the flexor tendons, behind by the expanſion of the extenſors, on each ſide by the interoſſei muſcles. The lateral ligaments are attached above to the ſides of the lower end of the metacarpal bones, and divide as they deſcend into two diſtinct bands, which are fixed to the ſides of the correſponding bones of the firſt phalanx. They are ſtrong, formed of parallel fibres, lined on the inner ſurface by the ſynovial membrane. In front of the joint we find the tranſverſe ligament of the lower end of the metacarpus, which has been already deſcribed. The ſynovial membrane is looſe, particularly before lining the extenſor tendon in its paſſage behind over the joint, and appearing between the ligaments, which it alſo covers in front and on the ſides. In front of the joint of the thumb we find two ſeſamoid bones developed in the tendons of the flexor brevis, leaving a furrow between them, in which the tendon of the flexor longus paſſes. They reſt on the head of the metacarpal bone, gliding up or down, as the joint is bent or extended. They are ſometimes found in the articulations between the metacarpus and fingers. The motions enjoyed by this joint are thoſe of flexion, extenſion, abduction, and adduction; of theſe the firſt is by far the moſt conſiderable, the thumb poſſeſſing it in the leaſt, the little finger in the moſt extenſive degree.

The articulations between the phalanges are alike in all; the condyles, at the lower extremities of the firſt and ſecond phalanx, are covered by cartilage, and correſpond to the little hollows at the upper ends of the ſecond and third. They are covered by a ſynovial membrane, and connected by lateral ligaments, which paſs from bone to bone, reſembling thoſe of the preceding articulation. The ſynovial membrane is ſupported by theſe, as alſo by the extenſor and flexor tendons. It is ſo cloſely united to the extenſor tendon, at the upper end of the ſecond and third phalanx, that it is almoſt impoſſible to ſeparate them. It is continued much further down on the bone on the palmar, than on the dorſal ſurface, forming a little bag in front of the joint. The thumb has but one of theſe articulations, which is in every reſpect ſimilar to the joints between the phalanges of the fingers.

In this laſt part of the hand we obſerve an evident decreaſe of firmneſs, when compared with the metacarpus and carpus, and a proportionate increaſe of facility and extent of motion. The ſhortneſs of the bones, however, ſcarcely offering a reſiſting point to external impulſes, ſecures their relations, and leſſens the chance of fracture, though the fingers are more immediately within the action of ſurrounding bodies, and more expoſed to injuries than any other part of the limb. The joints of the phalanxes of the thumb and fingers allow only of flexion and extenſion; the latter cannot be carried beyond the ſtraight line, the former is very free; an effect which depends on the continuation of the articular ſurfaces in front, far beyond their extent on the dorſal ſurface, and which is provided for by a correſponding laxity of the ſynovial membrane. The advantages of this diſpoſition, for the important functions of the fingers, is ſo conſpicuous as to require no comment. In opening the hand, the fingers cannot be extended beyond the plane of the hand; from this ſituation they may be bent in various degrees, until their points touch the lower end of the metacarpus. This general flexibility, derived from the ſucceſſive rows of firm bones, and their peculiar modes of articulation, allows of the fingers being applied accurately to any body whoſe qualities we wiſh to examine, whatever be its figure. The decreaſing length and ſize of the ſeveral phalanxes permit us to ſeize objects conveniently and firmly, to retain them, however ſmall. The power we poſſeſs of moving them ſingly, or in different degrees, of touching the palm of the hand at any point of its ſurface, of ſpreading them laterally, of ſeparating one from another, &c. enables us to adapt their poſition to every poſſible uſe. In all the actions of the hand, the thumb holds a conſpicuous rank. Alone, it oppoſes the efforts of the other fingers, which are much longer, and bend, as it were, to meet the thumb, whenever we cloſe them on the object. With regard to the different lengths of the thumb, and ſeveral fingers, we may obſerve, that when ſeparated moſt widely from each other, by gently bending the points they may be brought to deſcribe nearly a circle on a plane ſurface, forming with the hollow of the palm a concave hemiſphere; from which ſituation they may be further contracted, till the ſeveral points meet: from this conſtruction they are ſuited to graſp equably and firmly bodies of a rounded form. The ſenſe of touch owes, in a great meaſure, its delicacy and perfection to the readineſs and preciſion with which the fingers can be applied to the object whoſe qualities we wiſh to examine. It would be almoſt endleſs to deſcribe the different motions of which they are ſuſceptible; they are ſo rapid in ſucceſſion, ſo varied in direction, extent, and power, ſo exquiſitely adapted to the innumerable offices they have to perform, as to conſtitute an inexhauſtible, not to ſay an inexplicable ſubject for diſcuſſion.

We conclude our hiſtory of the upper extremity, by ſome remarks on its powers of reſiſtance and ſuſceptibility of motion, as a complete member, enjoying the aſſemblage of all the properties we have deſcribed as reſulting from the mechaniſm of each diviſion.

The caſes in which the upper extremities are required to ſupport great efforts, or to oppoſe a powerful impulſe, are by no means ſo numerous or ſo frequent as in the lower limbs, where conſiderable exertion and reſiſtance are neceſſary, to ſupport the body in the ordinary attitudes. In the action of puſhing, the hand is applied to an object, the fore-arm and arm extended between it and the trunk forming a ſtraight lever, which conveys the weight of the latter on the body to be puſhed. In this motion the hand being inflected backwards on the fore-arm, the joint of the wriſt is ſoon fatigued by the diſtenſion and preſſure in front; the ſigmoid cavity of the ulna bears directly againſt the lower end of the humerus, the latter reſts on the glenoid cavity of the ſcapula, which is fixed firmly by its muſcles and the clavicle.

It is only, however, when the arm is directed outwards, that it bears directly on the glenoid cavity; if it be turned forwards or backwards, the capſular ligament and the ſurrounding muſcles ſuſtain the effort. The firſt circumſtance is moſt favourable to firmneſs and continued reſiſtance; and we may obſerve, that when at liberty to chooſe our attitude in puſhing with one arm, we always place it in ſuch a direction as to bring it to bear directly on that cavity. For inſtance, if the object be in front, we turn ourſelves ſo as to bring the ſide of the body correſponding to the limb we are about to exert oppoſite to the object. In preſſing downwards, in reſting on the arm, &c. the mechaniſm is nearly the ſame, as far as regards the hand, which is ſo much extended on the fore-arm as to form an angle with it behind, while the fore-arm is placed in the ſame line with the arm, the joint of the elbow being fixed and immoveable. The difference depends only on the change of ſituation which takes place in the joint of the ſhoulder, the head of the humerus preſſing more or leſs advantageouſly, as the direction of the preſſure varies from the relative poſition of the object on which the limb reſts.

The beſt poſſible direction is where the arm is extended laterally, ſo as to bear on the glenoid cavity, the ſcapula being at the ſame time ſupported directly by the clavicle. It is underſtood that in every caſe the poſition of the limb is preſerved by muſcles, which are called on to act more or leſs, as that poſition is more or leſs favourable for ſuſtaining the effort, and become tired in the ſame proportion. This obſervation is more particularly applicable to the caſe in which the upper extremities have to ſuſtain the whole weight of the body, as in the inſtance of tumblers, when the hands are placed on the ground, and the body raiſed into the air, the upper exerting for a time the functions of the lower extremities. This attitude is both difficult and painful, from the want of ſufficient muſcles to maintain it, and from the ſmall extent of the articular ſurfaces. The wriſt ſuffers more particularly, as in marching on all-fours, becauſe theſe ſurfaces do not bear on each other, but on the front of the joint; the elbow is not ſo much diſtended from the conſtruction of the articulation; the ſhoulder-joint ſuffers almoſt equally with the wriſt, from the preſſure on its capſule. The upper extremities are articulated with the trunk in a plane poſterior to the lower; the line of gravity in the attitude above-deſcribed is anterior to the ſupport, and we find, conſequently, that to preſerve the balance, to counteract the tendency to fall forwards, the lower extremities are thrown conſiderably backwards.

The motions of the upper extremity are ſo numerous and varied, as ſcarcely to admit of claſſification; they are ſo familiar as not to require deſcription. The mechaniſm by which they are performed has been conſidered in treating of the ſeveral articulations, and may readily be applied to any caſe; we ſhall now only briefly recapitulate the more material points. The ſhoulder is the centre of motion of the whole limb; the arm gives the general movement, the parts below thoſe which are more partial. The motions of the ſhoulder affect the whole limb; as we deſcend, the actions are more and more confined. A finger may be employed while the arm is motionleſs; if the latter is moved, all below muſt partake of the motion. It is from the combination of the ſeveral partial motions that the increaſe and variety of the whole are derived, and theſe are multiplied the lower we go. The hand enjoys the individual motions of its component parts; a general motion from the joint of the wriſt; a more general ſtill from the connection of the bones of the fore-arm and the elbow, which is increaſed to a ſtill greater extent by the ſhoulder joint and ſhoulder. The motions then may be more compound as we deſcend, as well as more partial, becauſe each part enjoys the motion reſulting from its proper articulation, in conjunction with all thoſe above it. This general action of the parts of the upper extremity is obſervable in ſeizing or graſping any body, or in embracing, where all the articulations are *bent*, or in the oppoſite actions of ſpreading the arms, or *extending* the whole limb in different directions, &c. It is more commonly ſeen under caſes where the different joints are inflected variouſly at the ſame time, ſome extended, and others bent, theſe motions being often alternate. All theſe modifications of action may be obſerved in puſhing, pulling, climbing, graſping a diſtant object, ſwimming, ſtriking, &c. &c. In ſhort, in all the familiar exerciſes of the upper extremity we are conſtantly in the habit of performing. We cannot conclude without hinting at thoſe impreſſive actions of the upper extremity, which form a mute language employed moſt emphatically in aiding the expreſſions of our paſſions, or our will; it is enough to ſay, they are as numerous and varied as the feelings which bring them into play.

The lower extremity—is divided, as the upper, into four parts, *viz.* the hip, the thigh, the leg, and the foot, each of which has a more or leſs ſtriking analogy with the correſponding diviſions of the upper extremity. We ſhall examine their points of reſemblance and difference more minutely hereafter; at preſent, we would obſerve only, that the bones, which form the baſis of the lower extremity, are more maſſy and ſolid in their forms, and are hence adapted to their functions, as organs by which the reſt of the body is ſupported and moved. Their prominent character is ſolidity and firmneſs; in the upper extremity every thing is conſtructed for variety and quickneſs of motion.

The lower extremity is connected with the trunk by the articulation of the hip bone with the baſis of the vertebral column, the ſacrum; through which the whole weight of the body is tranſmitted to the bones of the hip. The connections of the two hip bones with the ſacrum behind, and with each other in front, form a bony cavity called the *pelvis*, the principal uſes of which are, to contain ſome important viſcera, to offer a baſis of ſupport to the trunk above, and two fixed points for the motions of the limbs below. It is in the laſt functions only that we ſhall have occaſion to notice the pelvis here; we ſhall not, therefore, enter into a deſcription of it as a whole, but attend to thoſe of its parts which bear on the preſent ſubject, and correſpond to analogous portions of the upper extremity.

The os coxæ, os innominatum, hip, or haunch bone, is the largeſt of the broad bones, placed laterally at the lower end of the trunk, connected with its fellow in front, by means of cartilage, and ſeparated from the oppoſite bone behind by the intervention of the ſacrum. The hip-bone is very irregular in figure, broad and flattened above, contracted and maſſy in the middle, and apparently more ſlender in the anterior and lower portions: it is curved ſo as to have its flat ſurfaces in almoſt oppoſite directions; the upper diviſion is flattened from ſide to ſide, the lower from back to front, the change of direction taking place in the middle portion. In young ſubjects this bone is formed of three ſeparate pieces; a ſuperior, called the *ilium*, an anterior, the *pubes*, and an inferior, the *iſchium*. In the adult they are ſo intimately united, that we can with difficulty trace their former line of ſeparation. We can ſee therefore no reaſon for deſcribing as diſtinct, what in its perfect ſtate forms but one ſolid bone. We ſhall conſider it as ſuch; but, not to deviate too much from common uſage, ſhall notice the different diviſions as we proceed, and afterwards particularly deſcribe their lines of union. We diſtinguiſh in the os innominatum two ſurfaces; an internal or pelvic, an external or femoral, and a circumference or border, which is again ſubdivided into ſeveral parts.

The external ſurface looks outward above, and forwards below; it is covered by ſtrong and numerous muſcles. The outſide of the broad upper diviſion, the dorſum of the ilium, is convex and concave in different parts; at the poſterior and ſuperior part is a rough eminence, which gives attachment to the gluteus maximus; below this a ſurface, concave and broad behind, convex and gradually narrowing in front, gives attachment to the fibres of the gluteus medius; it is bounded by the eminence juſt mentioned, by the upper edge or criſta of the ilium, and below by a ſemi-circular line, with the convexity upwards, paſſing forwards from a deep notch behind, (the great ſacroſciatic,) and terminating in the criſta of the ilium in front. The ſpace compriſed between this curved line and the deep articular cavity below, gives origin to the gluteus minimus; it is concave behind, and gibbous in front. At the anterior part, immediately above this cavity, is a rough impreſſion, where the curved tendon of the rectus cruris is fixed. The portion of the external ſurface, which is directed downwards and forwards, is very irregular in figure. Above is a deep and large cavity, called the acetabulum or cotyloid cavity; it forms nearly the half of a ſphere, lined by cartilage in its upper two thirds, the lower part a little deeper, lodging ſome cellular tiſſue, and the ſtrong ligament paſſing to the head of the thigh-bone. The margin of the cavity is irregular and waving, more prominent above than below, ſurmounted by a ligamentous ring, which makes the acetabulum ſtill deeper, interrupted towards the inner ſide by a notch, completed by a ligament which leaves only a ſmall opening for the paſſage of the articular veſſels; it gives attachment to the capſular ligament of the hip joint. The bone ſurrounding the cotyloid cavity is thick and maſſy, eſpecially at the upper and outer ſides; the cavity itſelf is directed obliquely outwards, downwards, and forwards. Below, and on the inner ſide of this cavity, is a large hole, of an oval ſhape, the foramen ovale, obturatorium, or thyroideum. Its long diameter is from above downwards, its edges are acute and rough, except at the upper part, where there is a ſmooth gutter directed obliquely from above inwards and downwards, in which the obturator nerve and veſſels are lodged. The groove is formed by the internal and external edges of the circumference croſſing each other at the top of the oval, the latter paſſing in front to a point called the ſpine of the pubes, leaving the oblique hollow between itſelf and the internal margin which paſſes up in the oppoſite direction. The foramen ovale is cloſed by a ligament attached to its edges every where but at the groove juſt mentioned, where it leaves a vacancy for the paſſage of the obturator veſſels, &c. In the female this foramen is ſmaller than in the male, and of a triangular figure. On the inner ſide of the foramen is a rough and unequal ſurface, broader above and below than in the middle, giving attachment to portions of the triceps, and the external obturator muſcle.

The internal or pelvic ſurface is concave, correſponding in its direction to the external or femoral, covered by muſcles which ariſe from it. The anterior part of the upper diviſion, the foſſa iliaca, is occupied by the iliacus internus muſcle; the poſterior is very ſcabrous and unequal, divided into two portions, of which the anterior is covered by cartilage, and articulated with the ſacrum, forming the ſacro-iliac ſymphiſis, reſembling ſomewhat in outline the human ear, the poſterior is convex and very rough, giving attachment to the ſtrong and numerous ligamentous fibres which connect this bone with the ſacrum above. Below the iliac foſſa, croſſing from the articular ſurface to the anterior angle of the bone, is a prominent angular line, forming a part of the ſuperior aperture of the pelvis, ſeparating the upper diviſion from the lower. The latter preſents a plane ſurface behind, broader above than below, giving attachment to the obturator internus and levator ani; in front of this is the obturator foramen, and in the inſide of the latter a narrower ſurface correſponding to the bladder above, giving origin to a part of the obturator internus below.

The circumference of the os innominatum is exceedingly irregular, with alternate prominences and hollows, and is divided into four portions, *viz.* a ſuperior, an inferior, a poſterior, and an anterior. The ſuperior margin bears the name of the criſta of the ilium; is convex, narrower in the middle than at the ends, and inclined outwards. The inner edge, or labium, gives attachment to the tranſverſalis abdominis, and quadratus lumborum; the external to the obliquus externus, the latiſſimus dorſi, and the faſcia of the thigh; the middle convex portion to the obliquus internus. The anterior margin is concave, and its lower half nearly horizontal. Its union with the criſta forms the anterior ſuperior ſpine of the ilium, which gives attachment to the tenſor vaginæ femoris, the ſartorius, and the upper end of that part of the tendon of the external oblique, called Poupart's ligament. Below this point is a ſlight notch, riſing again into another eminence, the anterior inferior ſpine of the ilium, from which the rectus crucis ariſes. This is ſucceeded by a ſmooth hollow, over which paſs the pſoas magnus, and iliacus, bounded by a protuberance called eminentia ileo-pectinea, into which the tendon of the pſoas parvus is implanted, when it exiſts. On the inſide of this there is an oblique ſurface, concave, triangular, with the baſe outwards, and the point inwards, bounded in front by a line which is continued from the external margin of the obturator foramen, behind by a ſharp ridge, the criſta of the pubes, which is continued from the tranſverſe line deſcribed as croſſing the pelvic ſurface. Over this concave ſpace paſs the crural veſſels. The anterior margin terminates by uniting with the inferior, at a right angle, called the angle of the pubes. A little before its end we obſerve on it a projecting point, the ſpine of the pubes, giving attachment to the pyramidalis, and the external pillar of the abdominal ring, formed by the tendon of the external oblique. The inferior margin is the ſhorteſt, preſenting above a perpendicular oblong ſurface, forming with the oppoſite bone, by the intervention of cartilage, the ſymphyſis pubis; below this the edge is thinner, forming with the oppoſite one the arch of the pubis, affording attachment to the gracilis, to portions of the triceps, to the corpus cavernoſum, the tranſverſalis perinei, and the erector penis, or clitoridis. The upper half of this bony plate is called the deſcending ramus of the pubis, the lower the aſcending ramus of the iſchium. The poſterior margin is the moſt irregular in its outline. Beginning from above we obſerve the angle formed by its junction with the ſuperior margin, the ſuperior poſterior ſpine of the ilium, an hollow ſeparating it from the eminence below, the inferior poſterior ſpine; a very deep notch forming part of the ſacro-ſciatic notch; a ſharp prominence, the ſpine of the iſchium, giving attachment to the ſuperior gemellus, the coccygeus, and the leſſer ſacro-ſciatic ligament; a ſmooth concave ſurface, over which the tendon of the obturator internus plays; and a broad eminence where it joins the inferior margin, the tuberoſity of the iſchium giving attachment, externally, to the quadratus femoris, and the great head of the triceps; within to the great ſacro-ſciatic ligament, and the inferior gemellus, in the interſpace to the biceps, the ſemi-tendinoſus, and ſemi-membranoſus.

The os innominatum is in ſtructure like the other flat bones; the two compact tables, encloſing the more cellular parts, touch each other in the middle of the iliac foſſa, and again at the depreſſion in the acetabulum. It is developed from three points of oſſification, at the angle of the pubis, the tuberoſity of the iſchium, and the middle of the upper diviſion, or ilium. The union of the bony plates proceeding from theſe points takes place between the ilium and pubes at the eminentia ileo-pectinea; between the latter and the iſchium, in the middle of the branch which forms the inner ſide of the foramen ovale, and the half of the arch of the pubes; between the iſchium and the ilium at the great ſacro-ſciatic notch. The junction of the three takes place in the acetabulum, which forms the principal point of union; the ilium makes the upper part of the cavity, the pubes the anterior, the iſchium contributing the principal ſhare, and completing it at the inferior and poſterior portions. The part which either bone takes in forming any of the principal features of the os innominatum will be immediately ſeen, by obſerving their lines of union with each other. At the time of birth the acetabulum, being far removed from the centres of oſſification, is wholly cartilaginous, as are alſo the different eminences, the ſpines, and the criſtæ. It is not till the time of puberty that all traces of cartilage are obliterated. The os innominatum is articulated with the ſacrum, by the ſacro-iliac ſymphyſis; with its fellow, by the ſymphyſis pubis; and with the thigh-bone by means of the cotyloid cavity. We ſhall ſay nothing of the two former of theſe connections, but that they are exceedingly ſtrong, and the bones bound ſo cloſely together, as not to allow of any perceptible motion; we ſhall deſcribe the laſt after having gone through the hiſtory of the thigh bone.

In commenting on the mechaniſm of the ſhoulder, we had to notice its articulation with the trunk, and the motions reſulting from its peculiar mode of connection; in the preſent inſtance we find an immoveable adherence of ſurfaces, which allows of no deviation from one determined poſition. In conſequence of this total want of motion, we ſhall not enter on the detail of the connections of the hip bone with the trunk, or with its fellow; they can influence the functions of the lower extremity no farther than by tranſmitting to it the weight of the body.

The oblique direction of the articular ſurfaces of the ſacrum, which gives it the form of a wedge driven between the two oſſa innominata, is well adapted to the purpoſe of tranſmitting ſecurely the weight of the trunk to the latter bones: the ſtronger the depreſſing impulſe, the more cloſely the ſurfaces are brought together; the ſhock muſt be violent indeed, which can in anywiſe looſen their connection. It is then through the medium of the ſacrum that every effort is propagated to the two hip bones, which in ſome poſitions are the immediate baſe o ſupport, while in others they continue the impulſe to the limb below. In the common attitude of ſitting, the trunk is ſupported on the tuberoſities of the iſchia; in progreſſion, or in ſtanding, on the cotyloid cavities. Theſe being at a diſtance from each other, facilitate the motions of the thighs, and increaſe their extent, the pubes executing one of the offices of the clavicle, in keeping the hip joints far aſunder, as the clavicle does thoſe of the ſhoulder. It will be ſeen, from the deſcription of the hip bone, that its ſurfaces and circumference give attachment to numerous and powerful muſcles, by far the greater number of which are deſtined to regulate, or to give vigour and effect to the motions of the thigh and leg, and to balance the varying weight above them.

The thigh—is the diviſion of the lower extremity between the hip and the leg. It is formed by a ſingle bone, called the *femur*, or *thigh bone.*

The femur is the longeſt bone of the body, the largeſt in volume, and the ſtrongeſt. It has a conſiderable curve forwards, is contracted in the middle, wider and more bulky at each extremity, one of which is called the upper, or *iliac*, the other the lower, or *tibial*.

The upper extremity includes three remarkable eminences; the head, ſupported by a long neck, and the great and little trochanters. The rounded head of the femur is received into the cotyloid cavity of the os innominatum; it forms more than half of a ſphere, directed upwards, inwards, and a little forwards; ſo that the greateſt part of its convexity is above, and its axis the ſame as that of the neck, which ſuſtains it. The convex ſurface is ſmooth, except juſt below the centre, where we find an hollow, which gives attachment to an inter-articular ligament; it extends further in front than behind, above than below, and terminates in a waving line at the neck. The latter contracts immediately below the head, and becomes a little flattened vertically, the upper edge remaining the wideſt; it is longer below and behind, on which aſpects it is alſo hollowed, than above and in front; joined by a broad baſis to the body of the bone, from which it ſtands off in a direction ſlanting upwards and inwards, advancing at the ſame time a little forwards, forming with it an angle more or leſs obtuſe. The length and obliquity of the neck vary conſiderably in different ſubjects, being in ſome nearly horizontal. The great trochanter is on the outer ſide, directed a little backwards, below the level of the head, riſing above the hollow of the neck, quadrilateral, convex on the outſide, and exceſſively rough for the attachment of ſtrong tendons, the tendon of the gluteus maximus paſſing over the ſmooth ſurface at the poſterior part; hollow, and of much leſs extent on the inſide, giving attachment above to the tendons of the gemelli, the obturator internus, and the pyramidalis below, and towards the back part to the obturator internus. It has rough and irregular borders; to the anterior is fixed the tendon of the gluteus minimus; to the lower part of the poſterior the quadratus; to the upper the gluteus medius; to the lower the vaſtus externus. The attachments of theſe muſcles are hardly, however, confined to the edges of the trochanter; their tendons are implanted alſo to a greater or leſs extent over the outer ſurface, for which purpoſe its roughneſs, as mentioned above, ſeems particularly deſigned. The little trochanter is placed at the internal and poſterior part of the baſe of the neck, oblong and ſomewhat pyramidal in ſhape, its rough ſummit giving attachment to the united tendon of the pſoas magnus and iliacus. From its baſe we trace two prominent lines proceeding obliquely upwards to the great trochanter, one uniting them in front, the other behind. Theſe, in conjunction with the two trochanters, mark the circumference of the baſis of the neck, and give attachment, more eſpecially the anterior, to the capſular ligament of the hip joint. The body of the thigh bone is convex forwards, and hollowed behind, appearing nearly cylindrical when viewed in front, but almoſt triangular above, and flattened tranſverſely towards the lower end. It has been divided in deſcriptions into three ſurfaces and as many angular lines; theſe characters, however, are not ſtrongly marked; the ſurfaces are univerſally ſmooth, the dividing lines blunt and rounded, if we except the poſterior ridge formed by the union of the internal and external ſurfaces, called with great propriety the linea aſpera, or ſpina femoris. This is formed by two converging rough lines, commencing from each trochanter above; that which proceeds from the trochanter major is the moſt prominent and rough, giving attachment to the gluteus maximus; the pectineus is affixed to the other; and the interſpace is occupied by the quadratus and a portion of the triceps. The double ridge, formed by the approach of the two rough lines, is continued down the bone, when it again divides into two leſs remarkable lines, which terminate in the condyles at the lower extremity. The whole middle of the linea aſpera gives attachment to the triceps; a portion of the biceps has its origin at the lower part, which is continued along the line diverging towards the external condyle; the line going to the internal condyle is ſcarcely obſervable for a little way below the point of bifurcation. Theſe two branches of the linea aſpera leave a triangular interval between them, ſmooth and ſomewhat concave, correſponding to the popliteal veſſels. Beſides the muſcles fixed to different parts of the linea aſpera, the vaſtus externus is attached to almoſt the whole extent of the line, proceeding from the great trochanter to the external condyle; and the vaſtus internus is connected in a ſimilar manner to the line from the little trochanter to the internal condyle. The ſurfaces of the body of the femur are covered by theſe muſcles, and by the crureus, which cover the bone at every point, excepting towards the lower end, and the ſpace intercepted between the bifurcation of the linea aſpera. The nutrient arteries of the body of the bone are found in the courſe of the linea aſpera; the principal one about the point of convergence above.

The lower extremity much exceeds the upper in volume, and preſents two eminences called condyles, the internal and external. They are both convex, project more behind than in front, are ſmooth below for articulation with the tibia, this ſurface being terminated behind by two hollows, which give origin to the heads of the gaſtrocnemius. They diverge behind, leaving a deep notch between them, where the crucial ligaments of the knee joint are fixed; on the front they are joined by a continued articular ſurface, which is hollowed to receive the knee-pan or patella; the edge of the pulley formed by the outer condyle being more elevated than the oppoſite one. The articular ſurface terminates abruptly in the lateral direction, in the perpendicular rough ſides of the condyles; in front it is continued a little way up the bone, ending in a ſlightly prominent edge. The internal condyle gives attachment on the inner ſide to a lateral ligament, and to the tendon of the triceps. The external ſurface of the outer condyle is marked by a depreſſion to which the popliteus is affixed, and by an eminence for the external lateral ligament of the knee. The articular ſurface of this condyle is broader than that of the internal, and not ſo convex, the anterior part being nearly plane; and it is continued much higher up in the front than on the oppoſite ſide. The internal condyle, when the thigh bone is placed perpendicularly, appears to deſcend much lower than the external; but in the natural oblique direction of the femur, the bottom of the two condyles will be found nearly in the ſame horizontal plane, the internal ſtill exceeding a little.

The femur is compact in its ſtructure in the middle part, reticular and ſpongy at the extremities, which are yet cartilaginous at the time of birth. Oſſification commences in the middle of the bone, and it is not till after this has reached the extremities that we obſerve three centres of oſſification above, in the great, the little trochanter, and the middle of the head, and two below, one for each condyle. The cartilages between them and the body of the bone gradually decreaſe in thickneſs, and they become united, the two trochanters the firſt, then the head, and laſt of all the conjoined condyle. It is not till the bone has nearly arrived at its complete and adult form that the line of ſeparation is entirely obliterated. In infancy the neck of the bone is nearer at right angles to the body than at any after period; as the age advances the angle becomes more and more obtuſe in the majority of ſubjects; in ſome few it ſcarcely alters its direction. This alteration, from an horizontal to an oblique line, is a proof among many others how little the functions or growth of the animal body are ſubject to phyſical laws; we ſee the neck of the thigh bone riſing, as it were, in direct oppoſition to the weight of the ſuper-incumbent body. This portion of the femur is alſo proportionally ſhorter than in the adult, and wholly cartilaginous. The body of the bone is ſtraight, inſtead of being curved forwards, as in the adult; and the inferior extremity is comparatively of larger dimenſions. Theſe characters of the infantile bone are loſt as it gradually becomes developed, and acquires its remarkable denſity and firmneſs. The thigh bone is articulated above with the os innominatum, below with the tibia and patella.

The articulation of the femur with the os innominatum, the hip joint.—The ſurface of the cotyloid cavity of the hip bone is lined by an articular cartilage, of which the central parts are thinner than the circumference. It terminates at the edge of the depreſſion obſerved at the inner and lower parts of the cavity, which is filled up by a fatty cellular tiſſue, ſupplied by numerous veſſels. The bony margin of the cavity is completed by a ligament croſſing the notch, and the whole rim of the acetabulum is ſurmounted by a circular ligament, called the cotyloid ligament, which much increaſes its depth. In this round articular cup, or acetabulum, the head of the thigh bone is lodged. The latter is covered by cartilage thinner at the circumference than towards the centre, where it is partially interrupted by the inſertion of a ligament, and accommodated exactly to the oppoſite ſurface of the acetabulum; the cartilaginous head, however, is ſo deep as not to be wholly embraced by this cavity in any poſition; and hence ſome part of its margin always appears expoſed on turning back the enveloping ligament. The contiguous ſurfaces are ſecured in their relations by a very ſtrong capſular ligament, ſupported by fibres from the neighbouring parts, and ſurrounded on all ſides by muſcles; and by an inter-articular ligament. The oppoſed ſurfaces are covered by a ſynovial membrane.

The cotyloid ligament adheres firmly to the edge of the acetabulum at every point, excepting the great notch which it croſſes. It is thick at the border next the bone, thin at the oppoſite prominent margin, broader above, and externally thin in the contrary directions, and partially broader wherever there is any depreſſion in the oſſeous rim, ſo that the unconnected margin of the ligament is exactly plane throughout. It is formed by ligamentous fibres ariſing from the edges of the cavity without, inclining gently towards it in their progreſs, and inſerted again into the ſides of the margin within at a greater or leſs diſtance from their point of origin. Theſe fibres receive an addition above from the curved tendon of the rectus cruris; below they are confounded with the fibres of another ligament, completing the great notch. The latter is formed by two croſs planes of fibres paſſing from one edge to the other; they decuſſate each other in their courſe, one band correſponding to the ſurface of the joint, the other to the edge of the obturator foramen, from the ligament occupying which it partly takes its origin. They leave a vacancy below for the paſſage of veſſels into the joint; towards the brim of the cavity they are continuous with the cotyloid ligament in the manner above-mentioned; they give a partial attachment alſo to the ligamentous capſule. The cotyloid ligament, in conjunction with theſe bands, completes the figure of the acetabulum, and by increaſing its depth ſecures the joint without in any degree diminiſhing the motions of the head of the femur, to the preſſure of which it readily yields. They are both lined towards the joint by the ſynovial membrane, which is continued over the edge of the cotyloid ligament a little way down the oppoſite ſurface, before it is reflected to the capſular ligament. Theſe two laſt are oppoſed to each other in part by its intervention; towards their mutual attachment to the brim of the cavity they are intimately united. Into the articular hollow thus conſtituted, the head of the femur is received, and ſecured by an orbicular and internal ligament.

The capſular ligament of the hip joint, (l. orbiculare, membrana capſularis femoris, Soemm.) extends from the circumference of the acetabulum to the baſe of the neck of the femur. It is fixed to the bony margin of the former from the line of inſertion of the cotyloid ligament, to a ſhort ſpace beyond it, ſo as to ſurround the latter, which projects freely into the joint. Its inſertion extends further beyond the cotyloid ligament in front and on the outer ſide than it does internally, where it may be almoſt ſaid to ariſe from its very edge. From this circular attachment the capſule deſcends, enveloping in its courſe the chief part of the neck of the femur, to the circumference of whoſe baſe it is finally fixed. In front it reaches the oblique line between the trochanters, the linea inter-trochanterica; behind, ſome of its fibres only reach ſo far, the greater number are implanted into the neck between the poſterior oblique line and its middle; above, it is fixed to the root of the great trochanter; below, it extends nearly to the little. The capſular ligament is in general very thick, and of a cloſe and condenſed texture; it is thinneſt internally and behind, thicker externally, and moſt decidedly ſo in front, where it is ſtrengthened by a layer of longitudinal fibres ariſing from the anterior margin of the os innominatum, and from the anterior inferior ſpine, and fixed below to the anterior linea inter-trochanterica. In other parts of the ligament the courſe of the fibres is leſs diſtinctly marked; from the margin of the acetabulum they follow different directions, decuſſating each other, and leaving occaſional intervals, more eſpecially below, through which veſſels paſs to the ſynovial membrane. This laſt is occaſionally expoſed and bare on the ſide next the obturator foramen. The capſular ligament is covered in front by the rectus cruris, pſoas magnus, and iliacus internus, a ſynovial burſa lying between them; on the internal ſide, by the obturator externus and pectineus; behind, by the quadratus femoris, the gemelli, the tendon of the obturator internus, and the pyramidalis; above and without, by the gluteus minimus, which is more cloſely connected with it than any other of theſe muſcles.

The interior, or round ligament, (ligamentum teres, internum) is entitled to almoſt any name rather than round; it is flattened, and of a triangular figure, the baſe towards the acetabulum, the ſummit next the head of the femur. It is fixed at one end to the extremities or corners of the great notch of the cotyloid cavity, and to the poſterior edge of the tranſverſe ligament occupying the vacancy; from thence it mounts obliquely backwards, and is attached to the depreſſion noticed towards the centre of the head of the thigh bone. It appears as if compoſed of two bands of fibres, one ariſing from the ſuperior, the other from the inferior extremity of the great cotyloid notch, which approach each other towards their oppoſite inſertion. The upper of theſe is by far the weakeſt; in many caſes it appears only as a duplicature of the ſynovial membrane, encloſing only a ſmall number of ligamentous fibres. It muſt reſtrain the head of the femur from quitting the cavity upwards and outwards, and muſt be partially, if not entirely, ruptured in the luxations in thoſe directions; in the diſplacement towards the obturator foramen it would not apparently ſuffer much injury.

The ſynovial membrane lines the cotyloid cavity, is ſpread over the fatty cellular tiſſue, occupying the ſinus at its bottom, is reflected from thence over the internal ligament, which it wholly encaſes, adhering to it more or leſs intimately in different parts: it covers the articular cartilage of the head of the femur, is continued over the perioſteum of the neck, which appears through it as if formed of parallel fibres; at the baſe of the neck it turns back over the inner ſurface of the capſular ligament, lines it to its attachment round the brim of the acetabulum, and from thence paſſes over the cotyloid ligament. The hip joint is very much ſtrengthened by the ſurrounding muſcles, eſpecially by thoſe which immediately cover it.

The motions which take place in the hip joint reſemble thoſe in the ſhoulder; they are, however, with the exception of rotation, leſs extenſive, owing to the immobility of the cotyloid cavity, its great depth, and the comparative tightneſs of its capſular ligament. The femur can be bent on the hip bone, extended, brought nearer to, or removed further from, the meſial plane, moved between theſe directions, or carried round in a circular direction (*circumduction*), and rolled inwards and outwards. In the moſt common poſition, with the thigh in the ſame line as the body, the ſummit of the great trochanter, which can be always felt externally under the integuments, is in the ſame horizontal line with the ſpine of the pubis, and about the middle of an oblique line extended between the ſuperior anterior ſpine of the ilium, and the tuberoſity of the iſchium. By a previous knowledge of the relative poſition of this eminence to points which can be eaſily felt, we ſhall be competent to decide on any accidental diſplacement, as well as to follow the alteration of poſition in the different motions of the femur.

When the thigh is bent, the head rolls in the acetabulum in the axis of the neck, the ſummit of the trochanter recedes from the ſpine of the ilium, and approaches the tuber of the iſchium, and the lower end of the bone is advanced. In moderate flexion there is but little alteration in the relations of the articular ſurfaces; when carried to its greateſt degree, a portion of the head of the femur quits the acetabulum, and reſts on the poſterior part of the capſular ligament, which undergoes conſiderable diſtenſion. Extenſion of the thigh is the replacement of the limb in its former ſtate, from the poſition of flexion. The very cloſe manner in which the head of the bone is covered in front by the ſtrong ligamentous fibres, which proceed from the anterior and inferior ſpine of the ilium, and the neighbouring anterior portion of the cotyloid line, entirely prevent us from carrying the limb backwards beyond a perpendicular line drawn from the pelvis downwards, if the latter part be preſerved immoveable. The degree of motion in this direction, if it exiſt at all, is very trifling, ſuppoſing the trunk to be erect, and the pelvis fixed; the apparent freedom of motion in the direction of extenſion ariſes from the pelvis being ordinarily moved in the oppoſite direction.

In abduction, or removing the thigh from its fellow, the great trochanter riſes towards the foſſa of the ilium, which it touches, if the motion be continued as far as poſſible, and thereby limits the extent of that motion. The internal ſurface of the head abandons the acetabulum, while the external ſinks deeper into it; the capſular ligament is made very tenſe on the inner ſide, where it ſupports the head and oppoſes its tendency to any diſplacement in that direction. In adduction nothing remarkable occurs; it is merely the return of the thigh from the laſt poſition to its natural one; the limb may, however, be carried, in this direction, acroſs the oppoſite one. Beſides theſe four motions in oppoſite lines, it will be readily underſtood that the femur can be moved through all of the intermediate points. Circumduction is not ſo free as in the ſhoulder joint, as may be gathered from the preceding obſervations: rotation is, on the contrary, leſs confined, on account of the length and obliquity of the neck of the femur, ſo ſtrikingly different from that of the humerus. In the latter rotation is nearly in the axis of the bone, on account of the extreme ſhortneſs of the neck; in the femur, where the axis of the bone is ſo far removed from the centre of motion, this motion paſſes round a line extended from the upper part of the head to the middle point or interval between the condyles. In rotation inwards, which is more confined than that outwards, the great trochanter deſcribes the arc of a circle from behind forwards, and the head of the bone is buried deeper in the cavity; the motion of the trochanter is more ſenſible and more extenſive as the neck is proportionally longer. In rolling the thigh outwards the great trochanter ſinks under the muſcles, and the head of the bone diſtends the capſule ſomewhat in front. In its moſt natural poſition the thigh is turned a little outwards, which contributes, with the direction given to the foot by the conſtruction of the ankle joint, to point the toes moderately outwards. As the leg and foot neceſſarily follow the rolling motions of the thigh, and more perfectly ſo when the leg is extended on the latter, it will be ſeen that the rotation of this bone inwards and outwards will imply a correſponding alteration in the poſition of the foot; and the great power we enjoy of turning the toes outwards, and the narrow limits to which we are confined in directing them inwards, will be found to reſult from the difference obſerved in the powers of rotation of the thigh.

The motions of the hip bone on the thigh, when the latter is the fixed point, will require no particular detail after the preceding remarks. It is ſufficient to ſay they may be made in every direction, and with tolerable facility, particularly lateral inclination, in which one hip bone is lowered, and the oppoſite one elevated, and rotation; motions executed with promptneſs and to a great extent in the *pirouettes* of our ſtage dancers. We ſhall have occaſion to ſpeak at length of the flexion and extenſion of the hip bones on the thigh, when we examine the mechaniſm of the whole in the attitude of ſtanding.

The leg—is the part of the lower extremity placed between the thigh and the foot; the bones which it contains are the tibia, the fibula, and the patella.

The tibia, the largeſt of the three, alone ſupports the weight placed on the leg from above; it comes next to the femur in ſize, is larger above than below, nearly triangular throughout, divided into an upper, femoral extremity, or head, a middle part or body, and a lower or tarſal extremity.

The upper extremity is nearly oval, with the long diameter tranſverſe, large, and ſpreading.

The vertex or top preſents two articular hollows or ſinuſes; of which the internal is oblong from before backwards, and deeper than the external, which is nearly circular. They correſpond to the condyles of the femur by the intervention of moveable cartilages; and are divided from each other by a middle eminence, terminating in a rough depreſſion before and behind, which completes the ſeparation. This protuberance, placed neareſt to the poſterior edge of the head, is not much elevated; it ſlopes into the articular ſurfaces at the baſe, and is bifid at the ſummit, with a rough groove in the interval. The rough depreſſion in front is larger than that behind; they both give attachment to the ſemi-lunar inter-articular cartilages of the knee, and to the crucial ligaments of the joint. In front of the upper extremity is a broad, flat, triangular ſurface, with the baſe upwards, correſponding to the ligament of the patella. The lateral parts have been called the tuberoſities; they project conſiderably by a convex edge, ſeparated in front by the flat ſpace juſt mentioned, behind by a notch varying much in depth. The internal protuberance is the largeſt, and is marked by the attachment of the ſemi-membranoſus behind, the external preſents in the ſame aſpect a rounded articular ſurface inclined downwards, for connection with the fibula.

The body of the tibia is ſlightly curved outwards above, and inwards below, diminiſhing in bulk as we trace it from the upper extremity till about one-third from its lower end, from which point its ſize gradually increaſes again downwards. It is of a priſmatic form, with ſtrongly marked edges. The anterior of theſe, the criſta or ſpine, commences above at a rough eminence, called the anterior tuberoſity of the tibia, into which the inferior ligament of the patella is fixed in front, and the tendons of the ſartorius, gracilis, and ſemi-tendinoſus internally; it is ſharp above and in the middle, in the latter of which portions it projects a little, and becomes inſenſibly loſt below; it forms by its courſe a waving line, which gives attachment to the aponeuroſis enveloping the muſcles of the leg. The internal edge is flattened above, and more angular below; in the firſt portion it gives attachment to the popliteus, for the lower two-thirds to the long flexor of the toes. To the external ridge, the leaſt prominent of the three, the interoſſeous ligament is fixed; below it bifurcates and is continued into the edges of the articular cavity, which receives the lower end of the fibula. Of the ſurfaces between theſe edges, the internal or the ſhin is the largeſt; ſmooth, ſlightly convex above, and covered by the tendons of the ſartorius, gracilis, and ſemi-tendinoſus; throughout the reſt of its extent it lies immediately under the ſkin. The outer ſurface is hollowed longitudinally above, and convex below, where it turns a little forward; its upper half is covered by the tibialis anticus, to which it gives attachment, and lower down the tendon of this muſcle, with thoſe of the extenſor of the great toe, and the common long extenſor of the toes, paſs over it. The poſterior ſurface is croſſed obliquely by a line paſſing downwards and inwards from the articular ſurface, at the back of the external tuberoſity; above this the popliteus is attached; below, the tibialis poſticus, and long flexor of the toes; to the line itſelf theſe muſcles are fixed, as alſo the ſoleus. It is towards the upper end of the poſterior ſurface that we find the hole which gives paſſage to the nutrient veſſels.

The lower extremity is much leſs in volume than the femoral or upper; it is nearly quadrilateral with an articular cavity of the ſame form at the bottom, which reſts on the foot. Of the four ſides, the anterior and poſterior are ſtraight, tranſverſely and nearly parallel, giving attachment at their edges to ligamentous fibres; the latter preſents alſo a groove for the paſſage of the long flexor of the great toe. The internal is prolonged downwards below the level of the others, forming a broad and ſtrong proceſs, called the malleolus internus. This eminence does not correſpond exactly to the inner tuberoſity of the femoral end, but is ſituated a little more forwards from the ſlightly twiſted form of the bone. The circumference of its anterior and loweſt parts gives attachment to ligaments; the poſterior has a broad and ſuperficial hollow, over which paſs the tendons of the tibialis anticus, and the long flexor of the toes; the inner ſurface is convex, and covered by the ſkin, the external is ſmooth, preſenting a vertical articular ſurface, joining above the large articular cavity, the depth of which it conſiderably increaſes. On the outer ſide of the tarſal extremity is a triangular hollow with the ſummit upwards, ſmooth below, and covered by cartilage, where it receives the fibula, rough above for the attachment of ſtrong and ſhort ligamentous fibres, which ſecure the connection: the edges of the cavity are continued above into the external ſpine of the body of the bone, and give attachment to ligaments which paſs to the fibula. The articular ſurface at the bottom is a little concave, quadrilateral, narroweſt and deepeſt towards the inner ſide, croſſed antero-poſteriorly by a broad gently riſing eminence; it correſponds to the upper ſurface of the aſtragalus, the higheſt of the bones of the tarſus.

The ſtructure and formation of the tibia reſemble thoſe of the other long bones. At birth the extremities are cartilaginous, and are not completely oſſified and united to the body till a late period; the bony ſpines in the latter are already very prominent, and better marked than in any other bone. The tibia is articulated with the femur, the fibula, and aſtragalus.

The patella, rotula, or knee-pan (knieſcheibe, Germ.) is ſituated in front of the knee-joint, or articulation between the femur and tibia, varying as the leg is bent or extended, in its relative poſition with regard to the femur. It is flattened, of a triangular form, with the baſe upwards, the upper angles rounded, the lower more acute. The anterior ſurface is convex, pierced by numerous longitudinal openings, covered by a tendinous expanſion from the extenſors of the leg, which is partially attached to it, and by the ſkin. The poſterior articular ſurface is oblong, tranſverſely divided by a blunt elevated line, paſſing rather obliquely from the upper edge to the lower angle, into two differently inclined concave faces, of which the external is the largeſt and deepeſt; they both correſpond to the condyles of the femur on which they play. It is terminated below by a rough depreſſion, into which a portion of the ligament of this bone is fixed. Of its circumference, the upper edge is thick, and gives attachment to the tendon of the extenſors, the lateral borders ſlightly convex, to the common aponeuroſis of theſe muſcles. In the lower angle the ſtrong anterior ligament which connects the patella to the tuber in front of the tibia is firmly implanted.

The ſubſtance of the patella is ſpongy in the middle, covered by a thin cruſt of compact bone. It is formed in the thickneſs of the tendon of the extenſors, and always preſerves the appearance of longitudinal fibres. It is not till ſome years after birth that bony matter is depoſited in room of the cartilaginous ſubſtance at firſt obſervable, and it is a later period ſtill before it is fully developed. The patella is articulated with the femur, and connected with the tibia by means of a ligament, of which we ſhall ſpeak below.

The knee joint, or articulation of the femur with the tibia and patella.—This joint, one of the moſt complicated in the body, reſults from the contact of the condyles of the thigh bone with the head of the tibia and the poſterior ſurface of the patella. The firſt of theſe, as well as the articular pulley formed by their union in front, are covered by cartilage, which is thicker in the middle of the condyles than at their circumference; the cartilage covering the patella is particularly thick, it is thinner on the hollows of the tibia, particularly in their centres. The forms of the articular ſurfaces of the femur are accommodated to thoſe of the patella and tibia; but in the latter caſe the correſpondence is further maintained by means of two inter-articular ſemilunar fibro-cartilages, interpoſed between the femur and tibia in ſuch a manner, that a ſmall portion only of the latter bone comes into actual contact with the condyles of the former. The relations between theſe parts are ſecured by muſcles, and their tendons, by the ligament of the patella, two lateral, and the ſame number of crucial or oblique ligaments, a poſterior ligament, and by a ſynovial membrane ſpread over the whole.

The ligament of the patella, which may be regarded as the termination of the tendons of the extenſor muſcles, conſiſts of a very ſtrong flat band of fibres attached above to the lower angle of that bone, and to the depreſſion on its poſterior ſurface, from which points it extends about two inches in length, and half as much in breadth to the anterior tuberoſity of the tibia. It is covered in front by the ſkin and an aponeurotic expanſion. The poſterior ſurface correſponds above to ſome fat and cellular tiſſue lying betwixt it and the ſynovial membrane, below to a ſmall ſynovial capſule placed between it and the tibia, a ſmooth portion of which it covers, juſt above the inſertion of the ligament. The edges are continuous, with an aponeuroſis proceeding laterally to the tibia. It is compoſed of parallel, ſhining, tendinous fibres, of which the anterior or moſt ſuperficial are continued in front of the patella to be identified with thoſe of the immediate tendons of the extenſors. It is exceedingly ſtrong, and capable of reſiſting the ſtrongeſt efforts of theſe muſcles.

The internal lateral ligament is flat and thin, attached above to the internal condyle of the femur, it becomes broader as it deſcends, part of its fibres is inſerted into the edge of the internal ſemi-lunar cartilage, and into the edge of the head of the tibia, the greater portion contracted in breadth is continued further down, and becomes fixed at the commencement of the body of the bone to the internal edge, where it joins the aponeurotic inſertion of the popliteus. It is covered by an aponeuroſis deſcending from the faſcia lata of the thigh, and below by the tendons of the ſartorius, the gracilis, and ſemi-tendinoſus: it lies over the ſynovial membrane, the internal ſemi-lunar cartilage, and a ſmall part of the tibia. The external lateral ligament is placed between the external condyle of the femur, and the fibula, in the form of a long, round, ſhining cord, covered nearly throughout by the tendons of the biceps. Immediately under it are the inferior articular veſſels. It is fixed to the condyle above the attachment of the tendon of the popliteus, and rather behind it; to the fibula on the outſide of its upper extremity, adhering to the outer ſemi-lunar cartilage in its paſſage. The poſterior ligament is nothing but a tendinous expanſion given off from the tendon of the ſemi-membranoſus, which mounts obliquely upwards

wards and outwards behind the crucial ligaments, from which it is ſeparated by cellular tiſſue and the middle articular veſſels. It is attached above to the external condyle, and is confounded with the tendon of the outer head of the gaſtrocnemius. Independent of this band, which is very irregular in its form and ſize, we find other fibrous parcels croſſing in different directions above it.

The crucial ligaments are more deeply ſeated, but may ſtill be conſidered as external to the joint as they are covered only in front, and on the ſides by the ſynovial membrane, and are really without the ſac which it forms. They are ſtrong fibrous bands croſſing each other in their courſe, from which they derive their name. The anterior paſſes from the poſterior and upper part of the hollow between the condyles, and from the interior ſide of the external condyle; obliquely downwards and forwards, narrowing as it deſcends, to be fixed in the rough ſurface, in front of the ſpine at the head of the tibia, behind the attachment of the internal ſemi-lunar cartilage, and on the inſide of the external, being partially united to both. The poſterior crucial ligament is attached above to the anterior part of the ſinus between the condyles, and the outer-ſide of the internal condyle. It deſcends backwards and inwards, becomes broader, and divides into two pretty diſtinct bands, of which the largeſt is inſerted into the depreſſion behind the ſpine, the other joins the external ſemi-lunar cartilage. Theſe two ligaments are ſeparated from each other by cellular tiſſue, and by the ſame means from the poſterior ligament behind; they adhere firmly to the ſynovial membrane, inveſting them on the anterior and lateral ſurfaces.

The ſemi-lunar cartilages, as they are termed, lie on the articular ſurfaces of the tibia, between them and the correſponding condyles, occupying only the circumference, the femur and tibia touching in the centre of each. They are thick at the convex margin, and become gradually thinner, terminating in a delicate concave edge, increaſing thereby the depth of the cavities which receive the gibbous condyles of the femur. The internal is broadeſt behind, the external in front; the firſt repreſents a portion of an oval, of which the ſhort diameter is tranſverſe; the latter forms nearly a circle, correſponding, in this reſpect, to the figure of the two articular ſurfaces of the tibia. The upper ſurface of each cartilage is concave, accommodated to the convexity of the condyles, the lower is nearly flat. The convex margins are united to the ligaments which croſs them in their courſe, eſpecially to the lateral; that of the external has an oblique depreſſion in it behind, where it is contiguous but not adherent to the tendon of the popliteus. The concave edges are free, thin, and ſharp. The anterior extremity of the internal cartilage paſſes in front of the anterior crucial ligament, and is inſerted on the outer ſide of the depreſſion which gives attachment to it; the poſterior is attached behind the ſpine, before the inſertion of the poſterior crucial ligament. The anterior extremity of the external ſemi-lunar cartilage is faſtened to the depreſſion in front of the ſpine, but much behind the attachment of the internal, and united in part with the anterior crucial ligament; behind it is implanted into the poſterior depreſſion, and is connected with a portion of the poſterior crucial ligament. We have called theſe cartilages, not to depart too much from eſtabliſhed language, though they are of a fibrous texture. They are formed of curved concentric fibres, which are particularly evident at their extremities and convex margins, leſs ſo in the middle, where they are more analogous in their appearance to cartilage. They are ſometimes immediately joined by a ſhort tranſverſe ligament, continued from the convex borders in front. The internal appears more fixed in its ſituation than the external, which has a gliding motion backwards and forwards on the tibia.

The ſynovial membrane, if we trace it from above, is reflected from the condyles of the femur, ſome way above the termination of the cartilage to the circumference of the patella. In this part it is looſe, covered above by looſe fat and by the cruræus, to the tendon of which it adheres moſt firmly, and laterally by an aponeurotic expanſion, from the extenſors paſſing from the edges of the patella to the tibia and femur. After lining the poſterior ſurface of the patella, it paſſes on to the upper edge of the tibia in front, lying under the ligament of the former bone, and a large quantity of fat and cellular tiſſue placed underneath it, and keeping them at a conſiderable diſtance. From this part a duplicature of it paſſes backwards through the joint, and is attached to the anterior and external part of the ſinus between the condyles. It has been called the ligamentum alare by Weitbrecht, or l. mucoſum, ſeu adipoſum; all names equally unapplicable to it. Laterally, alſo, it deſcends towards the tibia, inveſting the upper ſurfaces, and concave edge, and the under ſurfaces of the ſemi-lunar cartilages; after which it is continued downwards, covers the articular cartilages at the head of the bone, and is reflected upwards over the crucial ligaments in the middle, lining behind the tendons of the gaſtrocnemius on their anterior ſurface, and enveloping the tendon of the popliteus. It thus reaches the condyles behind, to the edges of which it is attached, leaving the ſinus between them without the bag, and paſſes over the cartilages to the point from which we ſet out. It is covered in front by the extenſors and their tendon; by their aponeuroſis laterally, as alſo on the inſide by the tendons of the ſartorius, gracilis, and ſemi-tendinoſus, and by the internal lateral ligament with which it is in contact; on the outſide by the tendon of the biceps and the external lateral ligament, behind by the ſemi-membranoſus and its lateral tendon, by the gaſtrocnemius and popliteus. After all, we ſhould have a very imperfect idea of the knee joint, if we conſidered it in this abſtract ſtate. It is moſt ſtrongly ſupported by the muſcular powers attached to the tendons we have mentioned, the latter being numerous, and of great ſtrength, and the muſcles maſſy and exceedingly powerful, ſecuring moſt effectually, when in action, the relations of the oppoſite bones.

The motions of the leg on the thigh—are thoſe of flexion, extenſion, and under particular circumſtances of rotation. In flexion, the tibia and ſemi-lunar cartilages glide backwards on the condyles of the femur; the patella quits the articular pulley, and deſcends in front of the joint, ſo as to be oppoſite to the ſinus between the condyles: the tendon of the extenſors occupies its place, and is much diſtended if the flexion be carried far back, as is alſo the ligament of the patella; and the crucial and oblique ligaments, as well as the poſterior, are relaxed. In extenſion, the tibia glides forwards again, and the ſemi-lunar cartilages are brought oppoſite to the inferior inſtead of the poſterior ſurfaces of the condyles, which, in this poſition, reſt againſt the heads of the gaſtrocnemius; the patella mounts again, and, in complete extenſion, if the muſcles are in action, paſſes up a little way above the articular pulley; if the muſcles are quieſcent, the tendon of the patella is relaxed; this bone is looſe and may be moved in all directions; the poſterior crucial and lateral ligaments are ſtretched, and prevent this motion from being carried beyond the point which brings the femur and tibia in the ſame line. The great ſtrength of the crucial ligaments, which are eſſentially diſtended at this time, is a powerful obſtacle to the luxation, which would throw the head of the tibia backward. When the leg is near the middle ſtate, between complete flexion and extenſion, it can be rotated ſlightly inwards and outwards; a motion, of which the foot neceſſarily partakes, and which carries the toes in correſponding directions. In rotation the articular ſurfaces of the tibia glide in oppoſite curves in the rounded ſurfaces of the condyles; not, however, in equal degrees, the moſt evident motion occurring on the outer condyle. In rotation inwards the poſterior crucial ligament is brought to croſs the anterior more directly, and is much tightened, ſo as effectually to limit it. In rotation outwards, which, on account of the diſpoſition of theſe ligaments, is more extenſive, we find them ſcarcely affected. In both caſes the lateral ligaments are rendered tenſe; the ſemi-lunar cartilages undergo little change of poſition, excepting that in rotation inwards, the external one, from its connection with the poſterior crucial ligament, is drawn a little aſide. When the leg is bent, the motions by which the toes are carried alternately inwards or outwards take place in the knee joint; when it is extended, they are effected in the hip, and depend on the rotation of the femur. The patella favours extenſion, by removing the power further from the centre of motion, beſides which it glides more readily over the pulley of the femur, than a flexible tendon could have done, and protects materially the front of the joint in flexion, for inſtance in kneeling. It ſcarcely moves in rotation inwards or outwards.

The fibula—is placed on the external ſide of the leg, obliquely with regard to the tibia, being behind it above, and immediately on the outſide below. It is a ſlender bone, nearly equal in length to the tibia, but very much ſmaller, divided into an upper or tibial, or lower or tarſal extremity, and a middle portion or body.

The upper extremity is very irregular; we remark in it above, and a little on the inſide, an oblique, ſlightly hollowed, articular ſurface, correſponding to one on the outer tuberoſity of the head of the tibia. In every other aſpect the ſurface is rough and unequal, giving attachment to ligaments which connect it with the tibia, to the external lateral ligament of the knee, and to the tendon of the biceps.

The body of the fibula is of an irregular priſmatic figure, ſomewhat twiſted, and curved a little, ſo as to approach nearer the tibia in the middle of the three angles, the anterior riſes gradually from above, is ſharp and prominent in the middle, and bifurcates below, where it is covered only by the ſkin. It gives origin, in the greateſt part of its extent, to an aponeuroſis, which ſeparates the peronei muſcles from the extenſor communis of the toes. The external edge is ſpiral in its courſe, running backwards as it deſcends. It gives attachment to an aponeuroſis, which divides the peronei from the long flexor of the great toe and the ſoleus. The internal edge becomes anterior as it deſcends; it is very prominent in the middle, and gradually loſt above and below. The upper two-thirds give origin to the flexor of the great toe, and the tibialis poſticus, the lower third to the interoſſeous ligament. Of the ſurfaces between theſe borders, the external alters its aſpect, becoming poſterior below; it is covered by the peronei, which are fixed to the two upper thirds. The internal ſurface looks rather backwards above, and forwards below; it is divided into two unequal portions by a ſpine extending from the upper part of the anterior angle to the lower part of the internal angle, and which gives attachment to the interoſſeous ligament. Of theſe two planes the anterior is covered by, and gives origin to, the extenſors of the great and of the other toes, and to the peroneus tertius; the poſterior, which is hollowed longitudinally, to the tibialis poſticus. The direction of this ſpine varies very conſiderably, as alſo its length. The poſterior face is inclined outwards above, where the ſoleus has its attachment; below it turns inwards, giving attachment by nearly its lower two-thirds to the long flexor of the great toe. About the middle is the opening for the nutrient artery directed longitudinally downwards. It widens towards the lower extremity, where it terminates in a rough convex ſurface, connected with the tibia.

The lower or tarſal end of the fibula is oblong, flattened tranſverſely, thicker behind than in front; it forms the outer malleolus, which deſcends rather lower, and is more pointed than the inner. The external ſurface is convex, and covered only by ſkin; the internal preſents, at its anterior part, a ſmooth articular ſurface convex from above downwards, articulated with the external ſide of the aſtragalus, and behind this a rough depreſſion for ligamentous attachments. The poſterior border has in it a ſuperficial groove for the paſſage of the peronei; the anterior, as well as the angle below, give attachment to ligaments.

The fibula is in ſtructure like the other long bones. It is formed from three points of oſſification, one for the body and one for each extremity. The latter are ſtill cartilaginous at birth.

The articulation between the tibia and fibula—is by actual contact at the two extremities, and by means of an interoſſeous ligament in the intervening ſpace. The ſuperior articulation reſults from the contact of two flat cartilaginous ſurfaces, ſecured by ligaments in front and behind, and covered by ſynovial membrane. The anterior ligament paſſes from the fore part of the upper end of the fibula to the anterior part of the external tuberoſity of the tibia. The fibres are tranſverſe, the ſuperior ones the longeſt, and divided into ſeveral parcels, with intervening cellular tiſſue. It is ſtrengthened by a portion of the tendon of the biceps, which embraces the external lateral ligament of the knee, and paſſes over this anterior ligament before it is fixed to the tibia. The poſterior ligament is alſo tranſverſe, but not ſo ſtrong, or ſo well marked as the preceding; it is continued above with ſome ligamentous fibres found in the back of the knee-joint; it is covered by the popliteus. Beſides theſe two ligaments, we find a few other ſcattered bands below, which help to ſecure the articulation. The ſynovial membrane lines theſe ligaments, and the cartilaginous ſurfaces; it is ſeparated from the tendon of the biceps by cellular tiſſue, and is contiguous behind to the ſynovial membrane of the knee. The middle connection is preſerved by means of an interoſſeous ligament, analogous to the one we have deſcribed in the fore-arm. It is thin, compoſed of parallel fibres deſcending obliquely from the external edge of the tibia to the ridge dividing the internal ſurface of the fibula, and below to the internal edge of this bone. It is broadeſt at the upper part, and terminates in a point beneath, where the bones begin to touch each other. It is pierced by many openings for the paſſage of veſſels; of theſe the moſt remarkable are, one above, near the edge of the fibula, for the paſſage of the anterior tibial veſſels; and another below for a branch from the peroneal artery. The anterior ſurface ſerves for attachment to the tibialis anticus, the extenſors of the great and other toes, and to the peroneus tertius, and ſupports the anterior tibial veſſels. To the poſterior ſurface the tibialis poſticus and long flexor of the great toe are fixed. The inferior articulation is compoſed of the contact of two cartilaginous ſurfaces below, a convex for the fibula, and a correſponding concave one for the tibia, lined by a continuation of the ſynovial membrane from the ankle joint. The relations are ſecured by ligaments before, behind, and between the bones. The anterior ligament is broad, attached to the anterior edge of the tarſal end of the fibula; in croſsing to the tibia it mounts a little upwards, widening in its progreſs, its fibres divided by intervals filled with cellular tiſſue, the ſuperior the longeſt, and is fixed to the neighbouring parts of the tibia. It is covered by the peroneus tertius, aponeuroſis of the leg and the ſhin; its lower end is confounded with ligamentous fibres paſſing from the fibula to the aſtragalus. The poſterior ligament reſembles it in direction, but it is not ſo large, and the lowermoſt fibres are the longeſt. It paſſes immediately from the poſterior part of this end of the fibula to be fixed to the tibia behind the cavity which lodges that bone, is confounded with the ſurrounding ligaments below, covered behind by the two lateral peronei muſcles. In addition to theſe ligaments we obſerve, between the oppoſite ſurfaces of the two bones, juſt above their cartilaginous contact, a fibrous ſubſtance paſſing from one to the other, occupying a conſiderable ſpace, interrupted here and there by cellular tiſſue, and continuous above with the interoſſeous ligament. It materially ſecures the articulation.

The motions of the fibula on the tibia are exceſſively limited, very different in this reſpect from thoſe between the bones of the fore-arm. The upper end of the fibula may glide a little backwards and forwards; the lower is nearly motionleſs from the diſpoſition of the ligaments, a ſtructure neceſſary for the ſtability of the articulation of the leg with the foot, as reſiſting the tendency to lateral diſplacement.

The foot—forms the laſt diviſion of the lower extremity; it has ſome characters in common with the hand, but is diſtinguiſhed from it in a remarkable manner by its great depth and firmneſs, by the preponderance of its ſolid over its moveable parts, the reverſe of which is ſo ſtrikingly ſeen in the hand. It varies much in ſize, in general is proportionably ſmaller in the female than in the male, is elongated in form, broad and flat anteriorly, thick and narrower behind. It is convex on the upper ſurface, which is called the back of the foot, concave on the lower, called the ſole, thin on the outer edge, deeper and longer internally, with a projection behind, named the heel, and terminated by the points of the toes in front. We divide it, as we did the hand, into three portions; the tarſus behind, the metatarſus in the middle, and the toes before.

The tarſus (oberfuſs, Germ.) forms about the poſterior half of the foot; it is compoſed of ſeven bones, *viz.* the aſtragalus, the os calcis, naviculare, cuboides, and three cuneiform bones.

The aſtragalus, (talus of Albinus,) occupies the upper part of the tarſus, riſing far above the level of the other bones; it is of a very irregular form, convex above, hollowed below, flattened at the ſides, and running out into a ſtrong proceſs before, termed the cervix or neck of the bone. It is placed faſt between the two bones of the leg, the heel bone, and the os naviculare. On the upper ſurface, anteriorly, is a rough, tranſverſe depreſſion, forming part of what has been called the neck of the bone, for inſertion of ligaments; behind this is a large articular ſurface, broader before than behind, convex in thoſe directions, rather concave from ſide to ſide, ſo as to form a ſuperficial pulley, ſuited to the oppoſite ſurface of the tibia. Below we have two articular ſurfaces, which reſt on the os calcis, ſeparated by a deep groove, running obliquely from within outwards, widening much in its courſe, and rough for ligamentous attachments. The poſterior articular ſurface, which is external, is the largeſt, concave, and oblong obliquely; the anterior is ſmall, oval, and nearly flat. The poſterior ſide is narrowed horizontally, and preſents the commencement of an oblique groove, in which the tendon of the long flexor of the great toe glides. In front is a convex rounded articular ſurface, which has been called the head of the bone; it reſts againſt the os naviculare, and by a ſmall ſurface on the os calcis. On the outſide a triangular articular ſurface, concave vertically, correſponding to the lower end of the fibula. On the inſide another articular ſurface, flat, elongated horizontally, adapted to the deſcending malleolus internus; below this a rough irregular ſurface for ligaments. Theſe two articular ſurfaces are continuous with that on the upper ſurface, and form part of the ankle joint. It is developed from two points of oſſification, which are juſt appearing at birth.

The os calcis (calcaneus of Albinus,) is ſituated at the poſterior part of the tarſus, where it forms the heel. It is the largeſt of the ſeven bones; its greateſt extent is from behind forwards, its next is in the depth, and it is narroweſt tranſverſely. On the ſuperior ſurface we obſerve poſteriorly a concave part occupied by the fat and cellular tiſſue in front of the tendo Achillis; next we have a large, convex, oblique articular face, adapted to one in the aſtragalus; on the inſide of this a groove, which divides it from another ſmaller oval, flat, articular facet, correſponding alſo to the aſtragalus. This laſt is placed on a lateral proceſs of the bone, ("ſuſtentaculum cervicis tali, Alb.") and is rather anterior to the firſt. It is ſometimes continuous with another ſmall articular ſurface in front of it, though generally ſeparated by a narrow groove. The reſt of the upper ſurface is flat and rough for ligaments. The under ſurface is long, much contracted tranſverſely, terminated behind by two tubercles which give attachment to ſome muſcles of the toes; the internal is the largeſt. There are alſo other eminences further in front to which ligaments are fixed. The poſterior ſurface is bulging and convex, and forms properly the heel; at the upper part it is ſmooth, where it is ſeparated from the tendo Achillis by a ſynovial *burſa*, and rough below for its inſertion. The anterior ſurface is the ſmalleſt of the whole; it is articulated with the os cuboides, and is ſlightly concave. The outſide is flat, much broader behind than before, and marked by two ſuperficial grooves for the long and ſhort peronei muſcles. The inſide is large and hollowed deeply, to lodge the nerves and veſſels going to the ſole of the foot, and alſo the tendons of the tibialis poſticus, the long extenſor of the toes, and the long extenſor of the great toe, which plays in a peculiar groove obſerved at its upper part. The muſculus acceſſorius has its origin from this ſurface, towards the back part. The os calcis is formed from two points of oſſification, which are viſible at birth. The two bones we have been deſcribing have been conſidered as the firſt row of tarſal bones; the remaining five as the ſecond.

The os naviculare is ſituated in the middle of the tarſus, of an oval figure, with its longeſt diameter tranſverſe; its circumference is rough for ligamentous attachments; broad and convex above, concave below, pointed and projecting internally where the tibialis poſticus is inſerted, and narrowed on the outer ſide, on which we generally find a flat articular facet oppoſed to the cuboides. The anterior ſurface is convex, divided into three articular planes for the three cuneiform bones; of theſe the internal is broadeſt below, and the two external above. The poſterior ſurface is concave, articulated with the aſtragalus.

The os cuboides, (cubiforme, Alb.) is placed at the external and anterior part of the tarſus, and reſembles ſomewhat a cube in figure. Above is a rough, ſlightly convex ſurface, with four unequal ſides; below poſteriorly an eminence for ligaments, a ſuperficial hollow, and a more marked protuberance for the ſame purpoſe, in front of which is a deep groove, which gives paſſage to the tendon of the peroneus longus, as it croſſes the foot. Anteriorly an oblique articular ſurface nearly plane, ſupporting the two outer metatarſal bones. Behind a concave ſmooth ſurface, ſtill more oblique, articulated with the os calcis. Externally, a narrow border, in which we obſerve the commencement of the groove for the tendon of the peroneus longus. Internally, a ſmall articular facet behind, in contact with the os naviculare; a larger one in the middle for the third cuneiform bone; the reſt of the ſurface is rough for ligaments.

The firſt cuneiform bone (majus ſive internum) lies at the inner and anterior part of the tarſus, and is the largeſt of the three; it is deeper than it is broad, with the baſe of the wedge below, and the narrower border upwards, of a rhomboid figure viewed laterally. The upper ſide is oblique, and gives attachment to ligaments; the inferior is convex, and gives attachment before to the tibialis anticus, behind to a part of the tibialis poſticus, as well as to ligaments. The poſterior ſurface, articulated with the naviculare, is concave and pointed above; the anterior, by which it reſts on the firſt metatarſal bone, is longer, and of an oblong, or rather ſemi-lunar figure. Internally, it is convex, rough, and ſub-cutaneous; externally concave, with a ſmall articular facet near the upper edge, in contact with the ſecond bone of the metatarſus, and another near the poſterior edge, which touches the following bone.

The ſecond cuneiform bone (minus ſive medium) is the ſmalleſt of the three, and of all the bones of the tarſus; it well deſerves its name both from its figure and ſituation. The baſe of the wedge forms the upper ſurface which is quadrilateral, with the ſhort diameter tranſverſe, and rough for ligaments. The edge of the wedge below is ſharp, and ſerves the ſame purpoſes; behind it is articulated by a concave ſurface, with the middle plane in the front of the os naviculare; before, by a convex one, with the ſecond metatarſal bone. Of the two four-cornered ſides the internal is nearly plane, with an articular facet near the upper edge, and another at the poſterior, joined to the laſt bone; the external has a concave articular facet for connection with the third cuneiform bone towards the upper and poſterior angle: they are both rough on the remainder of their ſurfaces for fibrous attachments.

The third cuneiform bone (externum, or medium, Alb.) is rather larger than the preceding, and longer from before backwards; it reſembles it much in figure and poſition. The baſe, which is above, and the edge below, give attachment to ligaments. Behind is a triangular articular ſurface, correſponding to one of the planes in front of the naviculare; before an oblong flat one in contact with the third metatarſal bone. The internal ſurface is marked by two articular facets, ſeparated by a rough depreſſion for ligaments, of which the anterior correſponds to the ſecond metatarſal bone, the poſterior to the ſecond cuneiform. The external ſide is rough anteriorly, and has a plane articular facet towards the upper and poſterior angle, in contact with a correſponding one on the inner ſide of the cuboides.

The laſt five bones of the tarſus are wholly cartilaginous at birth, and are gradually and ſolely developed from ſingle points of oſſification. They are not proportionably larger in this ſtate than when in their perfect oſſeous forms, in which reſpect they reſemble the carpus.

The articulation of the leg with the foot, the ankle joint.— To form this joint, the upper articular ſurface of the aſtragalus, nearly all the outer ſide, and the narrow cartilaginous facet on the inſide, are received into the cavity formed by the lower end of the tibia and fibula, and embraced cloſely by the two ankles. The correſponding ſurfaces are covered by cartilage, and united by ſeveral ligaments, the moſt efficient of which are placed at the ſides; the connection is much ſtrengthened by the numerous tendons which paſs over or near it to be attached to different bones of the foot.

The internal ligament (l. deltoides) is of conſiderable breadth; attached above to a part of the circumference of the internal malleolus, more eſpecially to its point, it deſcends a little obliquely backwards, and is fixed to the inner ſurface of the aſtragalus, and the neighbouring parts of the os calcis. It is compoſed of a conſiderable quantity of longitudinal fibres, of which the anterior and the moſt ſuperficial are the longeſt. On the inſide, the tendon of the tibialis poſticus paſſes over it, and is connected with it by its fibrous ſheath; it is contiguous alſo to the long flexor of the toes. On the outſide is a ſtraight rounded and thick ligament (l. medium perpendiculare) which deſcends from the lower extremity of the fibula a little obliquely backwards, paſſing under the tendon of the peroneus longus, and is attached to the outer ſide of the os calcis; it is formed of compact, longitudinal fibres. In front of this is another ligament (l. anterius malleoli externi), which paſſes from the anterior part of the point of the outer malleolus, forming a ſtrong flat band of fibres, frequently divided into two or more portions of conſiderable ſtrength, and is fixed to the aſtragalus in a depreſſion before the external articular ſurface. The front of the joint is ſtrengthened alſo by a collection of irregular fibrous bands, which deſcends from the anterior part of the lower extremity of the tibia, amidſt much cellular tiſſue and fat, and are inſerted partly into the aſtragalus cloſe to the termination of the articular pulley, and are partly continuous with the ligaments paſſing from this bone to the naviculare. Towards the back of the joint, we have ariſing from the fibula a ſtrong ligament (l. poſterius malleoli externi) paſſing nearly tranſverſely inwards, and fixed to the edge of the articular pulley at the back of the aſtragalus, cloſe to the outer margin of the groove for the tendon of the long flexor of the great toe. It is ſtronger than any of the preceding ligaments, and compoſed of numerous diſtinct packets of fibres. Immediately above this, and connected intimately with it, at its origin from the back of the external malleolus, is a tranſverſe band of fibres paſſing directly acroſs, or mounting a little obliquely, to be attached to the poſterior border of the articular ſurface of the tibia, and to the inner ankle. It increaſes a little the depth of the articular cavity behind, and might be regarded properly as one of the poſterior ligaments connecting the tibia and fibula. The ſynovial membrane is diſtributed as uſual, lining all the cartilaginous ſurfaces and the ligaments; lining alſo the narrow articular facets between the tibia and fibula, making this little joint communicate with that between theſe bones and the aſtragalus. It is looſe in front, where we find a conſiderable quantity of cellular tiſſue and fat; covered in this aſpect by the tendons of the tibialis anticus, the long extenſors of the great, and other toes, and the peroneus tertius; behind by the tendons of the tibialis poſticus, the flexors of the toes, and the peronei; partly in theſe ſituations, and on the ſides by the ligaments juſt deſcribed. In addition to the many tendons enumerated, this articulation is further ſtrengthened by the tendo Achillis behind, a powerful agent in preſerving its relations.

The motions which take place between the leg and foot are chiefly thoſe of flexion and extenſion; the lateral inflexions are extremely limited. In flexion, which is more confined than the oppoſite motion, on account of the diſpoſition of the articular pulley of the aſtragalus, this bone glides backwards on the lower end of the tibia, regulated by the two malleoli lying cloſe on either ſide; the poſterior ligament is ſtretched, the others undergo but little change; and luxation rarely occurs. In extenſion the motion may be continued, ſo as to make the foot form a very obtuſe angle with the leg; the external anterior ligament is diſtended conſiderably, the others leſs ſo, the poſterior is relaxed. In ſtanding on the toes this poſition is maintained by muſcular efforts, particularly by means of the tendo Achillis; the tibia reſts on the poſterior part of the pulley of the aſtragalus, and tranſmits the principal weight to the naviculare, inſtead of the os calcis, as in ordinary ſtation. The lateral inclinations of the foot on the leg, as far as this joint only is concerned, are extremely confined, owing to the lateral deſcent of the malleoli; in which reſpect they differ much from the lateral motions of the carpus on the fore-arm. The lateral ligaments are here reciprocally ſtretched or relaxed, as the foot is turned inwards or outwards. Diſlocations to either ſide occur more frequently than we might at firſt imagine from the apparent ſecurity afforded by the malleoli. Luxation outwards is the moſt frequent, the fibula breaking two or three inches above its lower end, ſo as to allow of the everſion of the foot; it is generally the conſequence of ſudden violence, as in jumping, or in falling on the foot from any height.

The articulations between the bones of the tarſus.—The aſtragalus is articulated by two, ſometimes three cartilaginous planes on its inferior ſurface, with correſponding ones on the upper ſurface of the os calcis. Theſe ſurfaces are preſerved in contact by a ſtrong collection of ligamentous fibres, paſſing directly upwards from the whole length of the oblique groove, between the articular facets on the upper ſurface of the os calcis to a ſimilar depreſſion on the under ſide of the aſtragalus, where it is attached to every point not occupied by articulating cartilage. The internal fibres lie deep between the bones, and are ſhort; the external ones are longer, and more in quantity, buried in the cellular tiſſue and fat which contribute to fill the vacancy obſerved in this part. Behind there are ſome parallel fibres paſſing down from the back of the aſtragalus to the os calcis, which concur in forming the ſheath for the tendon of the long flexor of the great toe; they are not numerous. This articulation is alſo ſtrengthened by the lateral ligaments of the ankle joint, eſpecially by the external, which paſſes immediately from the fibula to the os calcis. The ſynovial membranes offer nothing remarkable. The motions which have place here are always combined with others, and will be conſidered farther on.

The anterior convex articular ſurface of the aſtragalus is received into a cavity formed by the concave ſurface of the os naviculare, a ſmall ſpot of the os calcis, and completed below by ligaments paſſing between theſe two bones. We obſerve above a dorſal ligament, thin and flat, compoſed of fibres paſſing from the depreſſion called the neck of the aſtragalus to the upper rough ſurface of the naviculare; they ſometimes reach to the cuneiform bones. It is covered by the extenſors of the toes. Below is a very ſtrong ligament, paſſing from the anterior and internal parts of the os calcis obliquely forwards and inwards to be attached to the hollow in the lower ſurface of the naviculare. It is covered on the inſide by the tendon of the tibialis poſticus: above it is lined by ſynovial membrane, and forms the lower part of the cavity which lodges the head of the aſtragalus, to the ſupport of which it eminently contributes. It is very denſe in its ſtructure. There is alſo a ſhort and very firm band paſſing from the anterior part of the os calcis to the outſide of the naviculare, completing the cavity externally. This joint is lined by a ſynovial membrane, which communicates with the anterior articulation between the aſtragalus and os calcis, as before mentioned. It is ſpread over the correſponding ſurfaces and ligaments we have been deſcribing.

From what we have ſaid, it appears that the os calcis is firmly connected with the naviculare, though in contact only by a very narrow ſpot; the ligaments croſs the head of the aſtragalus in their courſe, and their apparent uſe is to ſupport the latter, at a point which appears ſo deficient, when examining the mechaniſm in the dry ſkeleton. The os calcis is more extenſively articulated with the cuboides by cartilaginous ſurfaces ſlightly concave and convex in oppoſite ſenſes. The joint is ſecured by two ligaments, a ſuperior or dorſal, an inferior or plantar. The firſt is broad and thin, compoſed of ſhort parallel fibres paſſing rather obliquely forwards from the upper and external parts of the os calcis, to the ſuperior rough ſurface of the cuboides. It is often formed into two ſeparate longitudinal bands. It lies under the peroneus tertius. The inferior ligament is the longeſt, and ſtrongeſt of all the ligaments of the tarſus. It is attached behind to the middle of the inferior ſurface of the calcis, paſſes horizontally forwards, and is fixed principally into the oblique protuberance obſerved on the lower ſurface of the cuboides. It is formed of a great number of fibres, divided into ſeveral bundles, which diverge rather as they approach the cuboides. The inferior ones, or the moſt ſuperficial, are much longer than thoſe more deeply ſeated, and are continued under the tendon of the peroneous longus, part of whoſe ſheath they form, to the poſterior extremities of the firſt and ſecond metatarſal bones. The upper plane is ſhorter in its courſe, and fixed behind the groove for the peroneus longus. The ligament is covered below by ſeveral muſcles of the foot, which have partly their origin from it. It ſhould be remembered that this joint is in the ſame tranſverſe line with the one between the aſtragalus and naviculare.

For the articulation between the naviculare and cuneiform bones we have in the firſt a cartilaginous ſurface divided into three planes, in the latter correſponding ſurfaces covered by articular cartilages continued laterally into their mutual articulations. It is ſecured by three dorſal ligaments, attached to the upper and lateral portions of the circumference of the naviculare, paſſing one internally to the firſt cuneiform, another in the middle to the ſecond, and a third more externally to the outer cuneiform bone. They leave intervals filled by cellular tiſſue: the internal is the largeſt; and thicker at its inferior edge. The plantar ligaments have been deſcribed as three alſo, but they are too irregular for diſtinction, appearing as fibrous bundles paſſing between the oppoſite bones, confounded at their attachment to the naviculare. This joint is ſtrengthened internally by an elongation of the tendon of the tibialis poſticus, which is attached to the baſe of the firſt cuneiform bone, and continuous with the more internal of the ligaments we have been deſcribing.

The articulation of the naviculare with the cuboides is formed by the contact of two ſmall plane cartilaginous ſurfaces, lined by their proper ſynovial membrane, and ſecured by numerous ſhort ligamentous fibres paſſing from bone to bone, occupying the remaining ſpace; they are very cloſe and compact. There is alſo a plantar ligament rounded in form, paſſing obliquely from the inferior and external part of the naviculare to the oppoſite point of the cuboides; and a dorſal tranſverſe band, croſſing from one to the other, covered by the extenſors.

The cuneiform bones are articulated with each other by cartilaginous facets connected by ligaments paſſing from bone to bone, deeply as well as ſuperficially. The dorſal ligaments are tranſverſe, and form really but a ſingle band, continued over the three, and attached in its courſe to each. The plantar ligaments are alſo tranſverſe, but not ſo marked; the one which goes from the firſt to the ſecond is the ſtrongeſt: they are covered by an extenſion of the tendon of the tibialis poſticus, one part of which is fixed to the ſecond cuneiform, another to the ſecond metatarſal bone; theſe are diſtinguiſhed from the ligaments by the oppoſite direction of their fibres. We find alſo many ſhort ligamentous fibres paſſing between theſe bones, as between many others of the tarſus, attached to the parts not occupied by cartilage: they add much to the ſtrength of union.

We have here a ſynovial membrane common to theſe joints, and that with the os naviculare above deſcribed. It is ſpread over the anterior ſurface of the latter, over the connecting ligaments, and dips between the cuneiform bones, lining their articulation throughout.

The articulation of the third cuneiform with the cuboides is by means of plane cartilaginous ſurfaces, provided with their diſtinct ſynovial capſule, and ſecured by ligaments. Of theſe the dorſal is oblique, ſmall and thin, uniting the oppoſite edges of bone; the plantar is conſiderably thicker, and more directly tranſverſe. Here alſo are many interoſſeous ligamentous fibres, fixed to the parts not covered by cartilage, or where the bones are not in immediate contact.

Motions of the tarſal bones on each other.—The motions which take place between the tarſal bones are very limited, if we except thoſe between the aſtragalus, and the os calcis and ſcaphoides. By this chiefly the foot is turned inwards and outwards; the lateral inflexions of the ankle joint aſſiſting the motion but little. In the movement which carries the point of the foot a little outwards, which depreſſes its internal and elevates its external edge, the naviculare glides on the head of the aſtragalus, and the os calcis on its lower articulating ſurfaces: the latter bones approach each other more cloſely, the interoſſeous ligament, and the external lateral one of the ankle joint are relaxed, the internal lateral ligament is ſtretched, eſpecially thoſe fibres which paſs to the calcaneum. In the oppoſite motion of twiſting the foot inwards, and bringing the ſole to face the other, the bones move in the contrary direction, the inner border of the foot is raiſed, and the external becomes inferior; the interoſſeous, and external lateral ligaments are diſtended. Theſe motions, which are very ſenſible, may be accidentally forced beyond their natural limits, and give riſe to injuries which are too generally referred to the joint of the ankle. The naviculare and cuboides may be moved up and down on the aſtragalus and os calcis, and the cuneiform bones have gliding motions on the naviculare, the cuboides, and between themſelves, by which the concavity of the foot may be a little increaſed or diminiſhed. The utility of theſe numerous articulations in enabling the foot to reſiſt the ſhocks it muſt often neceſſarily ſuffer, and in giving grace and eaſe to the motions of the lower extremity in progreſſion needs ſcarcely be inſiſted on: their great relative ſize and the very powerful ligaments ſubſervient to them make diſplacement of more rare occurrence than we might at firſt imagine, on conſidering the efforts they have to ſuſtain.

The metatarſus (mittelfuſs, Germ.)—is compoſed of five long bones placed horizontally and nearly parallel to each other, ſo as to form a gently convex ſurface above, and a concavity below. It is ſituated between the tarſus and the toes, and is analogous in many points to the metacarpus. The individual bones are diſtinguiſhed numerically, beginning from the inſide. The firſt metatarſal bone, that of the great toe, is by much the largeſt in volume, though rather ſhorter than the reſt; the ſecond is of the greateſt length; the third comes next to it, the two laſt differ but little: the four latter differ very little in ſize. They all contract a little in the middle, and ſwell at each end, particularly towards the tarſus, and are divided into two extremities and a body.

The tarſal, or poſterior extremity of the firſt, is oblong vertically, with a ſemi-circular articular cavity behind, reſting on the firſt cuneiform bone. The inner edge of the circumference, which is convex, gives attachment about its middle to a part of the tendon of the tibialis anticus; below is a blunt projecting proceſs, to which the tendon of the peroneus longus is fixed; and on the outer concave edge a ſmall ſmooth ſpot, which is in contact with the ſecond metatarſal bone.

The tarſal are much larger than the digital extremities of the other four, angular, and in cloſe oppoſition with each other. That of the ſecond is placed farther back than the firſt, is triangular, with the baſe upwards; it is wedged between the cuneiform bones, reſting on the ſecond by a concave triangular articular ſurface behind; on the firſt by a ſmall ſpot on the inſide, and on the third by one on its outer ſide. In the laſt aſpect there are two other articular facets in front of the laſt joined to the third metatarſal bone, ſurrounded by aſperities for ligaments: the edge above, and the point below are alſo rough, for the ſame purpoſes. The tarſal end of the third is triangular in the ſame direction as the preceding, articulated by a plane ſurface behind, with the third cuneiform bone. On the inſide are two ſmall facets contiguous to correſponding ones in the ſecond metatarſal; on the outſide a ſmooth ſpot above, articulated with the following bone, and a rough depreſſion beneath for ligaments. It is rough alſo above and below. In the fourth, the tarſal extremity is more quadrilateral: behind it is articulated with the front of the cuboides; on the inſide with the ſame bone, and with the third; on the outſide with the laſt metatarſal. Below, and in front of theſe articular ſpots, the bone is rough for ligamentous attachments. The tarſal end of the fifth or laſt metacarpal bone is larger than thoſe of the preceding. It preſents behind an oblique triangular articular ſurface for the cuboides; above and below rough and unequal borders, the former giving attachment to the peroneus tertius, and both to ligaments; on the inſide a ſmall articular facet in contact with the fourth; and on the outſide a rough eminence projecting backwards, to which the peroneus brevis is fixed, and a portion of the abductor of the little toe.

The bodies of the metatarſal bones are concave from before backwards below, and gibbous above, very irregular in form, and ſcarcely admitting of regular diviſions into ſurfaces. That of the firſt is of a triangular priſmatic form, with the upper ſurface convex, and inclined a little inwards; the inferior concave, covered by the flexor brevis of the great toe; the external flat and large, correſponding to the muſcles which lie between theſe bones. The bodies of the reſt may be regarded in four aſpects; the dorſal preſents in each a blunt riſing line, which divides the attachment of the interoſſei; the plantar offers a ſmooth ſurface for muſcular attachments; the internal and external exhibit variouſly inclined ſurfaces, of different breadths, continuous with the two former, ſmooth, and covered by the muſcles which ariſe from them, and fill the interſpaces. In the fifth the body is curved a little from within outwards, and its external ſide, or rather edge, gives origin in part to the abductor of the little toe ; the dorſal ſurface is inclined conſiderably outwards, and terminates on the inſide by a prominent line ; the plantar ſurface is covered partly by the flexor brevis of the ſame toe. In all the dorſal ſurface is covered by the tendons of the long and ſhort extenſors, by veſſels and nerves, and the plantar by the deep-ſeated muſcles and tendons in the ſole of the foot, by ligaments, and by larger blood veſſels and nerves.

The digital, or anterior extremity, is very ſimilar in all. It preſents a rounded articular ſurface, called the head, ſupporting the firſt phalanx of the toes : this extends further from above below than tranſverſely, in which direction it is compreſſed. The circumference is rough, offering above a ſenſible groove for ligaments, and on each ſide a hollow, in which the lateral ligaments are fixed. The articular ſurface is prolonged further below than on the dorſal aſpect, and terminates on each ſide by projecting tubercles. In the firſt this lower ſurface is divided by a prominent line into two pulleys, on which the ſeſamoid bones glide, which are placed below this joint of the great toe. In this bone alſo the articular ſurface has a much greater proportional breadth.

The metatarſal bones reſemble in ſtructure and formation the other long bones, with this exception only, that the ſmaller ones are ſometimes developed from two points of oſſification, one for the tarſal extremity, and body, another for the digital : in the firſt there are always three.

The articulations of the metatarſus with the tarſus.—The firſt bone of the metatarſus is articulated with the anterior ſurface of the firſt cuneiform ; the ſecond with the three cuneiform bones ; the third with the correſponding cuneiform ; the fourth and fifth with the cuboides. The oppoſite articular ſurfaces are covered by thin cartilage, and their relations preſerved by ligaments above and below ; they are all lined by ſynovial membranes common in general to theſe joints, and to the articulations of the metatarſal bones between themſelves.

The dorſal ligaments paſs from each metatarſal bone to thoſe bones of the tarſus with which they are articulated. From the firſt there paſſes a broad and thin band to the firſt cuneiform, attached to the ſuperior ſurface of each. From the ſecond, which is let in between the three cuneiform bones, we find three ligaments croſſing, one internally to the firſt, another in the middle to the ſecond, a third externally to the third cuneiform : the firſt and laſt are oblique in their courſe, the ſecond paſſes directly from before backwards. The dorſal ligament of the third is ſhort, and goes ſtraight to the third cuneiform ; thoſe of the third and fourth are attached to the upper ſurface of the cuboides ; they are more or leſs oblique, and by no means conſtant in their forms or ſituation, the dorſal ligament of the fourth being often attached to the third cuneiform. They are all covered by the extenſor tendons.

Of the plantar ligaments, which are analogous in direction and attachment to the dorſal, that paſſing from the firſt metatarſal is very ſtrong, and the joint is ſtrengthened alſo by an extenſion of the tendon of the tibialis anticus, which is fixed to the inſide of the tarſal end of that bone. The plantar ligaments of the ſecond are ſimilar to thoſe above. That which paſſes from the firſt cuneiform is thicker, and larger than the other, reaching to the baſe of the third metatarſal ; the other two are covered and ſtrengthened by a portion from the tendon of the tibialis poſticus. The inferior ligaments of the others are ſmall, yet diſtinct, and of various lengths. The plantar ligaments are much ſtrengthened by the numerous tendinous ſheaths which are found in the ſole of the foot, and particularly by that of the peroneus longus, which croſſes moſt of them as it paſſes along to reach the firſt metatarſal bone. The ligaments, both above and below, are compoſed of ſhort and cloſe parallel fibres, following longitudinal, oblique, or tranſverſe directions, according to the relations between the points to which they are fixed. They are ſeparated by intervals filled with cellular tiſſue, and giving paſſage to veſſels. The ſynovial membrane, lining the joint between the firſt metatarſal and cuneiform bones, is diſtinct, and offers nothing remarkable in its diſtribution. That lining the triple articulation, formed by the ſecond with the three cuneiform bones, is continuous with the ſynovial membrane, lining the articulation between the two firſt of theſe bones. A ſeparate one is found ſpread over the joint of the third metatarſal and cuneiform, and ſending off two ſmall lateral elongations, which dip between the articulations of the third with the ſecond, and fourth metatarſals. It often communicates with the former at the point where they are in contact. Another ſynovial membrane belongs to the articulation of the two laſt metatarſals with the cuboides, common alſo to that between the two former of theſe bones.

The articulations between the metatarſal bones,—are formed behind by the contact of lateral articular facets, with the exception only of the firſt, which touches the ſecond without being articulated with it. Theſe two bones are united by ſhort ligamentous fibres paſſing from one to the other, of conſiderable ſtrength ; the others are connected by dorſal, plantar, and interoſſeous ligaments. The dorſal are tranſverſe, and three in number, paſſing from one bone to the next, irregular in form, and attachment, appearing in ſome ſubjects as a ſingle tranſverſe band. The plantar are ſimilar in number and direction, but in addition we find ſeveral ſmall ſlips paſſing from the fifth to the three next metatarſals, ſeparated by cellular tiſſue. The interoſſeous ligaments between the poſterior ends of theſe bones are formed by numerous ſhort fibres, occupying the parts not covered by cartilage, and tending very materially to ſecure their relations. The anterior extremities of the metatarſal bones are not in abſolute contact, but they are firmly connected together by a tranſverſe ligament paſſing below them, and attached to each bone, reſembling the ligament deſcribed as paſſing between the digital ends of the metacarpal bones in its form and direction.

The metatarſal bones have but an obſcure motion on the tarſus, on which they may be ſlightly elevated and depreſſed. They may be moved alſo ſo as to approach each other in front, and augment the depth of the concavity of the ſole ; this effect is produced chiefly by the motion of the firſt and laſt towards the long axis of the foot, and is in conſequence of muſcular action : when the foot is flattened by preſſure they are forced farther apart mechanically.

The toes, forming the laſt diviſion of the foot, are five in number, placed horizontally ſide by ſide, compoſed of rows of ſmall bones extending longitudinally one beyond another. We reckon them numerically, beginning from within. The firſt and laſt are known alſo by the names of the great and little toe. The ſecond is rather longer than the firſt, the other three diminiſh ſucceſſively in length. We find three bones, named phalanges, in all, excepting the firſt, which has only two ; theſe are termed, from their ſituation, the firſt or metatarſal phalanx, the ſecond or middle, and the third or unguinal ; in the great toe the bone of the middle phalanx is deficient. The two bones of this laſt are very ſtrong, and exceed very much in volume the different rows of the other toes which are ſlender in form, and comparatively weak. The bones of the firſt phalanx are the longeſt ; thoſe of the ſecond are very ſhort, as alſo the third. They all ſwell conſiderably at the extremities, and are contracted in the middle part or body. They reſemble the fingers very nearly in the material points of their formation, differing from them chiefly in ſize and mobility.

The firſt phalanges are by much the longeſt, and the bones are more rounded than the correſponding ones in the fingers. They are hollowed below, particularly near the extremities, where the flexor tendons lie, the edges giving attachment to the ſheaths which confine them. The poſterior extremities are concave for the heads of the metatarſal bones, the anterior have condyles, and a middle depreſſion for the ſecond phalanx. The two oppoſite articulating ſurfaces between theſe bones and the correſponding ones of the metatarſus, are cruſted by cartilage, and ſecured by lateral ligaments, as in the fingers. Theſe are thick and ſtrong, paſſing from the end of one bone to the oppoſite. The joint is ſtrengthened below by a tranſverſe ligament, covering it from ſide to ſide, contributing to the ſheath of the flexor tendons; and is further ſupported by theſe laſt, by the extenſors, and the ſmaller muſcles which ſurround them. The ſynovial membrane is looſe and extenſive; in the joint of the great toe it lines the two ſeſamoid bones. Theſe ſmall bones are unequal in ſize; the internal is the largeſt, oblong, gibbous below, concave longitudinally above, and a little convex tranſverſely, covered in the laſt aſpect by cartilage, and reſting on the head of the metacarpal bone in the two hollows already mentioned, ſo as to be ſeparated by a ſmall interſpace. They are connected by ligaments to the firſt bone of the great toe, as the patella is to the tibia, and glide backwards and forwards in the different motions of the joint, defending it effectually below, giving an advantageous purchaſe to the muſcles which are fixed to them, and preſerving from preſſure the tendon of the long flexor, which runs between them. Theſe bones are rarely met with in the other articulations. The motions between theſe bones and the metatarſus may be effected in every direction, except rotation, and are in general more limited than in the fingers. The toes, however, can be inflected backwards, or extended on the metatarſus to a greater degree than they can be bent. The advantages of this mechaniſm, ſo widely different from what we noticed in the hand, may be particularly noticed in ſtanding on the toes, and in progreſſion, and will be examined hereafter.

The ſecond phalanges of the four leſſer toes are ſo ſhort and compreſſed longitudinally, as to have ſcarcely the uſual characters of the long bones. This is a diſtinguiſhing point, in comparing them with the ſecond phalanges of the fingers, which they otherwiſe reſemble in miniature, giving attachments in a ſimilar manner to flexor and extenſor tendons, and to the fibrous ſheaths of the former. The articulations are alſo analogous; the motions, which are thoſe only of flexion and extenſion, are more limited.

The laſt, or unguinal phalanges, five in number, reſemble thoſe of the fingers both in ſtructure and formation. That of the great toe is ſtrong and broad; the others are more than proportionably ſmall. This laſt difference is the principal one between them and the fingers; the articulations and motions are very nearly the ſame; the latter may be a little more limited. In children they are very moveable: this mobility diminiſhes as we grow up, and is often completely deſtroyed in advanced age, owing moſt probably to the confinement of our ſhoes. The metatarſal rows have three points of oſſification, the others have two, and very frequently only one.

From the aſſemblage of the bones we have been deſcribing, there reſults a long, broad, and partly vaulted baſis, for the ſupport of the weight above, ſecured by numerous and ſtrong ligaments binding the arch beneath. The principal points of bearing are on the lower part of the heel bone; the outſide of the foot in nearly its whole length, eſpecially the poſterior end of the metatarſal bone of the little toe; the anterior ends of all the metatarſal bones, and moſt conſpicuouſly that of the great toe, which is proportionably ſtrong. When the heel is elevated from the ground, the whole preſſure is on theſe laſt mentioned points, and on the toes, which compenſate, by their augmented breadth, their comparative want of ſolidity. The vaulted form gives a ſpace in which the veſſels and nerves can paſs free from compreſſion; and the number of the articulations, by diſtributing the ſhock over numerous ſlightly yielding ſurfaces, prevents the injurious effects which might otherwiſe ariſe from leaps, or falls on the feet.

Mechaniſm of the lower extremities.—In ſupporting the trunk, the hip bones are placed between two oppoſite efforts; *viz.* the weight of the body tranſmitted by the ſacrum; and the reſiſtance oppoſed by the limb below in the direction of the cotyloid cavity. The depreſſing impulſe acts in a plane poſterior to that of ſupport, tending to make the hip bones move backwards on the thighs, if they were not counterbalanced by muſcular efforts. The baſe of ſupport, as far as regards the oſſa innominata, is contained between the plane of the vertebral column behind, and that of the thigh bones in front; a ſpace which varies in different individuals, and which is comparatively narrow in infancy, from the more oblique direction of the hip-bones, which brings the thighs more immediately under the vertebral column. As the oſſa innominata become more horizontal, the baſe of ſupport is rendered wider, and the muſcles being at the ſame time more fully developed, give it additional ſecurity. This is one ſource of the difference in gait in manhood and infancy. Another is found in the diſpoſition of the cotyloid cavities. As they are at a diſtance from the points of oſſification, they are almoſt wholly cartilaginous for ſome time after birth, and therefore can offer but a feeble reſiſtance to the thighs, quite inſufficient for ſtanding or progreſſion, until the place of cartilage is ſupplied by bone. Add to this, that the two joints are comparatively nearer to each other; which circumſtance, though it give facility, muſt neceſſarily diminiſh firmneſs. The greater proportional diſtance in the adult throws the thighs further apart above. In females this diſtance is greater than in the male, which gives a peculiarity to their walk, a more obſervable rolling of the hip in the ſucceſſive advancement of each limb. This is not to be ſeen in the infant female, where the poſition and form of the hip bones differ but very little from thoſe of the male of the ſame age.

The femur, which is the only bone in the thigh, is curved conſiderably forwards in the middle; hence a larger ſpace is left behind for muſcles; and the baſe of ſupport, afforded by this bone to the trunk, is directed forwards, ſo that the latter is ſuſtained in the direction, in which it has the greateſt tendency to fall. The neck of the bone, beſides increaſing the extent of rotation, enlarges tranſverſely the baſe of ſupport; gives the body a greater firmneſs in ſtanding, without impeding progreſſion, ſince the head of the bone, and not the body, is the centre of motion. If the thigh bones poſſeſſed no neck, but were kept equally far apart, by increaſing the diſtance between the cotyloid cavities, the attitude of ſtanding would be equally ſecure, the tranſverſe baſe of ſupport being ſtill the ſame; but progreſſion would be impeded, as it actually is in the female, from the greater tranſverſe diameter of the pelvis. The head of the femur, ſunk into a deep cavity, is forced, in ſupporting the trunk, againſt the moſt reſiſting part of this cavity, *viz.* under the anterior ſpines. The ſtrong ligamentous bands which ſtrengthen the capſule in front and above, are ſo diſpoſed as to augment the reſiſtance to any effort of the thigh-bone in that direction, and to reſtrain any part of the head which may not be contained in the acetabulum. The interior ligament alſo adds to the firmneſs of the joint; preventing, by its tenſion, the diſplacement of the articular ſurfaces in every effort which forces the head upwards; an effort which, from the preſſure of the trunk, is almoſt conſtantly operating. In the infant, the body of the bone is nearly ſtraight, a conformation unfavourable to ſtanding, according to the reaſons above alledged: the neck is ſhorter, and conſequently the baſe of ſupport diminiſhed; it is cartilaginous, and therefore leſs able to endure, for any time, an attitude which demands ſolidity in the ſuſtaining parts. Theſe are other reaſons for the inſecurity of the ſtation and progreſſion of young children, and ſhew by contraſt the advantages of the form of the adult bone.

In the knee, we are ſtruck with the extent of the articular ſurfaces, and the number and ſtrength of the ligaments which connect them, ſo well adapted to ſuſtain the weight tranſmitted by the thighs; the crucial ligaments limiting and maintaining the extenſion of the leg, preventing it from paſſing in this direction beyond the axis of the thigh; the patella in ſome meaſure reſtraining its flexion, protecting the joint, and more particularly favouring the action of the extenſor muſcles, which play ſo important a part in the functions of the lower extremity. The perpendicular direction of the leg is very advantageous in giving firmneſs; to this end alſo the immobility of the two bones which compoſe it ſeems directed. The tibia, ſolid and broad at either end, alone receives the preſſure and continues it to the foot; the fibula ſerves principally to afford attachments to muſcles. This diſpoſition, ſo different from that obſerved in the analogous part of the upper extremity, bears an obvious relation to its different function. In infancy the patella is ſcarcely perceptible; its abſence muſt be unfavourable to the power of the extenſors, and may be one cauſe of the feebleneſs obſervable at that period; and further, its want is felt in kneeling.

The foot is admirably adapted to its office of ſuſtaining every effort continued from above. It is articulated at right angles with the leg, through which it receives the weight of the body in a perpendicular direction, bearing directly on the upper ſurface of the aſtragalus, the whole length of the foot reſting on the ground. The articulation is ſituated nearer to the poſterior than to the anterior part of the feet, which gives to the baſe of ſupport a greater extent forwards, a direction towards which the line of gravity naturally inclines. The lateral deſcent of the malleoli materially ſecures the firmneſs of the ankle joint. The breadth of the foot, increaſing gradually towards the front, the length of the metatarſal bones, the direction of that which ſuſtains the great toe, its ſituation and want of mobility, are other circumſtances marking the diſtinction between the hand and foot, and adapted to increaſe the ſolidity and extent of baſe afforded by the latter. The functions of the foot are aſſiſted alſo by its concave form, which enables it to gain a kind of hold of the bodies on which it reſts, and to accommodate itſelf to unequal ſurfaces, an advantage almoſt deſtroyed by the uſe of ſhoes, but eminently conſpicuous in thoſe people whoſe feet are not cramped by artificial means of defence. In its poſterior half nearly it reſts on the ground by its outer ſide, compoſed of the ſolid bone of the heel, and the os cuboides, the inner ſide repreſenting an arch, and placed at a diſtance from the plane below; in the anterior half the weight is principally ſupported by the inner ſide, where we find the ſolid bones of the great toe very little aſſiſted by the external edge.

Every thing in the ſtructure of man evinces that he is deſigned by nature for the erect poſture: we ſhall notice here thoſe proofs only which are deducible from the framing of the extremities. One of the moſt obvious is the great diſproportion in the reſpective lengths of the upper and lower limbs, and the greater comparative ſtrength of the lower. Other marks are found in the width and direction of the hip bones, in that of the neck of the femur, in the articulation of the leg at right angles with the foot, in the ſize and length of the latter, and the predominance of its ſolid over its moveable parts. We may remark alſo the flattened cheſt, and the ſhoulders ſet off by long clavicles, ſo very different from the conſtruction of theſe parts in quadrupeds, where the cheſt is compreſſed laterally, and the anterior extremities approach each other in front for the better ſupport of the body. The form of the hand, and the modes of articulation between the ſeveral bones of the upper extremity, are among the numerous and evident arguments that the erect poſture is natural to man, and we believe we may add, peculiar to him. In all the poſitions, produced by different motions, this poſture is more or leſs preſerved; ſo that, before we enter on progreſſive movements, it will be well to conſider ſeparately the ſimple act of ſupporting the body, which they neceſſarily include.

Station—or the act of ſtanding, in man, as far as the lower extremities are concerned, will be the firſt point for our obſervation. In this attitude it is neceſſary that the perpendicular line, which paſſes through the centre of gravity of the whole body, ſhould fall ſomewhere in the ſpace intercepted between the two feet, or on the ſole of the foot itſelf, if we are ſupporting ourſelves on one only. This centre of gravity, when the body is erect, has been proved by Borelli to be placed between the hip bones, "inter nates et pubem," in the human ſubject. To favour this diſpoſition, we find a vertebral column curved alternately in oppoſite directions, and placed obliquely with regard to the direction of the oſſa innominata, by which means the diſtribution of the ſoft parts is more eaſily managed, the balance preſerved, and permanent ſtation much facilitated. If this obliquity did not exiſt, and the vertebral column had been ſtraight, it would approach too nearly the line of direction of the leg and thigh, a diſproportionate quantity of the maſs of the body would be placed in front of the line paſſing through the centre of gravity, which would continually tend to make the body fall forwards in prolonged ſtation or progreſſion. In the orang-outang the angle, which the vertebral column raiſed perpendicularly makes with the hip bones, is much more obtuſe than in man, and the equilibrium is preſerved by the length of the arms; the ſame may be obſerved of the gibbon, the ſimia lar of Linnæus. In quadrupeds this angle, under ſimilar circumſtances, is ſtill more obtuſe, and the efforts they make to remain upright on the hinder feet are continued with difficulty, more eſpecially if not aſſiſted by ſome other peculiar advantages of conſtruction, as in the bear, for inſtance, by the length of the heel. In man, the hip bones united to the ſacrum form a circular ſupport, by means of which the columns below are not inclined to the trunk, but ſuſtain it in perpendicular lines. If they had converged above, they would have formed an angular ſupport, not ſo capable of reſiſting the preſſure, and requiring a conſtant and powerful exertion on the part of the adductor muſcles. As it is, the columns are preſſed on perpendicularly by the tranſverſe width of the hip bones, ſo that the preſſure may be ſaid to render them more firm and ſteady. The long bones of the lower extremity in man are placed nearly vertically on each other, and on the foot. And we may juſt remark, that even in ſtation a ſucceſſion of columns of the ſame ſize is probably more advantageous than a ſingle one, equal in bulk and length to the whole: this has been demonſtrated in the caſe where the weight is upheld by columns ſuppoſed to be flexible. The direction of the head and neck of the femur has been already mentioned as increaſing the baſe of ſupport, and we may add that the oblique poſition of the latter decompoſes, in ſome meaſure, the preſſure of the trunk from above, and renders it leſs ſenſible than if it had been vertical; avoiding at the ſame time the diſadvantages ariſing from an inclined poſition of the whole columns, as mentioned above. By the arch of the necks alſo the thigh bones are projected from under the hips, and ſuſtain the trunk with greater conſtancy and freedom than if they had been placed vertically beneath it during its different inclinations. The thighs, charged with the whole weight above, tranſmit it to the leg at the knee joint; ſomewhat differently, however, in the adult, and in the aged. In the latter the ſpine is bent forwards, and to preſerve the balance the thighs are neceſſarily alſo bent, and preſs obliquely on the leg, a diſadvantageous bearing, as requiring greater muſcular efforts, and ſoon becoming on this account wearisome. It is through the tibia alone that the preſſure is communicated to the foot, which finally ſupports the whole weight. The arch of the latter is favourable to ſtation only inaſmuch as it favours the adaptation of the ſole to inequalities of ſurface. In progreſſion it may give eaſe and grace, but the long and ſomewhat flattened foot is probably beſt ſuited to firmneſs of ſtation. The concavity is leſſened by the preſſure, which acts moſt ſenſibly on the anterior and more moveable part: it is very evident, when the foot comes with force to the ground, and it may be proved alſo by the aching and uneaſineſs produced by wearing ſhort ſhoes, which impede the elongation of the foot. A queſtion has ariſen concerning the moſt advantageous baſe of ſupport, or what opening between the two feet is beſt ſuited to ſecurity of ſtation. An anſwer equally applicable to every caſe cannot readily be found; the nearer it approaches a ſquare, including the feet, the better. Still different individuals muſt require different baſes as ſuited to their own form. In every caſe, if the ſeparation be too wide, the limbs loſe their perpendicular bearing, and become inclined to the trunk. The ſmaller the angle made by two lines produced backwards in the direction of the feet, the better: it ſeems, indeed, that a parallel direction of the two feet is the moſt natural, as we ſee it in children and in the greateſt number of adults, eſpecially of thoſe who have not been inſtructed by art. The body has a tendency to fall forwards, which is partly counteracted by the length of the foot; increaſing the baſe of ſupport in the anterior direction. Now if the foot be turned much outwards, the baſe is neceſſarily ſhortened towards the front; and, as in ſtation, the trunk has no diſpoſition to fall laterally, what the baſe gains in that direction is in no degree equivalent to what is taken away from the other. The ſame obſervation applies to turning the toes inwards; but as this never takes place to any conſiderable degree, an abuſe of it is leſs to be apprehended. The unnatural poſition, in which education teaches us to place our feet, with the heels forming an obtuſe angle behind, is contrary to the whole mechaniſm of the limbs, is uneaſy, and inſecure. In different gymnaſtic exerciſes the feet are placed ſo as to offer the greateſt poſſible reſiſtance to the probable direction of the effort they will have to withſtand. In wreſtling, where the force in the firſt inſtance is generally applied laterally, we obſerve the feet parallel, and at a conſiderable diſtance from each other. Conſtant attention, however, is abſolutely neceſſary to change this baſe, if any unexpected impulſe be made in a contrary line. A deficiency in this reſpect is the reaſon why inexperienced wreſtlers are ſo readily pulled down forwards, or thrown on their backs, their exertions being uniformly directed to oppoſe the expected ones of their adverſaries; if theſe be ſuddenly altered, there is no adequate power of reſiſtance. In boxing, the baſe is increaſed from before backwards, the feet are placed nearly at right angles and far apart, the knees are bent a little, and the trunk lowered. Here the impulſe is expected in front, and the attention is particularly directed to oppoſe it in that point. This, in ſhort, is one of the great principles obſerved not only in theſe exerciſes, but in every laborious exertion, as in puſhing or pulling, where the line of oppoſition does not vary. Whatever be the direction or diſtance of the feet from each other, no muſcular effort can prevent the fall of the body, whenever the perpendicular line from the centre of gravity falls without the quadrilateral ſpace intercepted between the feet. And a man can ſupport a weight much heavier than himſelf, provided that the line from the centre of gravity of ſuch body fall within the baſe of ſupport.

Our obſervations hitherto are principally applicable to ſtation, with the trunk erect. Let us now ſuppoſe the feet fixed ſecurely on the ground, and the trunk moving in different directions by means of the articulations of the hip with the thigh-bones. In bending forwards, if the motion be prolonged conſiderably, the centre of gravity is no longer ſupported, and a fall is the immediate and neceſſary conſequence. We have before remarked, that the articulation of the ſacrum with the oſſa innominata is in a plane poſterior to that of the feet. Now, if in bending forwards, the hip-bones move on the thighs, ſo as to bring the two baſes into the ſame plane, the centre of gravity is eaſily thrown forwards beyond them, and a fall is the reſult. To counteract this, when the trunk is bent much forwards, we at the ſame time carry the upper part of the lower extremities backwards, the feet remain advanced, the leg and thigh are inclined backwards, ſo as to form an angle with the body. In extending the body on the thighs, and carrying it back beyond the perpendicular, as there is no extended baſe of ſupport behind, analogous to that formed by the feet in front, we are obliged to bend the knees, in order to bring the centre of gravity within the ſpace occupied by the feet. If the lower extremities are maintained in an upright poſition, while the trunk paſſes behind the perpendicular line, a fall is inevitable. Lateral inclinations of the trunk on the thighs are neceſſarily confined; ſince, in order to lower it on one ſide, the oppoſite limb muſt be proportionably raiſed; when both feet touch the ground, it is almoſt completely prevented, ſo that the lateral balance is ſeldom loſt, eſpecially as we can at pleaſure widen the baſe of ſupport.

The power of ſtanding on the toes reſults from the mode of their articulation with the metatarſus, which allows of extenſion or inflection upwards, beyond the axis of the latter. By this mechaniſm we reſt on the whole length of the toes, not merely on their points, which would be utterly incapable of ſupporting the weight; here too the ſeſamoid bones are eſſentially uſeful, the preſſure bearing directly on them, as it does on the patella in kneeling. In this attitude the feet are extended on the leg, and form an obtuſe angle with the toes, which conſtitute the baſis of ſupport; the legs and thighs are in the ſame ſtraight line, and the trunk is projected a little forwards by the elevation, ſo that the centre of gravity is brought over the contracted plane, which now forms the baſe of ſupport, leſſened very much in length poſteriorly by the loſs of the tarſus and metatarſus. The ſame difficulties occur if we ſtand on any pointed, or narrow body, and for the ſame reaſon, *viz.* the diminution of the ſpace in which the vertical line from the centre of gravity muſt fall, in order to preſerve the equilibrium. This applies alſo, and more forcibly, to the caſes in which we ſtand on the toes, or heel of one foot only. In the laſt inſtance the foot is bent, the ſole elevated, the rounded heel alone touches the ground by a very limited ſurface, great muſcular exertion is required to keep the line of gravity vertical, the body vibrates on every ſide, and the attitude is neceſſarily ſoon loſt or diſcontinued. We have not ſo much difficulty in ſtanding on the heels of both feet, though this is far leſs eaſy than on the toes, on account of the points on which the weight reſts. Standing on a ſingle foot, with the whole ſole on the ground, is an attitude more eaſily maintained, on account of the greater length of contact, and the leſs muſcular exertion neceſſary to inflect or erect the trunk ſo as to bring the line of gravity within it. In this poſition the body is more or leſs inclined on the limb which ſupports it, and may be moved with facility in every direction by means of the joint at the hip. The long neck of the thigh-bone is here eminently uſeful, by widening the baſe of ſupport afforded above to the trunk; and the poſition cannot for an inſtant be maintained by animals, who, beſides other obſtacles, have a very ſhort neck to the femur. It is obvious that ſtation on one foot muſt be more difficult than on two, as in the laſt caſe it is not only the feet, but the plane intercepted by them, which form the baſe, and much leſs exertion is required to keep the line from the centre of gravity within it. We muſt have obſerved alſo, that when in ſtation on one foot, the trunk is much inclined in any direction, we throw out the other limb in the oppoſite one, in order to keep the centre of gravity vertical to the baſe: and if we ſtand on the toes or heel of one foot, not only the other leg, but the arms alſo, are called into action to preſerve the equilibrium, which is perpetually loſt and regained by the tottering trunk, and ſhuffling baſe. A fixed ſtability is utterly prevented by the difficulty of keeping the balance even under the greateſt muſcular exertions.

In ſitting, the ſupport is afforded by the tuberoſities of the iſchia, the thighs and the interval between them, and by the legs alſo, if we ſit on the ground with them extended. This is a firm poſition, eaſily continued, eſpecially if the body is inclined a little forwards over the baſe; if it is inflected backwards a fall may eaſily take place. On this account we have generally backs to our ſeats, to allow the trunk to recline, when the muſcles are fatigued by ſupporting it in its poſition of inclination forwards. The legs and thighs are concerned only in a ſecondary way in this poſture, as the principal ſupport is afforded by the tuberoſities of the iſchia reſting immediately on the ſurface below.

Kneeling is another attitude in which the lower extremities are employed, but the baſe of ſupport is extended poſteriorly, conſiſting of the ſpace included by the legs, which are projected backwards under the trunk. Hence the body, if erect, is diſpoſed to fall forwards; we require a reſting place in front, as we throw the hips backwards, to bring the line of gravity over the legs. This poſture is far from an eaſy one, ſince it requires a conſtant and unfavourable exertion of muſcular force. The uſe of the patella has been already explained.

The importance of the general law, by which it is neceſſary that a vertical line paſſing through the centre of gravity ſhould fall on ſome point within the baſe of ſupport, is ſtrikingly exemplified by the following obſervations. If we ſtand with our back and feet touching a wall, and then make a profound bow forwards, we inevitably fall, as the vertical line from the centre of gravity ſoon over-reaches the baſe of ſupport. Again, when ſitting with the trunk and legs perpendicular to an horizontal plane, we cannot riſe from our ſeat; becauſe the centre of gravity of the trunk falls far behind the feet: we are obliged conſequently either to incline the trunk very much forwards, or draw the feet backwards under it, in the firſt caſe changing the centre of gravity, in the latter the baſe of ſupport; and then by muſcular efforts the thighs are eaſily extended on the legs, the trunk ſuſpended, and the whole body erected; operations extremely difficult, if not impoſſible, ſuppoſing the original poſition had been preſerved. Our notions of ſtation would be very imperfect if we did not take muſcular exertions into the account; it is in vain that we place a dead body ſo as to bring the centre of gravity over the baſe of ſupport; the bony columns are no longer regulated by the varied efforts of numerous muſcles, as in the living ſubject; the machine is incomplete, and inſtantly gives way to the preſſure. The ſame phenomena occur if fainting comes on in the erect poſture; the head and neck incline forwards, as alſo the trunk; the bones bend on the thighs, the latter on the legs, and theſe again on the feet. We muſt not therefore confine our attention to the idea of bony columns preſſing vertically on each other, but recollect that they have highly moveable articulations, which require ſome ſtrong external efforts to give them poſitive ſtability. Theſe exertions are more or leſs powerful as the bones depart more or leſs from a vertical bearing on each other. Hence the anterior extremities of quadrupeds poſſeſs fewer and leſs powerful muſcles than the poſterior: as, in the firſt inſtance, the bones are directly extended on each other, and preſs vertically on the ground; in the laſt, they form angles more or leſs open, which can be preſerved only by a conſtant exertion of muſcular force. The elephant is an illuſtrative exception to this obſervation; his hind limbs are nearly vertical columns; a mechaniſm which diminiſhes the quantity of muſcle otherwiſe neceſſary to ſupport his enormous bulk. In inſects, on the other hand, the joints are bent at very acute angles; a ſtructure leſs inconvenient than we might at firſt ſuppoſe, as on account of the ſmalleſs of their body, the weight is diminiſhed in a ſub-duplicate ratio to their ſize. In birds who ſleep perched on trees there is a peculiar conſtruction, by which the mere ceſſation of muſcular action, the allowing the body to ſink, and the knees to bend, induces a mechanical contraction of the toes, which graſp firmly the body on which they reſt, and ſecure their poſition when at rooſt. In the grallæ tribe, in the ſtork for inſtance, who ſtands motionleſs for hours waiting for his prey, there is a particular conſtruction in the articulation of the knee, which enables him to ſtand without much muſcular exertion.

Progreſſion—may be effected in many different ways, of which we ſhall examine only the moſt ordinary and ſimple. In walking, the action, which carries the body forwards, backwards, or to either ſide, conſiſts in alternate motions of the lower extremities, in which each of them becomes, in its turn, the fixed point on which the whole weight of the body is ſupported; the limb which moves, giving in its elevation an impulſe to the trunk by means of the hip bone. Each of theſe motions is called a ſtep, and a ſuſtained ſucceſſion of them conſtitutes progreſſion: and in order to underſtand the latter, we ſhall examine the mechaniſm of the ſtep under different conditions. In walking, if we ſuppoſe both feet to be on the ſame tranſverſe line, the limb (ſay the left) which makes the firſt ſtep, is raiſed from the ground and advanced, by bending the hip joint; it is then extended, and laſtly, the foot preſerving its advanced poſition, is fixed on a different ſpot; ſo that the centre of gravity of the body which, during the advance of the left leg, was ſuſtained by the right, is moved forwards by a ſimultaneous movement of the trunk; and the line of gravity falls between the two feet. If the ſtep is ſhort, the hip and trunk move but little; if it be long, and the left leg carried far beyond the right, there is an evident rotation of the right hip, and conſequently of the trunk on the correſponding thigh. By this horizontal rotation, which carries the left ſide of the body obliquely onwards, the extent of the ſtep is greater than it would have been by the ſimple bending the thigh; and we ſee it in fact moſt evidently in long ſtrides, where the rotation is ſo great, as to bring the ſhoulder of the advanced ſide immediately in front, the hip moving through the quarter of a circle, giving thereby an additional impulſe to the limb below. As the ſtep is ſhorter, this lateral rotation is leſs obſervable, till in ſome caſes it can be no longer noticed. It is more evident in the female, from the greater tranſverſe diameter of the pelvis; and is particularly ſtriking in individuals who have a ſtiff, or anchyloſed hip joint, where the limb cannot be advanced by bending the thigh. The ſhort ſtep is effected, on the contrary, chiefly by the alternate flexions and extenſions of the joints of one extremity, uninfluenced by any movement of the trunk on the other.

If the feet are not in the ſame tranſverſe line at the commencement, the limb, which is behind, and inclined to the trunk, is the one to be moved forwards. Here the foot riſes, each part quitting the ground ſucceſſively, from the heel to the toes, by a kind of circular motion. The limb is thus elevated and advanced, and the centre of gravity is carried in the ſame direction, which latter is effected with greater facility, as the body at the ſame time leans a little forwards. When this impulſe is carried to its full extent, the toes are detached from the ground by the thigh being ſuddenly bent on the hip, which has been moved forwards, and the limb is carried on as in the former caſe, the other remaining fixed as the temporary ſupport. The hip and knee joints are then extended, and the foot bent on the leg. The foot touches the ground firſt by the heel: this is ſucceeded by a circular motion of the anterior part of the foot round this fixed point, and a correſponding motion of the leg in the ſame direction, which brings it to a vertical line at the time that the toes begin to bear on the plane below. In theſe circular motions the foot is ſenſibly elongated, and its concavity leſſened by the preſſure, its vaulted form, and the number and mode of its articulations imparting a degree of eaſe and grace to the whole motion which we look for in vain, where the foot is flat and ſtiff, and the whole ſole quits, or reaches the ground at the ſame inſtant. There is, in this caſe, an awkwardneſs of gait, and a real inability of walking with promptitude and vigour. This ſtep we have been deſcribing takes place ſucceſſively in each limb in progreſſion; and differs from the preceding in being more extenſive, and depending more importantly on the foot. The impulſe which its elevation communicates to the trunk will be influenced however materially by the knee: if this is bent in proportion as the foot riſes, the limb loſes in one action what it gains by another; the impulſe will be ſtronger as the knee is kept more extended. And when the foot is detached at once, without this rotation, no impulſe will be given to the hip by the limb in motion: if the pelvis roll on the thigh which is fixed, it muſt be by an independent muſcular action, as in the former caſe. In every caſe, as ſoon as the foot has left the ground, the trunk ſupports the limbs; and carries it forwards. The mechaniſm of the ſtep backwards will be eaſily underſtood from what has been ſaid: we obſerve only that the foot is raiſed more immediately by bending the knee; and that when the ſtep is prolonged, there is an evident horizontal rotation of the trunk in the ſame direction. The ſide ſtep is produced by gently bending the knee to detach the foot from the ground, and then abducting the thigh; or by lifting the whole limb by a lateral inclination of the trunk on the oppoſite one, and then ſeparating them, the knee being all the while extended.

Walking is a ſucceſſion of theſe motions, and requires for its regularity an equal length of both limbs; a ſhortneſs of either limb induces a ſinking and relative inclination of the whole trunk to the correſponding ſide, every time that the deficient extremity touches the ground. In the moſt natural mode of walking, one foot does not quit the ground entirely, until the other touches it wholly, or in a great part of its length: the latter begins to fix itſelf while the former ſtill reſts on its point; the vertical line from the centre of gravity, which fell on one foot during the tranſportation of the other, being carried forward, and dropping at this time between the two. When the advanced foot is firmly fixed, we throw on it the centre of gravity; the ſame motion neceſſarily projects the whole body forwards, and a ſucceſſion of ſimilar phenomena takes place. At each ſtep the impulſe given to the trunk by the limb which has juſt quitted the ground produces an undulatory motion up and down, and at the ſame time an horizontal rotation alternating from one ſide to the other. It is the latter which, from not being ſuſtained equally, produces the deviation from the ſtraight line in walking forwards, ſo conſtantly obſerved if we walk blind folded, where conſequently we cannot correct incidental errors by the ſight. The beſt chance of walking ſtraight in this caſe is by taking very ſhort ſteps, and for the reaſons inſiſted on above. In fact, the centre of gravity is not, when we carefully endeavour to attain it, moved forward in the ſame ſtraight line, but varies more or leſs between the lines deſcribed by the feet at every ſtep, in a degree proportionate to the extent of each. This is ſcarcely noticed, but is evident from this ſimple experiment. If we ſtand at any diſtance from a ſmall perpendicular rod, and fix our eyes on any point ſome way behind it, and in the ſame ſtraight line, we ſhall, as we advance to the rod, find this point alternately to the right and left of it, as we move each limb. A proof that the trunk is not carried as in a ſtraight line, but deſcribes a tortuous one, winding from one ſide to the other. Another conſequence of this rolling of the trunk on the oppoſite limbs in ſucceſſion, is a ſwinging motion communicated to the upper extremities: theſe move, moſt commonly, in an oppoſite way to the feet; that is, the right arm moves on at the ſame inſtant that the left leg propels the trunk. The uſe of this croſs motion of the arms is ſuppoſed to be that of correcting the lateral impulſe given to the trunk by the leg in its elevation. In every caſe of progreſſion there muſt be a regulated degree of flexions and extenſions, which is in ſome inſtances provided for by the mechaniſm of the bones, and their ligaments, but in all depends principally on an uniform ſucceſſion of ſuſtained muſcular actions. The greater difficulty and fatigue experienced in walking up an aſcending plane depends upon the greater degree of flexion neceſſary to raiſe the limb from the ground; this muſt be increaſed as the plane becomes more vertical; the heel is at the ſame time lower than the toes, and muſt paſs through more ſpace in each elevation than in the ordinary caſe of walking on plain ground. Walking down hill is for the ſame reaſons leſs difficult; there is leſs occaſion for extenſive muſcular action. The object is to regulate the impulſe which the trunk eaſily acquires, and to keep the centre of gravity over the feet, by throwing the trunk a little backwards, inſtead of leaning forwards, as in the preceding caſe. In aſcending alſo we have each time to elevate the weight of the body by muſcular powers; in deſcending we have only to prevent it from ſinking too faſt. Mounting ſteps, or a ladder, or deſcending either, are ſtill more difficult, as the reaſons above given apply more ſtrongly.

Running differs from walking chiefly in the rapidity and force with which the motions of the lower extremities are executed. The mechaniſm by which they are produced is nearly ſimilar; the remarkable differences are, that the toes only touch the ground, and the whole trunk is inclined very conſiderably forwards. In conſequence of the firſt circumſtance, a ſmall ſurface only is in contact with the ground; and this can be more rapidly applied and detached, while the extenſion of the foot upon the leg adds to the length of the limb. From this ſmall extent of the baſe of ſupport ariſe the frequent falls in running from trifling obſtacles, or ſlight lateral impulſes; and hence, in this mode of progreſſion, we ſhould conſtantly endeavour to preſerve the balance, by preventing the centre of gravity from being removed too quickly from the leg behind, or from being thrown too ſoon on the one in advance. Running is alſo inſecure from the ſhort time allowed for fixing the point of ſupport; and hence poſitive ſtability is leſſened inverſely as the neceſſity for it is increaſed by the quick tranſition of the centre of gravity from point to point. At each ſtep the trunk is ſuddenly and violently carried forwards by the limb which has juſt left the ground, and which muſt be immediately and conſiderably advanced to ſupport the centre of gravity. In running very faſt, eſpecially on a declivity, ſo powerful an impulſe is communicated to the trunk, that it is almoſt impoſſible to ſtop ſuddenly; we gradually ſlacken our pace, ſtill projecting the limbs to ſupport the trunk till the impulſe is weakened. In running up an acclivity we always bend forwards, to aſſiſt the propulſion of the centre of gravity, which is effected under many diſadvantages; we generally do ſo in running on plain ground, though, when we run carefully, the head and ſhoulders are thrown back to counterbalance the impulſe below. When from fear, or inability to continue the muſcular exertions neceſſary to maintain this poſture, the trunk is neither thrown back, nor even kept vertical to the horizon, the runner appears to yield entirely to the impulſe, to commit himſelf almoſt to chance; his only endeavours being to throw his legs out rapidly and to the greateſt extent, to ſuſtain the increaſing velocity with which the centre of gravity is carried onward: the ground covered at each ſtep is really immenſe, the power of balancing is totally loſt, and the ſlighteſt inequality of ſurface is ſufficient to overturn him with the rougheſt violence. If he is ſteady enough to reach the bottom in ſafety, he continues his courſe a very conſiderable way before the impulſe is deſtroyed, and the power of regulating his movements recovered. In running, the lateral rotation of the hip and trunk on the thigh is extenſive, from the length of the ſteps; and the ſame cauſe produces an equally great and rapid motion of the oppoſite arm to preſerve the equilibrium, which is more eaſily loſt than in walking.

In leaping, the body may be raiſed vertically, or with any degree of obliquity. The joints of the lower extremities are firſt cloſely bent, and then ſuddenly extended, ſo as to propel the trunk; for the ground effectually reſiſts the impulſe, which muſt be entirely ſpent on the moveable parts above. The alternate angles, formed by the ankles, knees, and hips, depreſs the centre of gravity, without altering its bearing on the feet; and the ſame mechaniſm enables us to elevate the trunk nearly in a vertical line, the circular motions in oppoſite directions executed with almoſt inſtantaneous velocity, acting in a ſtraight line intermediate to them all. If the flexions were all made in the ſame direction, ſubſequent extenſion would be more laborious, and a perpendicular impulſe, ſuch as produces the vertical leap, would be impoſſible. The mechaniſm of leaping may be illuſtrated by comparing it with other motions. The muſcular powers being the ſame, the leap will be more conſiderable as the levers are longer, and more inclined on each other. Hence animals, whoſe hind limbs appear diſproportionately long, can make the moſt extenſive bounds; we need ſcarcely inſtance the kangaroo, hare, ſquirrel, or graſshopper.

The elevation of the body in a vertical leap is continued ſo long as the communicated impulſe exceeds the power of gravitation; as the former diminiſhes, the latter again begins to operate, and the body deſcends in the ſame line with that in which it had been elevated. It is incapable, while in the air, of altering the general direction derived from the firſt impulſe; although many motions of the extremities may be produced, as we obſerve in dancing. The ground, from its want of elaſticity, communicates no impulſe to the body at the moment of elevation. A certain reſiſtance to the action of the muſcles on the moveable levers is required. If the ground be ſoft or ſandy, it yields too readily to the impulſe of the feet, and leaping is impeded: on the contrary, if the point from which the jumper ſprings be elaſtic, as in the caſe of a flexible board, or a tight rope, there is an evident re-action, conſiderably increaſing the impulſe communicated by the exertion of the lower limbs. In jumping forwards the trunk is inclined, and projected in the ſame direction by the extenſion of the thigh on the leg. This latter motion is counterpoiſed or varied, according to circumſtances; but it is ſo eſſential in every caſe, that we cannot leap if the knees are kept extended, no muſcular action or exertion could then raiſe the body from the ground. The chief effort is to turn the thigh and trunk balanced on it forwards on the tibia; and the impulſe thus given predominates over the others; in leaping backwards, the tibia is the more moveable diviſion of the lever by a variation in the combined action of the muſcles employed, determinable by the will. In the vertical leap the body moves up and down in the ſame line: but if the impulſe is given in a line inclined to the horizon at oblique angles, the line deſcribed by the centre of gravity will be a parabolic curve, compounded of the uniform ſtraight motion of projection, and the force of gravity, as in other projectiles. While the firſt predominates over the laſt, the body aſcends; when they are in equal power, the elevation is the greateſt; from this point, it deſcends, the force of gravity acting with increaſing effect as the impulſe is weakened. The impulſe, in this caſe, may be conſiderably increaſed by a previous motion given to the body by running: the impetus is ſomewhat altered in direction by the violent extenſion of the extremities, but it acts with almoſt undiminiſhed force in projecting the body: there are here two cauſes acting in oppoſition to gravitation. This kind of leap is facilitated by inclining the body forwards; and, in order to afford a point of ſupport to the centre of gravity, we always find, before the body is elevated from the ground, that one of the legs, generally the right, is much before the other; this poſition is preſerved throughout, for the ſame reaſon, or the two legs are brought into parallel obliquely inclined lines, before we reach the ground at the end of the leap. If we jump with the feet together, we cannot incline the body much forwards, without loſing the balance. In this caſe, to aſſiſt the impulſe, we ſwing the arms backwards and forwards before we make the ſpring, endeavouring to give ſome degree of horizontal impetus to the trunk, which muſt however always be inferior to that obtained by even a ſhort run. The body comes in contact with the ground, at the end of the leap, impreſſed by a double force, *viz.*; the projectile impetus, and that acquired by gravitation in the deſcent. We extend the feet on the legs, ſo as to touch the ground firſt by the toes; we then yield ſomewhat to the force, and allow the joints to be bent gradually, ſo as to weaken and finally deſtroy the ſhock. In order to deſtroy the impulſe given to the centre of gravity, we throw back the head and ſhoulders, and ſlacken our pace by degrees, till the power of balancing is reſtored.

The action of dancing, which conſiſts in a rapid change, in various manners and directions, of the lower extremities, principally reſembles, in ſome reſpects, the *run*, in many others the *leap*. We omit the detail of thoſe extraordinary and amazing feats of agility, which aſtoniſh us in the ſtage dancer, or the tumbler; as they depend, not on any peculiarity of mechaniſm, but on the powerful, long ſuſtained, or rapid actions of muſcles, educated to the taſk, and preſerved by conſtant exerciſe in the higheſt poſſible ſtate of energy. Hopping is a ſucceſſion of leaps on one leg only; the actions are otherwiſe analogous. Skaiting is a ſimple motion; the mechaniſm of which may be readily conceived after the obſervations we have made: the centre of gravity is brought alternately over the oppoſite feet, as each glides on the plane beneath, and the balance is preſerved by muſcular action. Swimming is a more compound action of both upper and lower extremities, involving in its diſcuſſion many intereſting queſtions, independent of their functions, and which conſequently cannot properly be conſidered here.

For more detailed information on the ſubject of animal mechanics, we refer the reader to Borelli, de Motu Animalium; Haller, Element. Phyſiol. tom. iv.; Barthéz, Nouvelle Mécanique de l'Homme: ſee Jour. des Scavans 1782-1783. Bichat, Anatomie Deſcriptive, tom. i. Cuvier, Leçons d'Anatomie compareé; tom. i. ſur la fin. There is a catalogue of authors on this ſubject in Dr. Young's Natural Philoſophy v. ii. p. 164.

Compariſon of the upper and lower extremities.—A review of the differences in the conſtruction of the upper and lower limbs will illuſtrate the mechaniſm of their component parts. There is a general reſemblance of form throughout; and the eſſential varieties may be all referred to the principle of mobility in the upper, and to that of firmneſs in the lower. In man, the extremities are nearly parallel to the long diameter of the trunk; and conſequently they muſt be parallel to each other; but they are not in the ſame vertical plane. A line drawn from the glenoid cavity of the ſcapula to the acetabulum, will be very oblique from above downwards and forwards, becauſe the plane in which the former lies is poſterior to that in which the latter is found. Hence the arm drops neceſſarily behind the thigh. The advantage of ſuch a diſpoſition in the upper extremities is, that the principal motions, which are thoſe in the anterior direction, have a greater range than if the glenoid cavity had been ſeated nearer to the front of the trunk. The extremities differ alſo in the ſpace, by which they are ſeparated from each other. If we judged only by the intervals between the right and left glenoid and cotyloid cavities reſpectively, we ſhould ſuppoſe the difference to be great; the long clavicles keeping the firſt at a greater diſtance than the pubal portions of the hip bones do the ſecond. This, however, is compenſated by the length and obliquity of the necks of the thigh bones, which throw the axes of theſe bones far without the cotyloid cavities. We have here ſuppoſed the legs to be extended, and the arms lying in their natural direction by the ſides of the trunk; if the knee and elbow be bent in this poſition, we ſhall find the angles are open in nearly oppoſite directions, that of the knee backwards, and the elbow forwards. Theſe are the only joints in which the articulations are directly inverſe in their modes of action; in quadrupeds, this condition prevails from the ſhoulder and hip to the feet in a very ſtriking manner. The lower extremities are nearer together below than above; while the upper are kept aſunder by the intervening body. The lower extremities are rather longer than the upper, in conſequence of the great length of the thigh and leg, when compared with the arm and fore arm. For the latter, by the long axis of the hand being in the ſame line with their length, gain much more than the lower extremity does by the mere thickneſs of the foot. When the arm hangs eaſily extended by the ſide, the points of the fingers reach to about the middle of the thigh; yet there are many varieties in this reſpect. The ſolid form, and the broad articular ſurfaces of the lower, are ſtrikingly contraſted with the ſlender make and narrow articulations of the upper; the firſt bearing a marked relation to their principal function of ſuſtaining the body, the latter to their diſtinguiſhing character of mobility. At the time of birth the upper extremities are more advanced in formation than the lower. This feature is, however, more remarkable, the nearer we mount to the firſt developement of the embryo; it is gradually loſt after birth, and the ſtructure of both is completed nearly about the ſame period. The different nature of their functions, thoſe of the upper commencing almoſt immediately, and thoſe of the lower not until a conſiderable interval after the birth of the child, explains eaſily the reaſon of this diſpoſition.

The bones of the hip and ſhoulder differ more in their form and connections than any other parts of the extremities. The ſcapulæ are ſuſtained by muſcles, allowing a great variety of motion, and are kept apart by the two moveable clavicles in front; the hip bones are bound firmly to the ſpine, and the articular cavities ſeparated from each other by an immoveable medium. The ſpace between the cotyloid cavities is proportionably greater in the female than in the male. The ſame exceſs may be obſerved in the ſhoulders, where it ariſes from the greater comparative length of the clavicle. The breadth of the ſcapulæ increaſes in the male the tranſverſe diameter of the ſhoulders, which on this account is particularly ſtriking from behind; in front they are not proportionably ſo wide as in the female. It is therefore the proportional exceſs of width in the hips, and not any decreaſe in the breadth of the ſhoulders, which gives to the female figure one of its moſt prominent features; this diſtinguiſhes it from the male, in whom the ſtrong, though narrow, hips are oppoſed to the comparatively ſpreading ſhoulders. Theſe circumſtances are ſufficiently evident in examining the diſpoſition of the bones; but they become ſtill more ſtriking, by the addition of the ſoft parts, in the complete ſubject, where the ſtrongly marked and muſcular form of the ſhoulders, and the contracted outline of the hips in the male, is finely contraſted with the delicacy of the firſt, and the ſwelling roundneſs of the laſt in the female. The hip bone exceeds the ſcapula and clavicle in volume, as well as in the firmneſs of its articulation; it further gives a fixed point of motion to the thigh, by a deep articular cavity, whereas the ſcapula offers a ſhallow and eaſily moveable one, yielding to a ſlight impulſe.

The femur exceeds the humerus very much in ſize, and length, (this laſt being nearly in the ratio of 46 to 33,) and in the extent of its articular ſurfaces. Although their motions are for the moſt part analogous, ſome differences may be pointed out. The movements of circumduction and rotation exiſt in an inverſe ratio to each other. In the thigh bone, the length of the neck, which is the lever of rotation, gives great extent to this motion, and thus ſupplies the want in the leg of the motions correſponding to the pronation and ſupination of the fore-arm, ſo that all rolling of the foot out and in, when the limb is extended, ariſes from a motion of the whole limb. The ſhort neck of the humerus, on the contrary, by bringing the axis of the bone nearer the centre of motion, limits rotation; which is leſs eſſential, inaſmuch as the hand is moved by the pronation and ſupination of the fore-arm. Circumduction is more confined in the thigh by this very length of the neck, which makes an angular lever of this bone, differing much from the nearly rectilineal one of the humerus. In the firſt caſe the axis of motion is not in the long axis of the bone; in the laſt, it is nearly ſo; and the difficulty of this motion is proportional to the difference between the two axes, while its facility is greater as they approach each other more nearly. The advantages of this diſpoſition, in giving mobility to the upper, and firmneſs to the lower extremities, may be readily perceived.

The leg exceeds the fore-arm in the ſize and length of the bones, the proportions being as 39 to 26. In the orang-outang the ratio of the thigh to the arm is as 9 to 10, and that of the fore-arm to the leg as 9 to 11; which proportions are very different from thoſe of the human ſubject. The exceſs of length in the lower extremity of man is ſeen moſt evidently when he attempts to move on all fours, as we expreſs it. To correct this diſproportion he is obliged to bend the joints of the lower extremities, or to throw them out very obliquely behind the trunk, whilſt the upper are perpendicular to it. The leg and fore-arm reſemble each other leſs than the thigh and arm; in the fore-arm the parts are arranged favourably to mobility; in the leg the object is to procure a firm and ſolid ſupport, which can tranſport the centre of gravity with eaſe and ſafety from one point to another. Of the two bones of the fore-arm, which are nearly equal in every reſpect, one rolls eaſily over the other, and the hand is articulated with the moveable bone. In the lower extremity theſe rolling motions would have been dangerous; to give it firmneſs, the foot is articulated with the tibia, which correſponds to the ulna, and not with the fibula; the latter poſſeſſes no perceptible power of motion.

The hand and foot reſemble each other moſt cloſely in the ſtructure and number of the phalanxes, and of the bones which ſupport them; the principal differences occur in the carpus and tarſus, which are the moſt ſolid portions. That part of the hand in which its ſtrength reſides is leſs developed, and has far leſs volume than the analogous parts of the foot, on which the whole weight of the body in ſtation finally reſts. The moveable phalanges, which are the principal agents in executing the functions of the hand, are much longer, and larger than thoſe of the toes, which are not ſo eſſential to ſtation or progreſſion. The foot and hand are diſpoſed inverſely as to form; the poſterior part of the former, and the anterior part of the latter, is the moſt important, the longeſt, and poſſeſſes the moſt ſtriking characters. The functions of the hand render it neceſſary that its plane ſhould be nearly continuous with that of the fore-arm; otherwiſe the radius could not guide it ſo preciſely over the objects in view. In the foot, the articulation is ſo diſpoſed that its poſterior part offers a powerful lever for muſcular agents, and a ſolid ſupport for the maſs above; it is formed by a ſingle bone of the foot, which neceſſarily adds to its ſolidity. The metacarpus and metatarſus have a much greater ſimilarity to each other; the latter is the more ſolid, and offers this principal difference. The metatarſal bone of the great toe, by far the ſtrongeſt of the whole, has ſcarcely any motion on the tarſus, and is on the ſame plane with the others; while that which ſupports the thumb has a very conſiderable extent of motion, and is anterior to the reſt. This ariſes from the obliquity in the articulating facet of the trapezium, which is directly tranſverſe in the firſt cuneiform bone of the tarſus. Further, this bone in the foot is not ſeparated from the other metatarſal bones, by an interoſſeous ſpace larger than that between all the reſt, as is the caſe with the metacarpal bone of the thumb. Theſe remarkable differences depend wholly on the ſolidity neceſſary for ſtation, and the great mobility required for the important offices executed by the thumb in the human ſubject. In the ape tribe, the great toe on the contrary may be properly regarded as another thumb in its ſtructure and uſes. The toes can be inflected further on the back of the foot than the fingers can be on the hand, a diſpoſition which is accommodated to progreſſion, eſpecially to running ſwiftly; an analogous effect is produced in the hand by the inflection of the carpus backwards on the fore-arm. At the time of birth the important parts of the hand are already well developed; the metacarpus, and more eſpecially the fingers, are ſufficiently formed for the infant to ſeize objects within its reach, and to diſtinguiſh ſome of their qualities. This early developement of the organs of touch would ſeem to bear a marked relation to the correſponding advancement in the formation of two other organs of ſenſe, the eye and ear, they being all aſſociated cloſely in confirming, or correcting external ſenſations. The important part of the foot, the tarſus, is far behind in formation, as it is not called into uſe till ſome time after birth, till the organs of ſenſe have long been exerciſed in common, and can now mutually aſſiſt each other.

Reſpecting this compariſon between the upper and lower limbs, ſee Vicq D'azyr ſur la comparaiſon des extremités entr'elles dans l'homme, et dans les quadrupedes, in the Hiſtoire de l'Acad. des Sciences 1774.

EXTREMUM *Clauſit Diem.* See DIEM.

THE END OF VOL. XIII.

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